65th Annual Meeting

of the International Society of Electrochemistry

31 August - 5 September, 2014
Lausanne, Switzerland

Ubiquitous Electrochemistry

PROGRAM

http://annual65.ise-online.org
e-mail: events@ise-online.org

International Society of Electrochemistry
chemin du Closelet 2
1006 Lausanne
Switzerland

Printed in Switzerland

Organizing Committee

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Symposium Organizers

Symposium 1: Dynamic Ion Sensing: from ITIES to ISEs

Eric Bakker (Coordinator), University of Geneva, Geneva, Switzerland
Damien Arrigan, Curtin University, Perth, Australia
Alain Walcarius, Nancy University, Nancy, France
Erno Pretsch, ETH, Zurich, Switzerland

Symposium 2: Scanning Electrochemical Microscopy: Reading, Writing, Monitoring of Functional Interfaces

Frederic Kanoufi (Coordinator), ESPCI ParisTech - CNRS, Paris, France
Gunther Wittstock, Carl von Ossietzky University of Oldenburg, Oldenburg, Germany
Fernando Cortés-Salazar, EPFL, Lausanne, Switzerland

Symposium 3: Bioelectrochemistry: from Fundamentals to Health Monitoring and Energy Conversion

Fred Lisdat (Coordinator), Wildau University of Applied Sciences, Wildau, Germany
Woonsup Shin, Sogang University, Seoul, Korea
Serge Cosnier, CNRS and University of Grenoble, Grenoble, France

Symposium 4: Electrochemical Energy Conversion and Storage: Fuel Cells and Electrolysers

Deborah Jones (Coordinator), CNRS and University of Montpellier 2, Montpellier, France
Hiroyuki Uchida, University of Yamanashi, Kofu, Japan
Felix N. Büchi, Paul Scherrer Institute, Villigen, Switzerland
Frederic Maillard, LEPMI and CNRS, Saint Martin d'Hères, France

Symposium 5: Electrochemical Energy Conversion and Storage: Batteries

Petr Novák (Coordinator), Paul Scherrer Institute, Villigen, Switzerland
Stefano Passerini, University of Muenster, Muenster, Germany
Wesley Henderson, North Carolina State University, Raleigh, USA

Symposium 6: Electrochemical Energy Conversion and Storage: Capacitors

Elzbieta Frackowiak (Coordinator), Poznan University of Technology, Poznan, Poland
Kwang-Bum Kim, Yonsei University, Seoul, Korea
Volker Presser, INM–Leibniz-Institute of New Materials and Saarland University, Saarbrücken, Germany

Symposium 7: Dye Sensitized Solar Cells

Kuppuswamy Kalyanasundaram (Coordinator), EPFL, Lausanne, Switzerland
Satoshi Uchida, University of Tokyo, Tokyo, Japan
Anders Hagfeldt, Uppsala University, Uppsala, Sweden
Ladislav Kavan, J. Heyrovsky Institute of Physical Chemistry, Prague, Czech Republic

Symposium 8: Modern Electroactive Polymeric, Organic, Inorganic and Nanocomposite Materials

Mikhail A. Vorotyntsev (Coordinator), University of Bourgogne, Dijon, France; M.V.Lomonosov Moscow State University, Russia; Institute for Problems of Chemical Physics, Chernogolovka, Russia
Marília Oliveira Fonseca Goulart, Federal University of Alagoas, Alagoas, Brazil
Achim Walter Hassel, Johannes Kepler University,Linz, Austria
Magdalena Skompska, University of Warsaw, Warsaw, Poland
Kevin Sivula, EPFL, Lausanne, Switzerland

Symposium 9: Corrosion, Passivity and Oxide Films

Bernard Tribollet (Coordinator), CNRS and University Pierre et Marie Curie, Paris, France
Francesco Di Quarto, University of Palermo, Palermo, Italy
Fatima Montemor, Technical University of Lisbon, Lisbon, Portugal
Ricardo Nogueira, CNRS and University of Grenoble, Grenoble, France
Monica Santamaria, University of Palermo, Palermo, Italy

Symposium 10: Electrodeposition for Energy Applications

Giovanni Zangari (Coordinator), University of Virginia, Charlottesville, USA
Stanko Brankovic, University of Houston, Houston, USA
Mary Ryan, Imperial College London, London, UK
Tom Moffat, NIST, Gaithersburg, USA
Peter Broekmann, University of Bern, Bern, Switzerland

Symposium 11: Electrochemical Technology: Crossroad for Energy and Environment

Christos Comninellis (Coordinator), EPFL, Lausanne, Switzerland
François Lapique, CNRS and University of Lorraine, Nancy, France
Juan Manuel Peralta-Hernandez, CIATEC, Leon Guanajuato, Mexico
Manuel Andres Rodrigo, Universidad de Castilla-la-Mancha, Ciudad Real, Spain

Symposium 12: Electrochemistry Combined with Spectroscopic and Microscopic Techniques for Molecular Descriptions of ET Processes

Fethi Bedioui (Coordinator), CNRS and Chimie ParisTech, Paris, France
Thomas Wandlowski, University of Bern, Bern, Switzerland
Carlos E. Frontana-Vazquez, CIDETEQ, Querétaro, Mexico
Francesco Paolucci, University of Bologna, Bologna, Italy

Symposium 13: Synergizing Theory and Experiment in Electrochemistry: State-of-the Art Developments

Jan Rossmeisl (Coordinator), Technical University of Denmark, Lyngby, Denmark
Nicola Marzari, EPFL, Lausanne, Switzerland
Marc Koper, Leiden University, Leiden, the Netherlands
Thomas J. Schmidt, Paul Scherrer Institute, Villigen, Switzerland
Frédéric Maillard, LEPMI and CNRS, Saint Martin d'Hères, France

Symposium 14: Brain Electrochemistry

Martyn G. Boutelle (Coordinator), Imperial College London, London, UK
Andrew Ewing, University of Gothenburg, Gothenburg, Sweden
Adrian C. Michael, University of Pittsburgh, Pittsburgh, USA
Frederic Lemaitre, ENS - CNRS - UPMC, Paris, France
Jay Wadhawan, University of Hull, Kingston-upon-Hull, UK

Symposium 15: General Session

Zhifeng Ding (Coordinator), University of Western Ontario, Canada
Hye Jin Lee, Kyungpook National University, Daegu, Korea
Su Bin, Zhejiang University, Hangzhou, China

Tutorial Lectures

Sunday, 31 August 2014

Location: EPFL
The Swiss Tech Convention Center

13:30 to 17:00
Auditorium B - Campus

Tutorial 1

DSC Grätzel's Cells

Michael Grätzel, *EPFL, Lausanne, Switzerland*

13:30 to 17:00
Auditorium C - Cloud

Tutorial 2

Ion Liquids in Electrochemistry

Roberto M. Torresi, *University of Sao Paulo, Brazil*
Mario del Popolo, *National University of Cuyo, Mendoza, Argentina*

15:00 to 15:15
Coffee break

Photography and recording is not permitted during the meeting activities (tutorials, plenary lectures, oral presentations and/or poster sessions) without the express, written consent from ISE.

Plenary Lectures

Location: Auditorium A - CAMPUS

Monday, 1 September 2014

08:30 to 09:30

Yang Shao-Horn
(MIT, USA)

Enabling Oxygen Electrocatalysis for Sustainable Energy

Tuesday, 2 September 2014

08:30 to 09:30

Patrick R. Unwin
(University of Warwick, UK)

Nanoscale Views of Electrochemical Processes

Wednesday, 3 September 2014

08:30 to 09:30

Nenad Markovic
(Argonne National Laboratory, USA)

Interfacing Electrochemistry

Thursday, 4 September 2014

08:30 to 09:30

Patrick Schmuki
(University of Erlangen, Germany)

We like it orderly – Anodic growth and use of highly aligned metal-oxide nanostructures

Friday, 5 September 2014

08:30 to 09:30

Digby Macdonald
(University of California at Berkeley, USA)

How Well Do We Understand Passivity and Passivity Breakdown?

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ISE Prize Winners 2013

Frumkin Memorial Medal

Digby Macdonald, *Pennsylvania State University, USA*

08:30 to 09:30, Friday, 5 September 2014, Plenary Lecture, Auditorium A - Campus

How Well Do We Understand Passivity and Passivity Breakdown

Born in Thames, New Zealand, 7 December 1943, Professor Macdonald gained his BSc (1965) and MSc (1966) degrees in Chemistry at the University of Auckland, New Zealand, and his Ph.D. degree (1969) in Chemistry from the University of Calgary in Canada. He has served as Assistant Research Officer at Atomic Energy of Canada Ltd., Lecturer in Chemistry at Victoria University of Wellington, New Zealand, Senior Research Associate at Alberta Sulfur Research, Honorary Associate Professor at the Chemistry Department of the University of Calgary, Director and Professor of the Fontana Corrosion Center, Ohio State University, Vice President, Physical Sciences Division, SRI International, Menlo Park, California and has been Professor and later Distinguished Professor of Materials Science and Engineering at Pennsylvania State University from 1991 to 2012. He is also a Visiting Chair Professor at the King Fahd University of Petroleum and Minerals (KFUPM) in Dhahran, Saudi Arabia. Professor Macdonald has received numerous awards and honors, including the 1991 Carl Wagner Memorial Award from The Electrochemical Society; the 1992 Willis Rodney Whitney Award from The National Association of Corrosion Engineers for "contributions to the science of corrosion"; the W. B. Lewis Memorial Lecture from Atomic Energy of Canada, Ltd., for his "contributions to the development of nuclear power in the service of mankind"; the H. H. Uhlig Award from The Electrochemical Society; the U. R. Evans Award from The Insitute of Corrosion, UK; the 20th Khwarizmi International Award in fundamental science; and the Wilson Research and Teaching Awards of the Pennsylvania State University. He is an elected fellow of NACE-International; The Electrochemical Society; the Royal Society of Canada; the Royal Society of New Zealand; ASM International; the World Innovation Foundation; the Institute of Corrosion (UK); and the International Society of Electrochemistry. From 1993 to 1997 he was a member of the US Air Force Science Advisory Board with the protocol rank of Lieutenant General. He was awarded the US Air Force Medal for Meritorious Civilian Service in 1997. Dr. Macdonald was a Trustee of ASM International and was inducted Docteur Honoris Causa by INSA-Lyon, Lyon, France. He was a recent recipient of the Lee Hsun Research Award of the Chinese Academy of Sciences. In 2012, he was awarded the Faraday Memorial Trust Gold Medal by CERC in Karaikudi, India, being only the fourth (and second foreigner) to be so honored. In 2013 he was the fourth person to be honored with the Gibbs Award from the International Association on the Properties of Water and Steam (IAPWS). He was nominated for the Nobel Prize in Chemistry in 2011 for his work on the phenomenon of passivity. Finally, under his tutelage, more than 150 students have graduated with advanced degrees in Chemistry and Materials Science and Engineering over the past four decades. Dr. Macdonald has published more than 920 papers in peer-reviewed scientific journals, books, and conference proceedings, plus four books, one of which ("Transient Techniques in Electrochemistry") established an important area of electrochemical research, and has 10 patents and numerous invention disclosures credited to his name. His professional competence lies in the fields of electrochemistry, corrosion science, battery science and technology, thermodynamics, chemical kinetics, high temperature aqueous chemistry, nuclear power technology, energy conversion technology, and physical chemistry.

Alexander Kuznetsov Prize for Theoretical Electrochemistry

Andrei Kulikovsky, *Research Center Jülich, Germany*

09:50 to 10:10, Friday, 5 September 2014, Symposium 4, Auditorium B - Campus

Analytical Tools for Understanding Fuel Cell Life and Death

Dr. Andrei Kulikovsky graduated from the Faculty of Theoretical and Experimental Physics of the Moscow Engineering—Physical Institute, one of the leading physical schools in the former USSR. In 1984, he defended his PhD thesis at the Institute for High Temperatures of the USSR Academy of Sciences. In 1998 he got the Doctor of Sciences (Research Professor) degree in physics and math from the M.V.Lomonosov Moscow State University. While working in Russia, his main research interests were in the field of numerical and analytical modeling of gas discharge plasmas.

In 1998, Dr. Kulikovsky moved to the Forschungszentrum Juelich (Research Centre Juelich), Germany, where Alexei Kornyshev engaged him into modeling of fuel cells, cell components and stacks. Over the past 15 years, Andrei published more than 70 research papers, most of which have a sole author. In 2012, he published a book "Analytical modeling of fuel cells" (Elsevier, 2010), which has been the first monograph on modeling of polymer electrolyte, direct methanol and solid oxide fuel cells performance. His current research interests include modeling of fuel cells and catalyst layers, macroscopic modeling of aging and defects in cells, analytical study of transport and kinetic processes in cells and stacks, impedance spectroscopy of cells. Andrei's work has always been focused on development.

ISE Prize Winners 2013

Tajima Prize

Tim Albrecht, *Imperial College, London, UK*

14:00 to 14:20, Monday, 1 September 2014, Symposium 15, Room 3bc - Garden

Functionalized Solid-State Nanopores for Biosensing Applications

Tim Albrecht studied Chemistry at the University of Essen (1995-2000) and obtained his PhD from the MPI of Bioinorganic Chemistry in Muelheim a.d. Ruhr and the TU Berlin, Germany, under the supervision of Prof. P. Hildebrandt (2003). His PhD project focused on interfacial charge transfer studies of artificial and natural heme proteins using single-crystal electrochemistry, surface-enhanced and resonance Raman spectroscopy, and electrochemical Scanning Tunnelling Microscopy. From 2003-2006, he was a Marie-Curie postdoctoral fellow in Professor Jens Ulstrup's group at the Technical University of Denmark in Lyngby, on single-molecule charge transport in small transition metal complexes, biomolecules and nanoparticles in electrochemical environments. He accepted a Lecturer position in the Department of Chemistry at Imperial College London in 2006 and was promoted to Senior Lecturer in 2011.

His research interests span a wide range of subjects, centred on the physical and chemical properties of charged interfaces in solution and charge transport at the nanoscale. Specific application areas include single-molecule biosensing with solid-state nanopores, molecular and spintronics, as well as the surface science of copper leaching.

Prix Jacques Tacussel

Zhong-Qun Tian, *Xiamen University, China*

17:40 to 18:00, Monday, 1 September 2014, Symposium 12, Room 4 - Garden

Single Crystal Surfaces, Active Sites and Jellium Model

Zhong-Qun Tian received his Ph.D. degree from University of Southampton in 1983. There he worked toward a thesis entitled "In-situ Raman Spectroscopic Studies on Electrodeposition and Electrosorption" under the guidance of Professor Martin Fleischmann (FRS). In 1987 he returned to Xiamen University, China and has worked there ever since. Tian and his coworkers made an important progress in the electrochemical surface-enhanced Raman spectroscopy (EC-SERS) by which substantial surface Raman enhancements could be imparted to the VIIIB transition metals of importance for electrochemistry and catalysis. They demonstrated that SERS can be directly generated on pure Pt, Ru, Rh, Pd, Fe, Co and Ni electrodes, which were commonly considered as non-SERS active metals. They systematically combined the EC-SERS with the DFT result to reveal complex electrified interfacial structures and electrocatalytic mechanisms. Recently, Tian and coworkers have devised a method by which SERS can be obtained from virtually any surfaces. Up to now, molecular-level investigations by Raman spectroscopy on diverse adsorbates at various material electrodes and atomically flat surfaces have been realized. This great extension is a breakthrough of surface Raman spectroscopy for not only electrochemistry but also surface science. Overall Tian championed the development of electrochemical Raman spectroscopic methods in conducting fundamental molecular-level studies of metal-solution interfaces in the past ten years. He has over 5,800 total cites and a current annual citation rate of more than 1100.

Hans-Jürgen Engell Prize

Aliaksandr Bandarenka, *Ruhr-Universität Bochum, Germany*

15:00 to 15:20, Monday, 1 September 2014, Symposium 10, Room 1bc - Garden

Towards a Rational Design of the Electrochemical Interface for Efficient Electrocatalysis

Aliaksandr Bandarenka received his diploma in Chemistry (2002) and PhD in the field of electrochemistry (2005, supervisor: Dr. Genady Ragoisha) from Belarusian State University (Minsk, Belarus). After working as a postdoc at the University of Twente (The Netherlands) and Technical University of Denmark (Center for Individual Nanoparticle Functionality), in 2010 he became a group leader in the Center for Electrochemical Sciences at the Ruhr University Bochum, Germany. His research focuses on electrocatalysis, adsorption phenomena at the electrode surface, and developing methods for detailed in-situ characterization of the electrode–electrolyte interface.

ISE Prize Winners 2013

Katsumi Niki Prize for Bioelectrochemistry

Lo Gorton, *Lund University, Sweden*

09:50 to 10:30, Monday, 1 September 2014, Symposium 3, Auditorium A - Campus

From Meldola Blue to Cyanobacter – 30 Years of Bioelectrochemistry

My current affiliation is Department of Analytical Chemistry/Biochemistry and Structural Biology, University of Lund, P. O. Box 124, SE-221 00 Lund, Sweden. I graduated from school in 1968 and in 1971 I received a Bachelor's degree after studying genetics, botany, microbiology at Lund University. Then after studying chemistry at Lund University for 18 months I received a Master's degree. I was then working for one year as technician at the wastewater treatment plant in Malmö before I enrolled on a Phd program in analytical chemistry in 1975 with Prof. Gillis Johansson as supervisor. In May 1981 I graduated as PhD with a thesis entitled: A Study of Modified Electrodes and Enzyme Reactors. My external examiner (faculty opponent) was Prof. Theodore Kuwana (USA). After that I continued on various positions at Lund University and became Associate Professor (docent) in analytical chemistry in 1986 and finally in 1997 I became the chair professor in analytical chemistry.

I have been main supervisor for 26 and second supervisor for additional 5 PhD students. I have been financially supported continuously since 1990 by the Swedish Research Council and been involved in 13 EU projects. Except for bioelectrochemistry my research interests cover immobilised enzymes, flow injection analysis, liquid chromatography, mass spectrometry, polysaccharide hydrolysing enzymes and their use for analysis and characterisation of derivatised cellulose, hemicellulose and starch.

ISE Prize for Environmental Electrochemistry

Isao Shitanda, *Tokyo University of Science, Japan*

17:20 to 17:40, Monday, 1 September 2014, Symposium 15, Room 3bc - Garden

Printable Electrochemistry for Analysis of Environmental Significance

Isao Shitanda received his Dr. Eng. degree from The University of Tokyo, Japan, in 2006. He is currently Junior Associate Professor in the Department of Pure and Applied Chemistry, Faculty of Science and Technology, Tokyo University of Science (TUS), Japan. His research interests are development of printable electrochemical devices, namely "Printable Electrochemistry", with a major focus on the design and fabrication of screen-printed electrochemical sensing devices and their application to analysis of environmental significance.

ISE Prize for Applied Electrochemistry

Naoaki Yabuuchi, *Tokyo University of Science, Japan*

09:50 to 10:10, Friday, 5 September 2014, Symposium 5, Auditorium C - Cloud

Toward Development of High-Energy Li/Na Insertion Materials for Rechargeable Batteries

Naoaki Yabuuchi is Assistant Professor at Tokyo University of Science from 2010. He graduated from Osaka City University and received his Ph.D degree there in 2006. He was appointed as a post-doc associate at Massachusetts Institute of Technology in 2006-2008.

His research has ranged over energy conversion materials, especially for lithium and sodium insertion materials for rechargeable batteries. He has developed many new electrode materials for battery applications.

Among the awards he has received are "Sano award" (young scientist award in electrochemistry, Japan) and 2nd ISSI young scientist award (International Society for Solid State Ionics).

ISE Prize Winners 2013

Oronzio and Niccolò De Nora Foundation Young Author Prize

Ann Laheäär, *University of Tartu, Estonia*

10:30 to 10:50, Wednesday, 3 September 2014, Symposium 6, Room 2 - Garden

Effect of Carbon Surface Properties on the Charge Storage Ability of Ionic Liquid Based Supercapacitors

Ann Laheäär was born in Tallinn (Estonia). She received her Master's degree in chemistry (cum laude) in the University of Tartu (Estonia) in 2009 and was awarded with the I prize in the field of natural science and technology for her Master's degree thesis in the National Contest of Students' Researches by the Foundation Archimedes. She has been working as a chemist in the Institute of Chemistry (University of Tartu) since 2008 and defended her PhD thesis in August 2013 under supervision of Prof. Enn Lust and PhD Alar Jänes, entitled 'Electrochemical characterization of alkali metal salt based non-aqueous electrolytes for supercapacitors'. Her scientific work has been focused on the characterization of various non-aqueous electrolytes and carbon materials of variable porosity and morphology for the application in supercapacitors. She has also performed carbon powder gas-phase chemical modification under supervision of Prof. François Béguin in the University of Orléans (France) in 2012. She has published 8 papers in several international journals, including Electrochimica Acta, Journal of Solid State Electrochemistry, Journal of Electroanalytical Chemistry, and ECS Transactions. Since 2011, she has been delivering lectures in the University of Tartu in the field of energy storage and technology.

Electrochimica Acta Travel Award Winnners 2014

Gabriel Loget-Huesken, *Irvine, CA,USA*
Gaston Crespo, *Geneva, Switzerland*

ISE Travel Award Winners 2014

Francesco Ciucci, Hong-Kong, China
Ioannis Katsounaros, Lemont, IL, USA
Youngkook Kwon, Berkeley, CA, USA
Liang Liu, Jerusalem, Israel
Kim McKelvey, Coventry, United Kingdom
Daniela Plana, Bristol, United Kingdom
Federico Tasca, Santiago, Chile
Joao Tedim, Aveiro, Portugal

Oral presentations program

Monday 1 September 2014

Rooms	Auditorium A	Auditorium B	Auditorium C	Room 1a	Room 1bc	Room 2	Room 3a	Room 3bc	Room 4	Room 5
	S03	**S04**	**S05**	**S14**	**S10**	**S06**	**S01**	**S15**	**S12**	**S07**
08:30 - 09:30	**Plenary Lecture, Auditorium A** : Yang Shao-Horn									
09:30 - 09:50	Coffee Break									
09:50 - 10:10	Lo Gorton	Jin Goo Lee	R. Kostecki	A. Ewing	J. Bachmann	C. Merlet	A. Bond	R. McCreery	F. Miomandre	J. Hupp
10:10 - 10:30		F. Sapountzi		R. Trouillon	M. Kanan	D. Weingarth				
10:30 - 10:50	Ch. Léger	Qiong Cai	Soyeon Lee	F. Lemaître	R. J. Behm	A. Kornyshev	J. Bobacka	Hong-Yuan Chen	Qiang Zeng	G. Boschloo
10:50 - 11:10		A. Mineshige	Yoji Sakurai	M. Heien			J-M. Noel	Jaeyoung Lee	I. Diez-Perez	Qing Wang
11:10 - 11:30				S. Arbault						
11:30 - 11:50	Poster Session 1 in Garden Foyer : Symposium 1, 2, 3, 4, 7, 9, 14									
11:50 - 12:10										
12:10 - 12:30										
12:30 - 12:50			12:45 - 13:45 Author Workshop: Auditorium C - Cloud							
12:50 - 13:10				12:50 - 13:50 Division Officers Meeting: Room 1a	12:50 - 13:50 Regional Representatives Meeting: Room 1bc					
13:10 - 13:30										
13:30 - 14:00										
14:00 - 14:20	T. Risbridger	K. Miyatake	C. Grey	N. Dale	L. Nyholm	M. Salanne	P. Buhlman	T. Albrecht	P. A. Ash	Hironori Arakawa
14:20 - 14:40	Wenrong Yang		K. Griffith					Dongping Zhan		
14:40 - 15:00	Kenji Kano	A. Weber	Y. Takahashi	S. Marinesco	R. Akolkar	A. Kovalenko	M. G. Afshar	P. Peljo	A. Colina	U. Wiesner
15:00 - 15:20	Koji Sode	M. Klein	R. Mingant	R. Barbosa	A. Bandarenka	P. Ratajczak	Yumi Yoshida	S. Legeai	D. Ibáñez	Weihong Zhu
15:20 - 15:40	K. R. Stieger	E. Kjeang	D. Asakura	A.-S. Cans	Hai Nguyen	Kwang-Bum Kim	Shigeru Amemiya	A. Fry	W. Kaim	L. Kloo
15:40 - 16:00	K. Brinkert	G. Futter	J. Costard	Lanqun Mao	T. Moffat	Q. Abbas		M. D. Scanlon	Bing-Wei Mao	S. M. Zakeeruddin
16:00 - 16:20	N. Plumeré	J. Wackerl	D. Schröder		Liang Liu	Wataru Sugimoto	G. Herzog	Yu-Tien Lin	P. Bohn	Mingkui Wang
16:20 - 16:40	Coffee Break									
16:40 - 17:00	P. Bartlett	M. Arenz	Ryoji Kanno	L. Sombers	M. Innocenti	L. Coustan	R. Gyurcsányi	Aicheng Chen	Masatoshi Osawa	R. Caruso
17:00 - 17:20	E. Ferapontova	Jin-Song Hu	F. Ozanam	Meining Zhang	P. Dale	L. Timperman	S. Kinnear	Marco Fantin		
17:20 - 17:40	J. L. Olloqui-Sariego	Hansung Kim	Bing Joe Hwang	B. J. Venton	S. Tay	G. Ayalneh Tiruye	R. Dryfe	Isao Shitanda	M. Baghernejad	M. Zukalova
17:40 - 18:00	E. Suprun	D. Scherson	R. Castaing	Danny Wong	J. Switzer	K. Fic	Yang Liu	L. Trnkova	Zhong-Qun Tian	H. Desilvestro
18:00 - 18:20	A. Karyakin	S. Mukerjee	Nae-Lih Wu	V. Carabelli	C. Morales-Guio	Chi-Chang Hu	Zdeněk Samec		C. Fernandez-B.	
18:20 - 18:40	J. Rishpon	A. Schuppert	S. Walus	M. Wightman	G.Zangari	J. Black			Masa-aki Haga	H. Pettersson
18:40 - 19:00						E. Mourad				
20:00	Reception									

Monday, 1 September 2014 - Morning

Plenary Lecture

Auditorium A - Campus

Chaired by : Deborah Jones

08:30 to 09:30

Yang Shao-Horn (Department of Mechanical Engineering, Massachusetts Institute of Technology, Cambridge, USA)

Enabling Oxygen Electrocatalysis for Sustainable Energy

09:30 to 09:50

Coffee Break

Symposium 1: Dynamic Ion Sensing: From ITIES to ISEs

Room 3a - Garden

Chaired by : Eric Bakker

09:50 to 10:30 Keynote

Alan Bond (School of Chemistry, Monash University, Clayton, Australia), Alexander R. Harris, Jie Zhang, Robert W. Cattrall

Dynamic Voltammetric Ion Selective Electrodes: Principles and Applications to the Determination of Na^+, K^+ and Ca^{2+} in Blood and other Matrices

10:30 to 10:50 Invited

Johan Bobacka (Process Chemistry Centre, Laboratory of Analytical Chemistry, Åbo Akademi University, Turku, Finland), Elisa Hupa, Ulriika Vanamo

Novel Signal Transduction Principle for Ion Sensors

10:50 to 11:10

Jean-Marc Noel (Laboratoire ITODYS, Université Paris Diderot, Paris, France), Ali Abou-Hassan, Frédéric Kanoufi, Sandra Ristori, Federico Rossi

Monitoring the passage of redox oscillations across soft interfaces: Towards communicating liposomes

Symposium 3: Bioelectrochemistry: From Fundamentals to Health Monitoring and Energy Conversion

Auditorium A - Campus

Chaired by : Woonsup Shin

09:50 to 10:30 Keynote

Katsumi Niki Prize for Bioelectrochemistry

Lo Gorton (Analytical Chemistry/Biochemistry and Structural Biology, Lund University, Lund, Sweden)

From Meldola Blue to Cyanobacter – 30 Years of Bioelectrochemistry

10:30 to 10:50

Christophe Léger (Department of Bioenergetics and Engineering of Proteins, CNRS and Aix Marseille University, Marseille, France)

A Combined Electrochemical and Theoretical Study of H_2 Binding and Activation in FeFe Hydrogenases

Symposium 4: Electrochemical Energy Conversion and Storage: Fuel Cells and Electrolysers

Auditorium B - Campus

Chaired by : Hideki Yoshioka

09:50 to 10:10

Jin Goo Lee (Department of Chemical and Bio-molecular Engineering, Yonsei University, Seoul, Korea), Jeong Ho Park, Myeong Geun Park

Tailoring Interfaces and Microstructures of a Solid Oxide Fuel Cell for Low-temperature Operation

10:10 to 10:30

Foteini Sapountzi (IRCELYON, CNRS, Université Claude Bernard Lyon 1, Villeurbanne, France), Antoinette Boreave, Laurence Retailleau, Michail Tsampas, Dimitrios Niakolas, Charalampos Neofytidis, Dario Montinaro, Philippe Vernoux

Novel anode materials and triode operation: Two approaches for improving the performance of SOFCs supplied with H_2S containing-methane

10:30 to 10:50

Qiong Cai (Department of Chemical and Process Engineering, University of Surrey, Guildford, United Kingdom), Khalil Rhazaoui, Masashi Kishimoto, Farid Tariq, Claire Adjiman, Nigel Brandon

Combining 3D effective conductivity modeling with electrochemical performance prediction for solid oxide fuel cell electrodes

10:50 to 11:10

Atsushi Mineshige (Materials Science and Chemistry, University of Hyogo, Himeji, Japan), Mika Tange, Atsushi Saito, Hiroyuki Mieda, Tetsuo Yazawa, Hideki Yoshioka, Ryohei Mori

Electrochemical Properties of Perovskite- and Ruddlesden-Popper-Type Cathode Materials in Oxygen-Excess-Type Solid Electrolyte (OESE)

Symposium 5: Electrochemical Energy Conversion and Storage: Batteries

Auditorium C - Cloud

Chaired by : Robert Kostecki and Yoji Sakurai

09:50 to 10:30 Keynote Invited

Robert Kostecki (Environmental Energy Technologies Division, Lawrence Berkeley National Laboratory, Berkeley, USA), Maurice Ayache, Angelique Jarry, Ivan Lucas, Alexander McLeod, Richard Russo, Jaroslaw Syzdek, Vasileia Zormpa

In situ/in operando characterization of electrical energy storage systems

10:30 to 10:50

Soyeon Lee (Materials Science and Engineering, Tokyo Institute of Technology, Tokyo, Japan), Yoshifumi Oshima, Eiji Hosono, Haoshen Zhou, Kyungsu Kim, Ryoji Kanno, Kunio Takayanagi

In-situ TEM and cyclic voltammetry study of a single $LiMn_2O_4$ nanowire battery

10:50 to 11:10

Yoji Sakurai (Department of Electrical and Electronic Information Engineering, Toyohashi University of Technology, Toyohashi, Japan), Shuhei Kawashiri, Haruki Suetome, Nobuaki Maeda, Masahiro Utagawa, Ryoji Inada, Tomonobu Tsujikawa

Single Particle Measurement of Battery Electrode Materials by the Particle/Current Collector Integrated Microelectrode

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Symposium 6: Electrochemical Energy Conversion and Storage: Capacitors

Room 2 - Garden

Chaired by : Volker Presser

09:50 to 10:10

Céline Merlet (Department of Chemistry, University of Cambridge, Cambridge, United Kingdom), Alexander Forse, John M. Griffin, Daan Frenkel, Clare Grey

Investigation of Supercapacitors through an Original Lattice Simulation Method Combined with *In Situ* NMR Experiments

10:10 to 10:30 Invited

Daniel Weingarth (Energy Materials Group, Leibniz Institute for New Materials, Saarbrücken, Germany), Marco Zeiger, Nicolas Jäckel, Mesut Aslan, Volker Presser

The effect of graphitization on the potential dependent capacitance of carbon supercapacitors

10:30 to 11:10 Keynote

Alexei Kornyshev (Chemistry, Imperial College London, London, United Kingdom), Maxim Fedorov, Svyatoslav Kondrat, Alpha A. Lee, Gleb Oshanin, Volker Presser, Gunnar Pruessner, Rui Qiao, Christopher Rochester, Peng Wu

Physics of supercapacitors at the nanoscale

Symposium 7: Dye Sensitized Solar Cells

Room 5 - Garden

Chaired by : Shozo Yanagida

09:50 to 10:30 Keynote

Joseph Hupp (Department of Chemistry, Northwestern University, Evanston, USA)

Tunneling Layers, Stabilizing Layers, and Waterproofing Layers for Boosting the Performance and Enhancing the Molecular Diversity of Grätzel Cells

10:30 to 10:50 Invited

Gerrit Boschloo (Department of Chemistry, Uppsala University, Uppsala, Sweden), Meysam Pazoki, Wenxing Yang, Anders Hagfeldt

Charge compensation at the mesoporous semiconductor / dye / electrolyte interface

10:50 to 11:10 Invited

Qing Wang (Department of Materials Science and Engineering, National University of Singapore, Singapore, Singapore), Feng Li, Yeru Liu, Xingzhu Wang, James R. Jennings

Charge Collection and Separation in Sensitized Mesoscopic Solar Cells: An Account of Studies from NUS

Symposium 10: Electrodeposition for Energy Applications

Room 1bc - Garden

Chaired by : Giovanni Zangari

09:50 to 10:10 Invited

Julien Bachmann (Department of Chemistry and Pharmacy, Institute of Inorganic Chemistry, Erlangen, Germany), Markus Licklederer, Valentin Roscher, Julia Gemmer, Johannes Schumacher

Systematic increase of electrocatalytic turnover based on the geometry of nanostructured electrodes

10:10 to 10:30 Invited

Matthew Kanan (Chemistry, Stanford University, Stanford, USA)

Recycling Carbon Dioxide

10:30 to 11:10 Keynote

R. Jürgen Behm (Institute of Surface Chemistry and Catalysis, Ulm University, Ulm, Germany)

Bimetallic Electrodes with Well-defined Nanostructure - Preparation and Characterization on an Atomic Scale

Symposium 12: Electrochemistry Combined with Spectroscopic and Microscopic Techniques for Molecular Descriptions of ET Processes

Room 4 - Garden

Chaired by : Fethi Bedioui

09:50 to 10:30 Keynote

Fabien Miomandre (PPSM, ENS Cachan, Cachan, France), Jean-Frédéric Audibert, Robert Pansu, Pierre Audebert

Recent developments and applications of fluorescence microscopy coupled to electrochemistry

10:30 to 10:50 Invited

Qiang Zeng (Department of Chemistry, University of Reading, Reading, United Kingdom)

Applications of Optical Spectroelectrochemistry Combining with Low Temperature Technique

10:50 to 11:10 Invited

Ismael Diez-Perez (Department of Physical Chemistry, University of Barcelona, Barcelona, Spain), Albert C. Aragonès, Nadim Darwish, Daniel Aravena, Eliseo Ruiz, Josep Puigmarti-Luis, David B. Amabilino

Single-molecule Charge Transport in Organometallic Systems

Symposium 14: Brain Electrochemistry

Room 1a - Garden

Chaired by : Christian Amatore

09:50 to 10:10 Keynote

Andrew Ewing (Dept. of Chem. and Mol. Biol. and Dept. of Chem. and Biol. Eng., Univ. of Gothenburg and Chalmers Univ. of Tech, Gothenburg, Sweden)

Small Electrochemical Sensors and Single Cells: Zeptomoles, Milliseconds, and the Nature of Reality in Exocytosis

10:10 to 10:30

Raphaël Trouillon (Laboratory of Microsystems, EPFL, Lausanne, Switzerland), Andrew Ewing

Actin contributes to the regulation of quantal release during exocytosis

10:30 to 10:50 Invited

Frédéric Lemaître (Department of Chemistry, Ecole Normale Supérieure, Paris, France), Manon Guille Collignon, Christian Amatore

Recent Advances in Electrochemical Detection of Oxidative Stress

10:50 to 11:10 Invited

Michael Heien (Department of Chemistry and Biochemistry, University of Arizona, Tucson, USA)

Thin PEDOT films for neurochemical measurements

11:10 to 11:30 Invited

Stéphane Arbault (Institute of Molecular Sciences - CNRS, University of Bordeaux, Pessac, France), Emmanuel Suraniti, Salem Ben-Amor, Pauline Landry, Michel Rigoulet, Eric Fontaine, Serge Bottari, Anne Devin, Neso Sojic, Nicolas Mano

Monitoring electrochemically early events of hydrogen peroxide production by mitochondria

Symposium 15: General Session

Room 3bc - Garden

Chaired by : Zhifeng Ding

09:50 to 10:30 Keynote

Richard McCreery (Department of Chemistry, University of Alberta, National Institute for Nanotechnology, Edmonton, Canada), Adam Bergren, Akhtar Bayat, Mykola Kondratenko, Gaelle Trippe-Allard, Pascal Martin, Jean-Christophe Lacroix

Long Range Electron Transport in Molecular Junctions

10:30 to 10:50 Invited

Hong-Yuan Chen (School of Chemistry and Chemical Engineering, Nanjing University, Nanjing, China)

Recent progresses on photoelectrochemical bioanalysis

10:50 to 11:10 Invited

Jaeyoung Lee (Ertl Center and SESE, GIST, Gwangju, Korea)

Alkaline Oxygen Electrocatalysis of Iron Triad Elements in Chemical Energy Conversions

AUTHOR WORKSHOP

Auditorium C - Cloud

12:45 - 13:45

Presenter: Professor Robert Hillman

This workshop is for early career scientists looking for assistance in identifying, preparing and submitting research articles to an academic journal. The workshop will provide advice on the motivation for publishing, communicating effectively with the intended readership, ethics, the review process, best practice, and a range of other important considerations.

Questions addressed at this workshop will include:

- What do I need to consider when preparing my article?
- How do I write an article for a specific journal?
- Which tools are available during the writing process?
- How do I choose a suitable journal?
- What happens after I submit my article to a scientific/medical journal?
- How does the peer-review process work?
- … any other questions you might have!

Monday, 1 September 2014 - Afternoon

Symposium 1: Dynamic Ion Sensing: from ITIES to ISEs

Room 3a - Garden

Chaired by : Damien Arrigan and Alain Walcarius

14:00 to 14:40 Keynote
Philippe Buhlmann (Department of Chemistry, University of Minnesota, Minneapolis, USA), Xu U. Zou, Maral P. S. Mousavi
Half of the Experiment: Different Approaches to Deal with Reference Electrode Problems

14:40 to 15:00
Majid Ghahraman Afshar (Department of Inorganic, Analytical and Applied Chemistry, University of Geneva, Geneva, Switzerland), Gaston Crespo, Eric Bakker
Coulometric Ion Release into Thin Layer Samples

15:00 to 15:20
Yumi Yoshida (Department of Chemistry and Materials Technology, Kyoto Institute of Technology, Kyoto, Japan), Junya Uchida, Shotaro Nakamura, Kohji Maeda
Improved thin-layer electrolysis cell for ion transfer at the liquid/liquid interface using a conducting polymer-coated electrode

15:20 to 16:00 Keynote
Shigeru Amemiya (Department of Chemistry, University of Pittsburgh, Pittsburgh, USA)
A Real View of Electrochemistry at Graphene and Graphite: Solid/Liquid or Liquid/Liquid Interface?

16:00 to 16:20 Invited
Grégoire Herzog (LCPME UMR 7564, CNRS-Université de Lorraine, Villers-lès-Nancy, France), Lukasz Poltorak, Alain Walcarius
Electrochemically Assisted Assembly of Mesoporous Silica at the Liquid-Liquid Interface

16:20 to 16:40
Coffee Break

16:40 to 17:00 Invited
Róbert Gyurcsányi (MTA-BME ”Lendület” Chemical Nanosensors Research Group, Budapest University of Technology and Economics, Budapest, Hungary), Gyula Jágerszki, István Makra, Alexandra Brajnovits, Péter Terejánszki, Péter Fürjes
Ion-selective Chemically Modified Solid-state Nanopores

17:00 to 17:20
Sophie Kinnear (Department of Chemistry, University of Warwick, Coventry, United Kingdom), Kim McKelvey, Michael Snowden, Massimo Peruffo, Alex Colburn, Patrick Unwin
Dual-barrel Conductance Micropipet as a New Approach to the Study of Local Interfacial Ionic Fluxes and Dissolution Processes

17:20 to 17:40 Invited
Robert Dryfe (Department of Chemistry, University of Manchester, Manchester, United Kingdom), Matej Velicky, Aled Williams
Membrane Permeability: Insights from Liquid-Liquid Electrochemistry

17:40 to 18:00
Yang Liu (Department of Chemistry, Curtin University, Perth, Australia), Masniza Sairi, Mickaël Rimboud, Damien Arrigan
Electrochemical Study of Ion Transfer at Nanoscale Liquid/Liquid Interface Arrays

18:00 to 18:40 Keynote

Zdenek Samec (Department of Biomimetic Electrochemistry, J. Heyrovský Institute of Physical Chemistry of ASCR, v.v.i., Prague, Czech Republic), Antonín Trojánek, Jan Langmaier

Voltammetry of Ion Transfer across the Polarized Liquid Membrane

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Symposium 3: Bioelectrochemistry: From Fundamentals to Health Monitoring and Energy Conversion

Auditorium A - Campus

Chaired by : Alexander Kuhn

14:00 to 14:20

Thomas Risbridger (School of Chemistry, University of Bristol, Bristol, United Kingdom), Emma Long, Ross Anderson, Kamendra Sharma, Stephen Mann, Adam Perriman, David Fermin

Bio-electrocatalysis Using Enzymes Modified for Enhanced Stability

14:20 to 14:40

Wenrong Yang (Center for Chemistry and Biotechnology, Deakin University, Waurn Ponds, Australia)

Protein Electrochemistry Using Graphene-based Nano-assembly

14:40 to 15:00 Invited

Kenji Kano (Division of Applied Life Sciences, Graduate School of Agriculture, Kyoto University, Kyoto, Japan)

Direct Electron Transfer and Protein Engineering of a Heterotrimetric Flavoprotein-Cytochrome c Complex, Fructose Dehydrogenase

15:00 to 15:20

Koji Sode (Department of Biotechnology and Life Science, Tokyo University of Agriculture & Technology, Koganei, Japan)

Direct Electron Transfer Principle Based Continuous Glucose Monitoring ~*in vitro, in vivo* and *in situ* studies~

15:20 to 15:40

Kai R. Stieger (Department of Biosystems Technology, University of Applied Sciences Wildau, Wildau, Germany), Sven C. Feifel, Fred Lisdat

Photocurrent Generation of Photosystem I Arranged in Mono- and Multilayers within an Artificial Protein Platform

15:40 to 16:00

Katharina Brinkert (Department of Life Sciences, Imperial College London, London, United Kingdom), Andrea Fantuzzi, Alfred W. Rutherford

Photocurrent generated by Photosystem II adsorbed on a nanostructured titanium dioxide/indium tin oxide electrode

16:00 to 16:20

Nicolas Plumeré (Center for Electrochemical Sciences, Ruhr University Bochum, Bochum, Germany), Tim Kothe, Marc Nowaczyk, Matthias Rögner, Rhodri Williams, Aala Alsheikh Oughli, Jeevanthi Vivekananthan, Sascha Pöller, Olaf Rüdiger, Wolfgang Lubitz, Wolfgang Schuhmann

Electron relays for biofuel cells and biophotovoltaics

16:20 to 16:40

Coffee Break

Chaired by : Lars Jeuken

16:40 to 17:00 Invited

Philip Bartlett (Department of Chemistry, University of Southampton, Southampton, United Kingdom)

The Modification of Electrodes for Biosensors and Biofuel Cells

17:00 to 17:20

Elena E. Ferapontova (Interdisciplinary Nanoscience Centre (iNANO), Aarhus University, Aarhus, Denmark), Alessandra Bonamore, Alberto Boffi, Paula Lopes

Direct bioelectrocatalysis of NADH oxidation by "*Escherichia coli*" flavohemoglobin at promoter-modified electrodes

17:20 to 17:40

Jose Luis Olloqui-Sariego (Department of Physical Chemistry, University of Seville, Seville, Spain), Blas Moreno-Beltrán, Antonio Díaz-Quintana, Miguel A. De la Rosa, Juan José Calvente, Rafael Andreu

Temperature-induced Changeover in the Electron Transfer Kinetics for an Adsorbed Thermophilic Plastocyanin

17:40 to 18:00

Elena Suprun (Department of Personalized Medicine, Institute of Biomedical Chemistry, RAMS, Moscow, Russia), Maria Zharkova, Sergey Radko, Alexander Veselovsky, Victoria Shumyantseva, Alexander Archakov

Protein Electrochemistry Based on Amino Acid Residues: Theory and Medical Application

18:00 to 18:20

Arkady Karyakin (Chemistry Faculty, M.V. Lomonosov Moscow State University, Moscow, Russia)

Polyaniline Self-doping *via* Complexation of Boronic Acid Substituent with Polyols: Towards Microbial Sensor

18:20 to 18:40

Judith Rishpon (Department of Molecular Microbiolgy and Biotechnology, Tel-Aviv University, Tel-Aviv, Israel), Yifaat Betzalel, Michael Danon, Keren Goloub

Microbial Fuel Cells for Treatment of Olive Oil Mills and Municipal Waste Water

Symposium 4: Electrochemical Energy Conversion and Storage: Fuel Cells and Electrolysers

Auditorium B - Campus

Chaired by : Cesar Alfredo Barbero and Frederic Jaouen

14:00 to 14:40 Keynote

Kenji Miyatake (Clean Energy Research Center, University of Yamanashi, Kofu, Japan), Junpei Miyake, Masahiro Watanabe

Hydrocarbon Ionomer Membranes: Current Issues and Future Prospects

14:40 to 15:00

Adam Z. Weber (Environmental Energy Technologies Division, Lawrence Berkeley National Laboratory, Berkeley, USA), Ahmet Kusoglu, Andrew Crothers

Understanding and Modeling Water Transport in Proton-exchange Membranes

15:00 to 15:20

Mathieu Klein (LEMTA - CNRS UMR7563, Université de Lorraine, Vandoeuvre-lès-Nancy, France), Jean-Christophe Perrin, Sébastien Leclerc, Laouès Guendouz, Jérôme Dillet, Olivier Lottin

NMR/MRI methods dedicated to the study of water transport in membranes for PEMFC applications

15:20 to 15:40

Erik Kjeang (School of Mechatronic Systems Engineering, Simon Fraser University, Surrey, Canada), Natalia Macauley, Mark Watson, Chan Lim, Gary Wang, Erin Rogers, Mike Lauritzen, Shanna Knights

Membrane Durability Testing and Lifetime Predictions for Heavy Duty Fuel Cells

15:40 to 16:00

Georg Futter (Institute of Technical Thermodynamics, German Aerospace Center (DLR), Stuttgart, Germany), Thomas Jahnke, Arnulf Latz

Modeling and Simulation of Transport and Degradation Mechanisms in Reinforced PFSA Membranes for Automotive Fuel Cell Applications

16:00 to 16:20

Jürgen Wackerl (Institute of Energy and Clima Research (IEK-3), Forschungszentrum Jülich GmbH, Jülich, Germany), Fosca Conti, Werner Lehnert, Carsten Korte

Liquid – gas phase equilibria of phosphoric acid at high temperature electrolyte polymer fuel cell conditions

16:20 to 16:40

Coffee Break

16:40 to 17:00 Invited

Matthias Arenz (Department of Chemistry, University of Copenhagen, Copenhagen, Denmark), Jozsef Speder, Lena Altmann, Marcus Bäumer, Jacob Kirkensgaard, Kell Mortensen

Colloidal Pt Nanoparticles: An approach for systematic studies of fuel cell catalysts

17:00 to 17:20

Jin-Song Hu (Key Laboratory of Molecular Nanostructure and Nanotechnology, Institute of Chemistry, Chinese Academy of Sciences, Beijing, China), Zi-Dong Wei, Li-Jun Wan

Rational Design of Nanocatalysts with Enhanced Electrocatalytic Performances for Fuel Cell Applications

17:20 to 17:40

Hansung Kim (Chemical and Biomolecular Engineering, Yonsei University, Seoul, Korea), Youngick Cho

Novel synthetic route for the preparation of nanosegregated Pt alloy catalysts for oxygen reduction reaction

17:40 to 18:00

Daniel Scherson (Department of Chemistry, Case Western Reserve University, Cleveland, USA), Adriel Jebaraj

Impurity effects on the oxygen reduction reaction (ORR)

18:00 to 18:20

Sanjeev Mukerjee (Department of Chemistry and Chemical Biology, Northeastern University, Boston, USA), Urszula Tylus, Kara Strickland, Elise Miner, Qingying JIa

Engendering Anion Resistance in Electrocatalysts and its Implications

18:20 to 18:40

Anna K. Schuppert (Interface Chemistry and Surface Engineering, Max-Planck-Institut für Eisenforschung GmbH, Düsseldorf, Germany), Alan Savan, Alfred Ludwig, Karl Mayrhofer

Potential-resolved Dissolution of Pt-Cu Thin-film Alloys

Symposium 5: Electrochemical Energy Conversion and Storage: Batteries

Auditorium C - Cloud

Chaired by : Clare Grey and Ryoji Kanno

14:00 to 14:20 Invited

Clare Grey (Department of Chemistry, University of Cambridge, Cambridge, United Kingdom), Hao Liu, Fiona Strobridge, Lina Zhou, Michal Leskes

New NMR and X-ray Diffraction Based Approaches for Studying Electrode Reaction Mechanisms

14:20 to 14:40

Kent Griffith (Department of Chemistry, University of Cambridge, Cambridge, United Kingdom), Alexander Forse, John M. Griffin, Hyung-Seok Kim, Bruce Dunn, Clare Grey

Multinuclear NMR Investigation of Nb_2O_5 Polymorphs Calcined from NbO_2

14:40 to 15:00

Yasufumi Takahashi (WPI-AIMR, Tohoku, Sendai, Japan), Akichika Kumatani, Hirokazu Munakata, Hirotaka Inomata, Hitoshi Shiku, Patrick Unwin, Yuri Korchev, Kiyoshi Kanamura, Tomokazu Matsue

Development of Nanoscale Meniscus Cell Microscope for Visualizing Li^+ (de)intercalation Dynamics at $LiFePO_4$ Cathodes

15:00 to 15:20

Rémy Mingant (Department of Electrochemistry and Materials, IFPEN, Solaize, France), Julien Bernard, Valérie Sauvant-Moynot

P-EIS state of health diagnosis method for Li-ion battery module

15:20 to 15:40

Daisuke Asakura (Energy Technology Research Institute, AIST, Tsukuba, Japan), Eiji Hosono, Hideharu Niwa, Hisao Kiuchi, Jun Miyawaki, Yusuke Nanba, Masashi Okubo, Hirofumi Matsuda, Haoshen Zhou, Masaharu Oshima, Yoshihisa Harada

Operando Soft X-ray Emission Spectroscopy of Electrode Materials for Li-Ion Batteries

15:40 to 16:00

Janina Costard (Institut für Werkstoffe der Elektrotechnik (IWE), Karlsruher Institut für Technologie (KIT), Karlsruhe, Germany), Ellen Ivers-Tiffée, André Weber, Michael Weiss

Reference electrode materials for three-electrode impedance measurements: Reliability, reproducibility and long-term stability

16:00 to 16:20

Daniel Schröder (Institute of Energy and Process Systems Engineering, TU Braunschweig, Braunschweig, Germany), Tobias Arlt, Ingo Manke, Ulrike Krewer

In-Operando Tomography and Modeling: Analysis of Species-distribution in Zinc-Air-Batteries

16:20 to 16:40

Coffee Break

16:40 to 17:00 Invited

Ryoji Kanno (Department of Electronic Chemistry, Tokyo Institute of Technology, Yokohama, Japan), Kota Suzuki, Masaaki Hirayama, KyungSu Kim, Kazuhisa Tamura, Masao Yonemura, Norifumi Yamada

In situ X-ray and Neutron Scattering Studies on Electrode-electrolyte Interface in Lithium Battery

17:00 to 17:20

Francois Ozanam (Physique de la Matiere Condensee, CNRS-Ecole polytechnique, Palaiseau, France), Daniel Alves Dalla Corte, Georges Caillon, Christian Jordy, Jean-Noel Chazalviel, Michel Rosso

In-situ Infrared Study of Amorphous-silicon Electrodes for Lithium-ion Batteries

17:20 to 17:40

Bing Joe Hwang (Department of Chemical Engineering, National Taiwan University of Science and Technology, Taipei, Taiwan), Sunny Hy, Felix Felix, Ming-Xian Lin, You-Ren Yeh, Wei-Nien Su

In situ SERS Observation on Li Rich High Capacity Cathode Material, $Li[NixLi_{(1-2x)/3}Mn_{(2-x)/3}]O_2$

17:40 to 18:00

Rémi Castaing (Electrochemical Storage and Transformation of Energy, Institut des Matériaux Jean Rouxel (IMN), Nantes, France), Philippe Moreau, Dominique Guyomard, Nicolas Dupré, Yvan Reynier, Séverine Jouanneau Si Larbi, Donald Schleich

Aging Diagnosis of $Li_4Ti_5O_{12}/LiFePO_4$ Batteries

18:00 to 18:20

Nae-Lih Wu (Department of Chemical Engineering, National Taiwan University, Taipei, Taiwan)

Dynamics of Sulfur/Polysulfides Dissolution and Re-deposition in Li-S Battery Revealed by *In-Operando* Transmission X-ray Microscopy

18:20 to 18:40

Sylwia Walus (LITEN, CEA, Grenoble, France), Céline Barchasz, Jean-François Colin, Jean-Frédéric Martin, Erik Elkaim, Carsten Bähtz, Jean-Claude Leprêtre, Renaud Bouchet, Fannie Alloin

Application of *in situ* X-Ray Diffraction and Electrochemical Impedance Spectroscopy to Lithium/Sulfur Batteries

Symposium 6: Electrochemical Energy Conversion and Storage: Capacitors

Room 2 - Garden

Chaired by : François Béguin

14:00 to 14:40 Keynote

Mathieu Salanne (PHENIX Laboratory, Sorbonne University, UPMC, Paris, France), Clarisse Pean, Celine Merlet, Benjamin Rotenberg, Paul Madden, Barbara Daffos, Pierre-Louis Taberna, Patrice Simon, Yury Gogotsi

Modelling Ion Adsorption and Dynamics in Nanoporous Carbon Electrodes

14:40 to 15:00

Andriy Kovalenko (Department of Mechanical Engineering, University of Alberta, Edmonton, Canada)

Molecular Mechanisms of Nanoporous Carbon Electrode Supercapacitance

15:00 to 15:20

Paula Ratajczak (Institute of Chemistry and Technical Electrochemistry, Poznan University of Technology, Poznan, Poland), Pawel Jezowski, François Béguin

Performance improvement of AC/AC capacitors in aqueous medium through modification of the current collector/active material interface

15:20 to 15:40

Kwang-Bum Kim (Department of Material Science and Engineering, Yonsei University, Seoul, Korea), Seung-Beom Yoon

Electrochemical Kinetic Study on the Manganese Oxides for Electrochemical Capacitor Applications

15:40 to 16:00

Qamar Abbas (Institute of Chemistry and Technical Electrochemistry, Poznan University of Technology, Poznan, Poland), François Béguin

Optimization of AC/AC Electrochemical Capacitors in Salt Aqueous Electrolytes

16:00 to 16:20 Invited

Wataru Sugimoto (Faculty of Textile Science and Technology, Shinshu University, Ueda, Japan)

Buffer Solutions as a New Environmentally Benign Electrolyte for Aqueous Supercapacitors

16:20 to 16:40

Coffee Break

16:40 to 17:00

Laura Coustan (Institut Charles Gerhardt Montpellier - CNRS, Université Montpellier 2, Montpellier, France), Frederic Favier

MnO_2 as Ink Material for the Fabrication of Flexible Supercapacitor Electrodes

17:00 to 17:20

Laure Timperman (Department of Chemistry, Université François Rabelais, Laboratoire PCM2E, Tours, France), Warda Zaïdi, Aurélien Boisset, Mérièm Anouti

Deep Eutectic Solvents Based on N-Methylacetamide and a Lithium or Sodium Salt as Electrolytes for Activated Carbon-based Supercapacitors

17:20 to 17:40

Girum Ayalneh Tiruye (Unit of Electrochemical Processes, IMDEA Energy Institute, Mostoles, Spain), Jesus Palma, Marc Anderson, Rebeca Marcilla

All-solid state supercapacitors based on a binary mixture of Ionic liquids & Polymeric Ionic liquid

17:40 to 18:00

Krzysztof Fic (Institute of Chemistry and Technical Electrochemistry, Poznan University of Technology, Poznan, Poland), Mikolaj Meller, Elzbieta Frackowiak

Enhancement of Electrochemical Capacitor Performance by Understanding its Impedance Response – Theoretical and Experimental Study

18:00 to 18:20

Chi-Chang Hu (Department of Chemical Engineering, National Tsing Hua University, Hsinchu, Taiwan)

Influences of the charge balance issue on the performances of asymmetric supercapacitors with a battery electrode: The $Ni(OH)_2$-activated carbon system

18:20 to 18:40

Jennifer Black (Center for Nanophase Materials Sciences, Oak Ridge National Laboratory, Oak Ridge, USA), Guang Feng, M. Baris Okatan, Patrick Hillesheim, Sheng Dai, Peter T. Cummings, Sergei V. Kalinin, Nina Balke

Force Spectroscopy Investigation of Ionic Liquid Structure at Carbon Interface

18:40 to 19:00

Eléonore Mourad (Institut Charles Gerhardt, UMR5253, Université Montpellier 2, Montpellier, France)

Biredox ionic liquids: New opportunities to develop high performance electrochemical devices

Symposium 7: Dye Sensitized Solar Cells

Room 5 - Garden

Chaired by : Anders Hagfeldt

14:00 to 14:40 Keynote

Hironori Arakawa (Department of Industrial Chemistry, Tokyo University of Science, Tokyo, Japan), Yuki Tawaraya, Hironobu Ozawa

Highly Efficient Black-dye-Based Dye-sensitized Solar Cells – Effect of Imidazolium-iodide Species on Solar Cell Performance

14:40 to 15:00 Invited

Ulrich Wiesner (Department of Materials Science and Engineering, Cornell University, Ithaca, USA)

Block Copolymer-based Dye Sensitized Solar Cells

15:00 to 15:20

Weihong Zhu (Institute of Fine Chemicals, East China University of Science and Technology, Shanghai, China)

Organic Sensitizers from D-π-A to D-A-π-A: Effect of the Internal Electron-Withdrawing Units on Molecular Absorption, Energy Levels and Photovoltaic Performances

15:20 to 15:40 Invited

Lars Kloo (Department of Applied Physical Chemistry, KTH Royal Institute of Technology, Stochholm, Sweden)

Dye-sensitized Solar Cells – On the Organization of the Sensitizing Dye Molecules

15:40 to 16:00

Shaik M. Zakeeruddin (Laboratory for Photonics and Interfaces, EPFL, Lausanne, Switzerland)

Redox Electrolytes for High Efficiency and Stable Mesoscopic Dye Sensitized Solar Cells

16:00 to 16:20

Mingkui Wang (Wuhan National Laboratory for Optoelectronics, Huazhong University of Science and Technology, Wuhan, China)

D-π-A Structured Porphyrins for Mesoscopic Solar Cells

16:20 to 16:40

Coffee Break

16:40 to 17:20 Keynote

Rachel Caruso (School of Chemistry, The University of Melbourne, Melbourne, Australia), Dehong Chen, Fuzhi Huang, Yi-Bing Cheng

Controlling the Structure and Porosity of Materials for Use as the Photoanode in Dye Sensitized Solar Cells

17:20 to 17:40

Marketa Zukalova (Electrochemical Materials, J. Heyrovsky Institute of Physical Chemistry, AS CR, Prague, Czech Republic), Ladislav Kavan, Arnost Zukal, Jan Prochazka, Michael Grätzel

Engineering of TiO_2 Photoanode for Dye-sensitized Solar Cell

17:40 to 18:20 Keynote

Hans Desilvestro (R&D, Greatcell Solar S.A., Ecublens, Switzerland), James Farnell, Peng Qin, Nancy Jiang, Olivier Bellon, Timothy Lee, Jakub Mazurkiewicz, Geoffrey Munyeme, Paul Murray, Taro Sumitomo, Damion Milliken, Michael Grätzel

Perovskite-based Mesoscopic Solar Cells – Industrial *vs* Academic Challenges

18:20 to 18:40

Henrik Pettersson (Solar Cells, Swerea IVF, Mölndal, Sweden)

20 years experience of developing DSSC modules – from Ekologisk Energy to Dyenamo

Symposium 10: Electrodeposition for Energy Applications

Room 1bc - Garden

Chaired by : Peter Broekmann

14:00 to 14:40 Keynote

Leif Nyholm (Department of Chemistry, Ångström Laboratory, Uppsala University, Uppsala, Sweden), Gabriel Oltean, David Rehnlund, Mario Valvo, Solveig Böhme, Habtom D. Asfaw, Wei Wei, Kristina Edström

Electrodeposition of Nanostructured Electrode Materials for Li-ion Batteries

14:40 to 15:00 Invited

Rohan Akolkar (Department of Chemical Engineering, Case Western Reserve University, Cleveland, USA), Stephen Banik, Aniruddha Joi, Uziel Landau

Theory-guided Design of Electrodeposition Systems: Applications in Semiconductor Processing and Advanced Energy Storage Devices

15:00 to 15:20

Hans-Jürgen Engell Prize

Aliaksandr Bandarenka (Center for Electrochemical Sciences, Ruhr-Universität Bochum, Bochum, Germany)

Towards a Rational Design of the Electrochemical Interface for Efficient Electrocatalysis

15:20 to 15:40

Hai Nguyen (Department of Chemistry and Biochemistry, University of Bern, Bern, Switzerland), Julien Furrer, Enrico Barletta, Felice Janser, Nicola Luedi, Peter Broekmann

Tailored Design of Multi-functionalized Suppressor Additive for Copper Electroplating

15:40 to 16:00

Thomas Moffat (Materials Measurement Laboratory, NIST, Gaithersburg, USA)

Electrochemical deposition of Pt-(Fe, Co, Ni) alloys: Self-terminated growth to underpotential co-deposition

16:00 to 16:20

Liang Liu (Institute of Chemistry, The Hebrew University of Jerusalem, Jerusalem, Israel), Daniel Mandler

Electrodeposition of nano-objects

16:20 to 16:40

Coffee Break

16:40 to 17:00 Invited

Massimo Innocenti (Department of Chemistry, Università di Firenze, Firenze, Italy), Serena Cinotti, Francesco Di Benedetto, Alessandro Lavacchi, Roberto Felici, Francesco Carla, Nicola Cioffi, Francesco Vizza

Electrodeposition of semiconductor thin films for photovoltaic devices

17:00 to 17:20 Invited

Phillip Dale (Physics and Materials Science Research Unit, University of Luxembourg, Belval, Luxembourg), Monika Arasimowicz, Ashish Bhatia, Alexandre Crossay, Diego Colombara, Helene Meadows, Sudhajit Misra, Mike Scarpulla

Microstructure Matters: Matching Electrodeposited Precursors to Annealing Routines for Thin Film Photovoltaics

17:20 to 17:40

Stephen Tay (Department of Materials, Imperial College London, London, United Kingdom), Xuemei Zhang, Fatemehsadat Pishbin, Jason Riley, Sandrine Heutz, Mary Ryan

An Environmentally Friendly Solution Processing of Earth-abundant and Non-toxic Materials for Photovoltaics

17:40 to 18:00 Invited

Jay Switzer (Department of Chemistry, Missouri University of Science and Technology, Rolla, USA), James Hill, Alan Landers, Ying-Chau Liu, Jakub Koza

Photoelectrochemical water oxidation on an electrodeposited n-Si/SiOx/Co/CoOOH heterojunction

18:00 to 18:20

Carlos Morales-Guio (Institute of Chemical Sciences and Engineering, Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland), Matthew Mayers, S. David Tilley, Heron Vrubel, Michael Grätzel, Xile Hu

Coupling of Hydrogen and Oxygen Evolving Electrocatalysts to Metal Oxide Photoelectrodes for Solar Fuel Production

18:20 to 18:40

Giovanni Zangari (Department of Materials Science and Engineering, University of Virginia, Charlottesville, USA), Lok-kun Tsui

Passivation of Defects in TiO_2 Nanotubes by Li and H Doping

Symposium 12: Electrochemistry Combined with Spectroscopic and Microscopic Techniques for Molecular Descriptions of ET Processes

Room 4 - Garden

Chaired by : Francesco Paolucci

14:00 to 14:40 Keynote

Philip A. Ash (Department of Chemistry, Inorganic Chemistry Laboratory, University of Oxford, Oxford, United Kingdom), Ricardo Hidalgo, Min-Wen Chung, Ian J. McPherson, Kylie A. Vincent

New Approaches to Coupling IR Spectroscopy with Electrochemistry for Addressing Supported Catalysts: from Hydrogenase Enzymes to Metal Nanoparticles

14:40 to 15:00

Alvaro Colina (Department of Chemistry, Universidad de Burgos, Burgos, Spain), Jesus Garoz-Ruiz, Daniel Izquierdo, Cristina Fernandez-Blanco, Veronica Ferraresi, Ana M. Gonzalez-Baro, Aranzazu Heras

New Developments in Bidimensional Spectroelectrochemistry

15:00 to 15:20

David Ibáñez (Department of Chemistry, University of Burgos, Burgos, Spain), Daniela Plana, Aranzazu Heras, David J. Fermín, Alvaro Colina

Raman spectroelectrochemistry at liquid/liquid interfaces

15:20 to 15:40 Invited

Wolfgang Kaim (Institut für Anorganische Chemie, Universität Stuttgart, Stuttgart, Germany)

Electron Transfer Induced Coordination Changes Based on Non-innocently Behaving Hemilabile Ligands

15:40 to 16:00 Invited

Bing-Wei Mao (Chemistry Department, Xiamen University, Xiamen, China), Jia-Wei Yan, Xiao-Yan Hu, Yun-Xin Zhong, Mian-Gang Li, Meng Zhang, Li Chen, Wen-Yun Hu, Zhong-Qun Tian

Electrode-Ionic Liquid Interfaces Studied by EIS, SPM and SHINERS

16:00 to 16:20

Paul Bohn (Department of Chemical and Biomolecular Engineering, University of Notre Dame, Notre Dame, USA), Lawrence Zaino, Dane Grismer, Chaoxiong Ma

Redox Cycling and Single Molecule Spectroelectrochemistry in Zero-dimensional Electrochemical Nanostructures

16:20 to 16:40 Coffee Break

16:40 to 17:20 Keynote
Masatoshi Osawa (Catalysis Research Center, Hokkaido University, Sapporo, Japan)
Spectroscopic Approach to Fast and Ultrafast Dynamics at the Electrochemical Interface

17:20 to 17:40
Masoud Baghernejad (Department of Chemistry and Biochemistry, University of Bern, Bern, Switzerland), Veerabhadrarao Kaliginedi, Wenjing Hong, Thomas Wandlowski
Electrochemical Gate-effect on Single Molecular Junction Conductance

17:40 to 18:00
Prix Jacques Tacussel
Zhong-Qun Tian (Department of Chemistry, Xiamen University, Xiamen, China)
Electrochemical Surface-enhanced Raman Spectroscopy: From Core-shell Nanoparticles to Single Crystal Surfaces, Active Sites and Jellium Model

18:00 to 18:20
Cristina Fernandez-Blanco (Department of Chemistry, Universidad de Burgos, Burgos, Spain), Alvaro Colina, Aranzazu Heras
Spectroelectrochemical Synthesis of Gold Nanoparticles on Single Walled Carbon Nanotubes-Optically Transparent Electrodes

18:20 to 18:40
Masa-aki Haga (Department of Applied Chemistry, Chuo University, Tokyo, Japan), Takumi Nagashima, Takashi Suzuki, Hiroaki Ozawa
Electrochemical Behavior of Sequential Programmed Hetero-layer Films based on Dinuclear Ru Complexes on ITO Electrode

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Symposium 14: Brain Electrochemistry

Room 1a - Garden

Chaired by : Martyn Boutelle and Adrian Michael

14:00 to 14:40 Keynote Invited
Nicholas Dale (School of Life Sciences, University of Warwick, Coventry, United Kingdom)
Biosensors for ATP and adenosine: New insights from real-time measurement of purine release

14:40 to 15:00 Invited
Stephane Marinesco (Lyon Neuroscience Research Center, Team Waking, Inserm U1028, CNRS UMR5292, University Claude Bernard Lyon I, Lyon, France)
Monitoring D-serine concentration in the brain interstitial fluid using microelectrode biosensors

15:00 to 15:20
Rui Barbosa (Center for Neuroscience and Cell Biology, Faculty of Pharmacy, University of Coimbra, Coimbra, Portugal), Cátia Lourenço, Ana Ledo, Ricardo Santos, Miguel Caetano, Nuno Ferreira, Greg Gerhardt, Joao Laranjinha
Enzyme-Modified Microelectrodes for Monitoring Nonelectroactive Neurochemicals in the Brain

15:20 to 15:40 Invited
Ann-Sofie Cans (Department of Chemical and Biological Engineering, Gothenburg, Sweden), Jacqueline Keighron, Michael Kurczy, Joakim Wigström
Sensing of Acetylcholine Release from an Artificial Secretory Cell Model

15:40 to 16:20 Keynote Invited
Lanqun Mao (Institute of Chemistry, Chinese Academy of Sciences, Beijing, China)
In Vivo Electrochemistry for Monitoring Cerebral Ascorbate

16:20 to 16:40 Coffee Break

16:40 to 17:00 Invited

Leslie Sombers (Department of Chemistry, NC State University, Raleigh, USA), Lingjiao Qi, Marina Spanos, James Roberts, Leyda Lugo-Morales

Disambiguating the Complex Chemical Mechanisms Underlying Basic Brain Function using Hydrogen Peroxide Microelectrochemistry

17:00 to 17:20

Meining Zhang (Department of Chemistry, Renmin University of China, Beijing, China)

Aligned Carbon Nanotube-sheathed Carbon Fiber Microelectrodes for *In Vivo* Voltammetry

17:20 to 17:40 Invited

B. Jill Venton (Department of Chemistry, University of Virginia, Charlottesville, USA), Christopher Jacobs, Alexander Zestos, Hillary Rees, Cheng Yang

New carbon electrodes for neurotransmitter detection: Nanotubes, nanopetals and nanopipettes

17:40 to 18:00 Invited

Danny Wong (Department of Chemistry and Biomolecular Sciences, Macquarie University, Sydney, Australia), Shaneel Chandra, Shajahan Siraj, Christopher McRae, Anthony Miller, Avi Bendavid, Philip Martin

In Vivo Dopamine Detection with Minimal Fouling at Hydrogenated Conical-tip Carbon Electrodes

18:00 to 18:20 Invited

Valentina Carabelli (Department of Drug Science and Technology, University of Torino, Torino, Italy), Sara Gosso, Federico Picollo, Alfio Battiato, Ettore Bernardi, Paolo Olivero, Alberto Pasquarelli, Emilio Carbone

Diamond-based Biosensors for Monitoring Neurosecretion in Chromaffin Cells

18:20 to 19:00 Keynote Invited

Mark Wightman (Department of Chemistry and Neuroscience Center, University of North Carolina at Chapel Hill, Chapel Hill, USA)

Challenges and Opportunities for Brain Electrochemistry

Symposium 15: General Session

Room 3bc - Garden

Chaired by : Andrew Gewirth and Jaeyoung Lee

14:00 to 14:20

Tajima Prize

Tim Albrecht (Department of Chemistry, Imperial College London, London, United Kingdom)

Functionalized Solid-state Nanopores for Biosensing Applications

14:20 to 14:40 Invited

Dongping Zhan (Department of Chemistry, Xiamen University, Xiamen, China), Uwitonze Nestor, Girum Girma, Zhong-Qun Tian

Ion Transfer across the Water/1,2-DCE Interface Facilitated by Solvent Effect

14:40 to 15:00

Pekka Peljo (Laboratoire d'Electrochimie Physique et Analytique, Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland), Manuel A. Méndez, Micheal D. Scanlon, Heron Vrubel, Hubert Girault

Photo-ionic Cells: Two Solutions for Solar Energy Storage

15:00 to 15:20

Sophie Legeai (Institut Jean Lamour, UMR CNRS 7198, Equipe 208, Université de Lorraine, Metz Cedex 3, France), Youssouf Traore, Maxime Balva, Guilhem Arrachart, Stephane Pellet-Rostaing, Micheline Draye

Indium recovery by coupling liquid-liquid extraction and electrodeposition in ionic liquids

15:20 to 15:40

Albert Fry (Chemistry Department, Wesleyan University, Middletown, USA), Rachel Merzel, Boris Sheludko, Evan Baum, Leah Temes, Elaine Tsui, Grace Bomann, Emily Garvin

Electrochemical Reaction of Diphenylacetaldehyde in the Presence of Alcohols. An Electrode Process Involving Consecutive Electrochemical Transformations at Both Electrodes

15:40 to 16:00

Michael D. Scanlon (Laboratory of Physical and Analytical Electrochemistry, Ecole Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland), Manuel A. Méndez, Hubert Girault

Fermi-level Equilibration in Gold Nanoparticles: Theory and Potentiometric Redox Titrations

16:00 to 16:20

Yu-Tien Lin (Department of Chemical Engeering, National Chung Hsing University, Taichung, Taiwan), Mei-Ling Wang, Chia-Fu Hsu, Wei-Ping Dow, Shih-Min Lin, Jian-Jun Yang

Through-hole Filling in a Cu Plating Bath with Functional Insoluble Anodes and Acetic Acid as a Supporting Electrolyte

16:20 to 16:40

Coffee Break

16:40 to 17:00 Invited

Aicheng Chen (Department of Chemistry, Lakehead University, Thunder Bay, Canada), Wei Jin, Zhaoyang Zhang, Daniel Liba, Lucia Alvarado

Electrochemical Detection and Removal of Cr(VI)

17:00 to 17:20

Marco Fantin (Department of Chemical Sciences, Università degli Studi di Padova, Padova, Italy), Abdirisak Ahmed Isse, Armando Gennaro

Controlling Aqueous Atom Transfer Radical Polymerization

17:20 to 17:40

ISE Prize for Environmental Electrochemistry

Isao Shitanda (Department of Pure and Applied Chemistry, Tokyo University of Science, Chiba, Japan)

Printable Electrochemistry for Analysis of Environmental Significance

17:40 to 18:00

Libuse Trnkova (Department of Chemistry, Masaryk University, Faculty of Science, Brno, Czech Republic)

Elimination Voltammetry for the Future

18:00 to 18:20

Corie Horwood (Department of Chemistry, University of Calgary, Calgary, Canada) Viola Birss, Ebenezer Ansah, Hany El-Sayed, Annie Hoang, Yujun Shi

Determining Particle Size Effect on Electrochemical Behavior of Nanoparticle Arrays Prepared by Laser Dewetting

Tuesday 2 September 2014

Room	Auditorium A	Auditorium B	Auditorium C	Room 1a	Room 1bc	Room 2	Room 3a	Room 3bc	Room 4	Room 5
Symposium	**S03**	**S04**	**S05**	**S14/08**	**S10/09**	**S06**	**S11**	**S15**	**S12/02**	**S07/13**
08:30 - 09:30	**Plenary Lecture, Auditorium A** : Patrick R. Unwin									
09:30 - 09:50	Coffee Break									
09:50 - 10:10	F.Tasca	T. J. Schmidt	A. Van der Ven	A. Michael	F. Endres	F. Béguin	Yasuaki Einaga	A. Gewirth	P. Machata	G. Hodes
10:10 - 10:30	F. A. Armstrong		M.-L. Doublet	S. Weber			E. Mahe		M. Marcaccio	A. Abate
10:30 - 10:50		Wang Chih Dong	A. Latz	R. Forster	Takayuki Homma	Masayuki Morita	T. Watanabe	Huangxian Ju	B. Sarkar	A. Zaban
10:50 - 11:10		E. Lust	Yu-Guo Guo	N. Maidment	C. Berger	R. Mysyk	Ch. Comninellis	F. Ciucci	R. Nichols	K. Yamashita
11:10 - 11:30				M. Boutelle						
11:30 - 11:50	Poster Session 2 in Garden Foyer : Symposium 3, 5, 8, 12									
11:50 - 12:10										
12:10 - 12:30										
12:30 - 12:50										
12:50 - 13:10						12:50 - 13:50 Council Meeting: Room 2				
13:10 - 13:30										
13:30 - 14:00			**S08**		**S09**					
14:00 - 14:20	Ping Yu	N. Alonso-Vante	Masashi Ishikawa	J. Heinze	Xiaorong Zhou	M. Levi	B. K. Körbahti	Jing-Juan Xu	A. Patel	N. S. Sariciftci
14:20 - 14:30	K. Monsalve		V. Chaudoy		Q. Van Overmeere		R. C. Rocha-Filho	H. Kasuk	T. Zambelli	
14:30 - 14:40	B. Reuillard									
14:40 - 14:50	S. Vogt	L. Castanheira	T. Bergholz	R. Hillman	F. La Mantia	L. Dagousset	H. Baltruschat	Joohoon Kim	Dong Wang	Shozo Yanagida
14:50 - 15:00	L. Edembe									
15:00 - 15:10	J. Marquez-Leon	S. Mezzavilla	M. Lacey	G. Inzelt	B. R. Shrestha	P. Skowron	Y. Pleskov	E. Doeven	L. Kavan	J. E. Moser
15:10 - 15:20	F. Haddache									
15:20 - 15:30	N. M. Hemed	F. Alcaide	V. A. Mihali	H. Perrot	A. Beni	N. Jäckel	C. A. Martinez-Huitle	Zhifeng Ding	A. Guell	T. Murakami
15:30 - 15:40	B. P. Nadappuram									
15:40 - 15:50	Enhua Zhu	C. A. Barbero	F. Alloin	Ch. Karlsson	Sachiko Ono	F. Thissandier	G. Botte	M. Gratzl	Ch. Kranz	
15:50 - 16:00	K. Hasan									
16:00 - 16:10	L. Jourdin	M. Hashempour	Yuki Yamada	V. Malev	M. Altomare	Haegyeom Kim		G. Denuault		
16:10 - 16:20	S. Bajracharya									
16:20 - 16:40	Coffee Break								**S02**	**S13**
16:40 - 17:00	L. Jeuken	L. Dubau	R. Bouchet	M. Vorotyntsev	S. Ramanathan	J. R. Miller	I. González	Jingyuan Chen	M. Mirkin	P. Balbuena
17:00 - 17:20	A. L. De Lacey	E. Higuchi	Chihiro Yada	L. Ruhlmann			D. Woisetschläger	M. Turmine		
17:20 - 17:40	Yi-Tao Long	Shi-Gang Sun	Xinwei Chen	M. Skompska	A. Mozalev	Etsuro Iwama	G. C. Aguilera	Koichi Aoki	Rui Wen	M. Wessel
17:40 - 18:00	Akihiro Okamoto	A. Velázquez-P.	L. Berlouis	A. Fakhry	F. Di Franco	E. Gucciardi	O. Scialdone	M. Anderson	D. Mandler	J. Greeley
18:00 - 18:20	S. Cordoba	Hiroyuki Uchida	D. Lloyd	A. Nekrasov	Hiroki Habazaki	R. S. Dey	K. Groenen Serrano		W. Nogala	Mon-che Tsai
18:20 - 18:40	W. Kutner	N. Hodnik	I. Bardenhagen	D. Schaming	D. Veys-Renaux	R. Outlaw	C. Sáez		A. Lesch	Jun Cheng
20:00 - 21:00	CONCERT IN CATHEDRAL									

Tuesday, 2 September 2014 - Morning

Plenary Lecture

Auditorium A - Campus

Chaired by : Alan Bond

08:30 to 09:30

Patrick R. Unwin (Department of Chemistry, University of Warwick, Coventry, United Kingdom)

Nanoscale Views of Electrochemical Processes

09:30 to 09:50

Coffee Break

Symposium 3: Bioelectrochemistry: From Fundamentals to Health Monitoring and Energy Conversion

Auditorium A - Campus

Chaired by : David Waldeck

09:50 to 10:10

Federico Tasca (Química de los Materiales, USACH, Santiago, Chile), Riccarda Antiochia, Gabriele Favero, Franco Mazzei

Bilirubin Oxidase from *Myrothecium verrucaria* Physically Adsorbed onto Graphite Electrodes. Insights into the Alternative Resting Form of the Enzyme and the Impact of Chloride, Temperature and pH

10:10 to 10:50 Keynote

Fraser A. Armstrong (Department of Chemistry, University of Oxford, Oxford, United Kingdom)

What Electrochemistry has Taught us about Hydrogen Activation by Enzymes

Symposium 4: Electrochemical Energy Conversion and Storage: Fuel Cells and Electrolysers

Auditorium B - Campus

Chaired by : Nicolas Alonso-Vante

09:50 to 10:30 Keynote

Thomas J. Schmidt (Electrochemistry Laboratory, Paul Scherrer Intitute, Villigen PSI, Switzerland)

Durability of PEFC Cathode Catalysts: Challenges, New Concepts and Solutions

10:30 to 10:50

Wang Chih Dong (Chemical Engineering, National Taiwan University of Science and Technology, Taipei, Taiwan), Trung-Thanh Nguyen, Nibret Gebeyehu Akalework, Chun-Jern Pan, Mon-Che Tsai, John Rick, Wei-Nien Su, Bing Joe Hwang

Conductive $Ti_{1-x}Mo_xO_2$ Oxide Supported Pt nanocrystals Used as High-performance Catalyst for Oxygen Reduction Reaction

10:50 to 11:10

Enn Lust (Institute of Chemistry, University of Chemistry, Tartu, Estonia), Kersti Vaarmets, Silver Sepp, Jaak Nerut, Eneli Härk, Peeter Valk

Physical Characterization of Pt Nanoclusters Modified Carbide Derived Carbons and Oxygen Electroreduction Kinetics in Acidic and Basic Solutions

Symposium 5: Electrochemical Energy Conversion and Storage: Batteries

Auditorium C - Cloud

Chaired by : Marie-Liesse Doublet and Anton Van der Ven

09:50 to 10:10 Invited

Anton Van der Ven (Materials Department, University of California Santa Barbara, Santa Barbara, USA)

Elucidating kinetic processes and chemo-mechanical couplings in electrode materials from first principles

10:10 to 10:30 Invited

Marie-Liesse Doublet (Department of Chemistry, Institut Charles Gerhardt, CNRS, Université Montpellier 2, Montpellier, France), Anne-Laure Dalverny, Rémi Khatib, Jean-Sébastien Filhol

Interface Electrochemistry in Li-Materials: A First Step towards Multiscale Modeling

10:30 to 10:50

Arnulf Latz (Department of Computational Electrochemistry, German Aerospace Center and Helmholtz Institute Ulm, Ulm, Germany), Birger Horstmann, Simon Hein

Modeling of Lithium Stripping and Plating

10:50 to 11:10

Yu-Guo Guo (Institute of Chemistry, Chinese Academy of Sciences (CAS), Beijing, China), Sen Xin, Ya-Xia Yin, Chun-Peng Yang, Huan Ye, Juan Zhang, Li-Jun Wan

Rational Design of Electrode Materials Based on Chalcogen Elements for Li-Ion and Post Li-Ion Batteries

Symposium 6: Electrochemical Energy Conversion and Storage: Capacitors

Room 2 - Garden

Chaired by : John R. Miller

09:50 to 10:30 Keynote

François Béguin (Institute of Chemistry and Technical Electrochemistry, Poznan University of Technology, Poznan, Poland), Qamar Abbas, Elzbieta Frackowiak

Electrochemical Capacitor in Aqueous Electrolyte Reaching the Energy Density of Organic Systems

10:30 to 10:50

Masayuki Morita (Graduate School of Science and Engineering, Yamaguchi University, Ube, Japan), Rie Yamamoto, Keisuke Tsuchimochi, Nobuko Yoshimoto

Utilization of Poly(vinylpyridine) as an Oxidant-capture for Iodine-based Redox Capacitors

10:50 to 11:10

Roman Mysyk (EES, CIC Energigune, Miñano, Spain)

Supercapacitor Electrode Materials from Abundant Lignocellulose Biomass: Fine-Tuning Porosity to Specific Electrolytes

Symposium 7: Dye Sensitized Solar Cells

Room 5 - Garden

Chaired by : Ladislav Kavan

09:50 to 10:10 Invited

Gary Hodes (Department of Materials and Interfaces, Weizmann Institute of Science, Rehovot, Israel), Eran Edri, Saar Kirmayer, Michael Kulbak, David Cahen

High Voltage Perovskite Cells

10:10 to 10:30

Antonio Abate (Department of Physics, University of Oxford, Oxford, United Kingdom)

Organic “donor-free” dye with enhanced open circuit voltage in solid-state sensitized solar cells

10:30 to 10:50 Invited

Arie Zaban (Department of Chemistry, Bar-Ilan University, Ramat-Gan, Israel)

Quantum Dot Solar Cells

10:50 to 11:10

Koichi Yamashita (Department of Chemical System Engineering, The University of Tokyo, Tokyo, Japan), Giacomo Giorgi, Jun-ichi Fujisawa, Hiroshi Segawa

Structural and Electronic Properties Featuring Ambipolar Transport in Methylammonium Lead Iodide Perovskite: A DFT Analysis

Symposium 10: Electrodeposition for Energy Applications

Room 1bc - Garden

Chaired by : Mary Ryan

09:50 to 10:30 Keynote

Frank Endres (Institute of Electrochemistry, TU Clausthal, Clausthal-Zellerfeld, Germany)

Peculiarities of the interface ionic liquid(s) / electrode(s) and the possible influence of solutes/impurities

10:30 to 10:50 Invited

Takayuki Homma (Applied Chemistry, Waseda University, Tokyo, Japan), Yasuhiro Fukunaka, Toshiyuki Nohira

High Purity Silicon Materials Prepared Through Wet-chemical and Electrochemical Approaches

10:50 to 11:10

Claudia Berger (Institute of Electrochemistry, Ulm University, Ulm, Germany), Timo Jacob

Electrochemical studies of the lithium deposition on Au(111) from a piperidinium-based ionic liquid

Symposium 11: Electrochemical Technology: Crossroad for Energy and Environment

Room 3a - Garden

Chaired by : Gerardine G. Botte and Christos Comninellis

09:50 to 10:10 Invited

Yasuaki Einaga (Department of Chemistry, Keio University, Yokohama, Japan)

Recent development on boron-doped diamond electrodes

10:10 to 10:30 Invited

Eric Mahe (UMR CNRS/UPMC N° 8234 - PHENIX, Université Pierre-et-Marie Curie, Paris, France)

Electrogenerated radical species produced at BDD electrodes: Identification and reactivity

10:30 to 10:50

Takeshi Watanabe (Department of Chemistry, Keio University, Yokohama, Japan), Yasuaki Einaga

Design of Boron-doped Diamond with sp2-bonded Carbon Impurities According to the Electrochemical Applications

10:50 to 11:10

Christos Comninellis (Department of Chemistry, EPFL, Lausanne, Switzerland)

Oxidation of Organics *via* a Non-Faradaic Electrochemical Activation of Molecular Oxygen

Symposium 12: Electrochemistry Combined with Spectroscopic and Microscopic Techniques for Molecular Descriptions of ET Processes

Room 4 - Garden

Chaired by : Deborah Jones

09:50 to 10:10

Peter Machata (Department of Physical Chemistry, Slovak University of Technology, Bratislava, Slovakia), Peter Rapta, Martin Breza

Spectroelectrochemical and Theoretical Study of Redox Properties of Galactose Oxidase Models

10:10 to 10:30 Invited

Massimo Marcaccio (Dipartimento di Chimica, Università di Bologna, Bologna, Italy)

Electron Transfer and Spectroelectrochemistry of Carbon Nanostructured Systems

10:30 to 10:50

Biprajit Sarkar (Department of Chemistry and Biochemistry, Free University, Berlin, Germany), Hari Sankar Das, Fritz Weisser, David Schweinfurth

Polyelectrochromism in Diruthenium Complexes with Redox-active Ligands

10:50 to 11:10

Richard Nichols (Chemistry, The University of Liverpool, Liverpool, United Kingdom), Nicola Kay, Jens Ulstrup, Edmund Leary, Simon Higgins, Jess Lycoops, Samantha Catarelli, Jan Jeppesen, Andrea Vezzoli

STM Studies of Single Molecule Electrochemical and Chemical Gating

Symposium 14: Brain Electrochemistry

Room 1a - Garden

Chaired by : Andrew Ewing and Mark Wightman

09:50 to 10:10 Keynote Invited

Adrian Michael (Department of Chemistry, University of Pittsburgh, Pittsburgh, USA)

In Vivo Fast-scan Cyclic Voltammetry of Dopamine Domains in the Central Nervous System

10:10 to 10:30 Invited

Stephen Weber (Department of Chemistry, University of Pittsburgh, Pittsburgh, USA), Yangguang Ou, Juanfang Wu, Jessie Jiang, Amy Rupert

Electroosmotic Flow in Brain Tissue. Implications for Measurements

10:30 to 10:50 Invited

Robert Forster (School of Chemical Sciences, Dublin City University, Dublin, Ireland), Tia Keyes, Andrea McCooey, Hazel McArdle, Elaine Spain, Eoin Brennan, Colm Montgomery

Ultrasensitive Electrochemical Detection of miRNA Biomarkers in Epilepsy

10:50 to 11:10 Invited

Nigel Maidment (Department of Psychiatry and Biobehavioral Sciences, University of California, Los Angeles, Los Angeles, USA), Vanessa Tolosa, Tina Tseng, Harold Monbouquette, Kate Wassum

Micro-electrode Array Biosensors for Neurotransmitter Detection in Behaving Animals

11:10 to 11:30 Invited

Martyn Boutelle (Department of Bioengineering, Imperial College London, London, United Kingdom), Michelle Rogers, Chi Leng Leong, Chu Wang, Emmanuel Drakakis, Toby Jeffcote, Clemens Pahl, Daniel Walsh, Christos Tolias, Anthony Strong

Microfluidic Based Electrochemical Sensors and Biosensors for Real-time Neurochemical Monitoring of the Injured Human Brain

Symposium 15: General Session

Room 3bc - Garden

Chaired by : Jingyuan Chen

09:50 to 10:30 Keynote

Andrew Gewirth (Department of Chemistry, University of Illinois, Urbana, USA)

Using Hybrid Bilayer Membrane Devices and Electrochemical Stress Measurements to Interrogate Processes at Electrode Surfaces

10:30 to 10:50 Invited

Huangxian Ju (Department of Chemistry, Nanjing University, Nanjing, China)

Signal Amplification for Electrochemical Analysis of Nucleic Acids and Proteins

10:50 to 11:10

Francesco Ciucci (Department of Mechanical and Aerospace Engineering, HKUST, Hong Kong, China)

Model-based Optimal Experimental Design and Statistical Methods for Electrochemistry

Tuesday, 2 September 2014 - Afternoon

Symposium 2: Scanning Electrochemical Microscopy: Reading, Writing, Monitoring of Functional Interfaces

Room 4 - Garden

Chaired by : Frederic Kanoufi

16:40 to 17:20 Keynote Invited

Michael Mirkin (Department of Chemistry, Queens College-CUNY, Flushing, USA), Tong Sun, Yun Yu, Brian Zacher

"I know it when I see it"—AFM meets a nanoelectrode

17:20 to 17:40

Rui Wen (Institute of Experimental and Applied Physics, Kiel University, Kiel, Germany), Björn Rahn, Olaf Magnussen

In-situ Video STM Studies of Dynamic Processes at Metal/Ionic Liquid Interfaces

17:40 to 18:00 Invited

Daniel Mandler (Institute of Chemistry, The Hebrew University of Jerusalem, Jerusalem, Israel), Roman G. Fedorov

Local Deposition of Shape Controlled Nano-objects by Scanning Electrochemical Microscopy (SECM)

18:00 to 18:20

Wojciech Nogala (Institute of Physical Chemistry, Polish Academy of Sciences, Warsaw, Poland), Gunther Wittstock, Justyna Jedraszko, Magdalena Kominiak, Marcin Opallo

Electrochemical Imaging of Rough and Tilted Samples: How to Drive Commercial SECM at Constant Current Mode

18:20 to 18:40

Andreas Lesch (Laboratory of Physical and Analytical Electrochemistry, Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland), Fernando Cortes-Salazar, Po-Chung Chen, Alexandra Bondarenko, Tzu-En Lin, Gunther Wittstock, Hubert Girault

Soft microelectrode arrays vs. finger probe arrays – Joining the concepts for ultra-soft scanning

Symposium 3: Bioelectrochemistry: From Fundamentals to Health Monitoring and Energy Conversion

Auditorium A - Campus

Chaired by : Fred Lisdat

14:00 to 14:20

Ping Yu (Institute of Chemistry, Chinese Academy of Sciences, Beijing, China), Lanqun Mao

Tuning Ionic Interaction For Improving Selectivity

14:20 to 14:30

Karen Monsalve (Bioénergétique et Ingénierie des Protéines, CNRS-AMU, Marseille, France), Anne de Poulpiquet, Magali Roger, Serge Nitsche, Deborah Byrne-Kodjabachian, Marie Thérèse Giudici-Orticoni, Marianne Ilbert, Elisabeth Lojou

Gold Nanoparticules as Platforms for Electrical Connections of Biomolecules

14:30 to 14:40

Bertrand Reuillard (Departement de Chimie Moléculaire, Université de Grenoble, Grenoble, France), Alan Le Goff, Serge Cosnier, Michael Holzinger, Kamal Elouarzaki, Charles Agnès, Chantal Gondran

Wiring redox enzymes in functionalized carbon nanotube matrixes for high power glucose-oxygen biofuel cells

14:40 to 14:50

Stephan Vogt (Department of Chemistry, Biology, University of Siegen, Siegen, Germany), Heiko Schäfer-Eberwein, Marcel Schneider

Spectroelectrochemical Investigation of Glucose Oxidase at Different pH

14:50 to 15:00

Lise Edembe (Biopiles et Biocapteurs, Centre de Rechercche Paul Pascal Université de Bordeaux, Pessac, France), Sébastien Gounel, Nicolas Mano

A novel bi-enzymatic cathode made with BODs from *Bacillus pumilus* and *Magnaporthe oryzae*

15:00 to 15:10

Jessica Marquez-Leon (Facultad de Ciencias Quimicas, Universidad Autonoma de San Luis Potosi, San Luis Potosi, Mexico), Gabriela Palestino, Luis F. Chazaro-Ruiz

Porous silicon/cytochrome c biosensor for the detection of the superoxide anion

15:10 to 15:20

Fatima Haddache (Département de Chimie Moléculaire, Université Joseph Fourier, Grenoble, France)

Electrogenerated Ru(II)-Metallopolymer with Intercalating Properties for HIV DNA Photoelectrochemical Detection

15:20 to 15:30

Nofar Mintz Hemed (Department of Physical Electronics, School of Electrical Eng, Tel Aviv University, Tel Aviv, Israel), Carmit Ophir, Annalisa Convertino, Yosi Shacham-Diamand

Comparative Study of Planar *vs*. Si Nanowire Electrode for Bacterial Cells Sensing Using Electrochemical Impedance Spectroscopy

15:30 to 15:40

Binoy Paulose Nadappuram (Department of Chemistry, University of Warwick, Coventry, United Kingdom), Kim McKelvey, Patrick R. Unwin

Localized Nanoscale Imaging of Molecular and Ion Fluxes at Living Cells using Multifunctional Electrochemical Probes

15:40 to 15:50

Enhua Zhu (Department of Chemistry, Sogang University, Seoul, Korea)

Stable and Low Voltage Operated Miniaturized Nongassing Electroosmotic Pump for the Drug Delivery

15:50 to 16:00

Kamrul Hasan (Biochemistry and Structural Biology, Lund University, Lund, Sweden), Kesava Reddy, Kamil Górecki, Peter O'Conghaile, Cecilia Hägerhäll, Dónal Leech, Lo Gorton

Photo-electrochemical Communication between *Rhodobacter capsulatus* and Electrode for Harnessing Solar Energy

16:00 to 16:10

Ludovic Jourdin (Advanced Water Management Center, University of Queensland, St Lucia, Brisbane, Australia), Victoria Flexer, Jun Chen, Gordon G. Wallace, Stefano Freguia, Jurg Keller

A novel carbon nanotube modified scaffold creates an efficient biocathode material for improved microbial electrosynthesis

16:10 to 16:20

Suman Bajracharya (Separation and Conversion Unit, VITO, Flemish Institite for Technological Research, Mol, Belgium), Annemiek Ter Heijne, Xochitl Dominguez-Benetton, David Strik, Karolien Vanbroekhoven, Cees J.N. Buisman, Deepak Pant

Microbial Electrocatalysis of CO_2 Reduction for Acetate and Ethanol Production

16:20 to 16:40

Coffee Break

Chaired by : Serge Cosnier

16:40 to 17:00 Invited

Lars Jeuken (School of Biomedical Sciences, University of Leeds, Leeds, United Kingdom)

Single-enzyme Fluorescence Electrochemistry Studies of a Heme-copper Oxidase Proton Pump

17:00 to 17:20

Antonio L. De Lacey (Instituto de Catálisis y Petroleoquímica, CSIC, Madrid, Spain), Oscar Gutiérrez-Sanz, David Olea, Marcos Pita, Ana P. Batista, Manuela M. Pereira, Marisela Vélez

Electrochemical Characterization of Respiratory Complex I Reconstituted on a Supported Biomimetic Membrane over a Gold Electrode

17:20 to 17:40

Yi-Tao Long (Department of Chemistry, East China University of Science and Technology, Shanghai, China)

Electrochemistry of Quinone/Hydroquinone-Functionalized Biointerfaces

17:40 to 18:00

Akihiro Okamoto (Department of Applied Chemistry, The University of Tokyo, Tokyo, Japan)

Unification of Extracellular Electron Transport Mechanisms in *Shewanella* and *Geobacter* Species

18:00 to 18:20

Susana Cordoba de Torresi (Instituto de Quimica, Universidade de Sao Paulo, Sao Paulo, Brazil), Vinicius R. Gonçales, Marco A. de S. Minadeo, Rafael N.P. Colombo, Elaine Y. Matsubara, Jose M. Rosolen

Three-dimensional Carbon Felt Decorated with Carbon Nanotubes and/or Reduced Graphene Oxide for Direct Electron Transfer of Glucose Oxidase

18:20 to 18:40

Wlodzimierz Kutner (Department of Physical Chemistry of Supramolecular Complexes, Institute of Physical Chemistry, Polish Academy of Sciences, Warsaw, Poland), Tan-Phat Huynh, Marta Sosnowska, Chandra Bikram KC, Vladimir Nesterov, Janusz W. Sobczak, Francis D'Souza

Selective Chemosensing with Molecularly Imprinted Polymers of Thiophenes

Symposium 4: Electrochemical Energy Conversion and Storage: Fuel Cells and Electrolysers

Auditorium B - Campus

Chaired by : Matthias Arenz and Daniel Scherson

14:00 to 14:40 Keynote

Nicolas Alonso-Vante (Department of IC2MP UMR CNRS 7285, University of Poitiers, Poitiers, France)

Advanced Nanomaterials for Oxygen Reduction Process

14:40 to 15:00

Luis Castanheira (Department of EI - Electrochimie Interfaciale, LEPMI, Grenoble, France), Laetitia Dubau, Frédéric Maillard

Carbon Corrosion in PEMFCs: From Model Experiments to MEAs Operated in Real-life Conditions

15:00 to 15:20

Stefano Mezzavilla (Department of Heterogeneous Catalysis, Max-Planck-Institut für Kohlenforschung, Mülheim an der Ruhr, Germany), Claudio Baldizzone, Hudson Wallace Pereira Carvalho, Ivan Radev, Volker Peinecke, Jan-Dierk Grunwaldt, Karl Mayrhofer, Ferdi Schüth

Hollow graphitic spheres: Beyond conventional carbon supports for efficient PEM fuel cell catalysts

15:20 to 15:40

Francisco Alcaide (Energy, IK4-CIDETEC, San Sebastián, Spain), Garbiñe Alvarez, Oscar Miguel, Amaia Querejeta

High performance, low Pt-on-carbon nanofibers catalyst loading MEAs for low temperature PEMFC

15:40 to 16:00

Cesar Alfredo Barbero (Department of Chemistry, Universidad Nacional de Rio Cuarto, Rio Cuarto, Argentina), Angelica Baena Moncada, Rusbel Coneo Rodriguez, Diego Fernando Acevedo, Gabriel Angel Planes

Hierarchical Nanoporous Carbon Materials as Active Support of Electrocatalytic Nanoparticles

16:00 to 16:20

Mazdak Hashempour (Department of Chemistry, Materials and Chemical Engineering, Politecnico di Milano, Milan, Italy), Surbhi Sharma, Daniel Gonzalez, Gaurav Gupta, Antonello Vicenzo, Massimiliano Bestetti

The role of different graphene supports in ORR activity of Pt catalyst in PEMFC; Ionic liquid exfoliation of graphite *vs*. microwave assisted reduction of graphene oxide

16:20 to 16:40

Coffee Break

16:40 to 17:00 Invited

Laetitia Dubau (LEPMI, CNRS, Grenoble, France), Miguel Lopez-Haro, Julien Durst, Laure Guetaz, Pascale Bayle-Guillemaud, Marian Chatenet, Frédéric Maillard

Towards improved and sustainable ORR electrocatalysis with Pt “hollow” nanoparticles

17:00 to 17:20

Eiji Higuchi (Applied Chemistry, Graduate School of Engineering, Osaka Prefecture University, Osaka, Japan), Kohei Okada, Masanobu Chiku, Hiroshi Inoue

Electrocatalytic Activity for Oxygen Reduction Reaction of Pt/Au/CB Catalyst with Different Core Sizes

17:20 to 17:40

Shi-Gang Sun (Department of Chemistry, Xiamen University, Xiamen, China), Hong-Hui Wang, Yu-Jiao Lai, Chi Chen, Zhi-You Zhou

Bimetallic Platinum-Gold Nanoparticle Netlike Assembly with High Activity and Durability for Oxygen Reduction Reaction

17:40 to 18:00

Amado Velázquez-Palenzuela (DTU Physics, Technical University of Denmark, Kongens Lyngby, Denmark), Federico Masini, Anders F. Pedersen, Maria Escudero-Escribano, Davide Deiana, Paolo Malacrida, Daniel Friebel, Anders Nilsson, Ifan E.L. Stephens, Ib Chorkendorff

Oxygen Reduction on Mass-selected PtxGd Nanoparticles as Model Catalysts for Fuel Cells

18:00 to 18:20

Hiroyuki Uchida (Clean Energy Research Center, University of Yamanashi, Kofu, Japan), Jun Omura, Shoya Morishima, Donald A. Tryk, Mitsuru Wakisaka, Masahiro Watanabe

Effect of Adsorbed ClO_4^- and Oxygen Species on the Oxygen Reduction Activities of Pt_3Co Alloy Electrode

18:20 to 18:40

Nejc Hodnik (Department of Interface Chemistry and Surface Engineering, Max-Planck-Institut für Eisenforschung GmbH, Düsseldorf , Germany), Chinnaya Jeyabharathi, Kanala Phani, Aleksander Recnik, Marjan Bele, Stanko Hocevar, Miran Gaberscek, Karl Mayrhofer

Effect of ordering of $PtCu_3$ electrocatalyst structure on the stability for oxygen reduction reaction

Symposium 5: Electrochemical Energy Conversion and Storage: Batteries

Auditorium C - Cloud

Chaired by : Philipp Adelhelm and Renaud Bouchet

14:00 to 14:20 Invited

Masashi Ishikawa (Department of Chemistry and Materials Engineering, Kansai University, Suita, Japan), Masaki Yamagata

Peculiar Behavior of FSI-based Ionic Liquid Electrolyte at Electrode Interphase and its Effect on LIB Performance

14:20 to 14:40

Victor Chaudoy (Department of Chemistry - PCM2E, University of Tours, Tours, France), Fouad Ghamouss, Jean-Christophe Houdbert, François Tran-Van

A Comparative Study of PVdF-HFP and Crosslinked PEO with Ionic Liquids as Polymer Electrolytes for Lithium Ion Batteries

14:40 to 15:00

Timm Bergholz (Institute of Energy and Climate Research, IEK-3, Forschungszentrum Juelich GmbH, Juelich, Germany), Carsten Korte, Jörg Sundermeyer, Detlef Stolten

Synthesis and Characterization of Novel Ionic Liquids for the Utilization in Lithium-Ion Batteries

15:00 to 15:20

Matthew Lacey (Department of Chemistry - Ångström Laboratory, Uppsala University, Uppsala, Sweden), Fabian Jeschull, Kristina Edström, Daniel Brandell

Functional, Water-Soluble Binders for Improved Capacity and Stability of Lithium-Sulfur Batteries

15:20 to 15:40

Viorica Alina Mihali (Department of Chemistry, Uppsala University, Uppsala, Sweden), Stéven Renault, Daniel Brandell

Benzenediacrylates as novel materials for organic Na- and Li-ion batteries

15:40 to 16:00

Fannie Alloin (LEPMI-ELSA, CNRS, Saint Martin d'Hères, France), Marco Bolloli, Julian Kalhoff, Jean-Claude Leprêtre, Jean-Frédéric Martin, Dominic Bresser, Stéphano Passerini, Jean-yves Sanchez

Alternative electrolyte for lithium battery: Fluorinated solvents and additives

16:00 to 16:20

Yuki Yamada (Department of Chemical System Engineering, The University of Tokyo, Tokyo, Japan), Keitaro Sodeyama, Jianhui Wang, Keizo Furukawa, Keisuke Kikuchi, Makoto Yaegashi, Yoshitaka Tateyama, Atsuo Yamada

A Superconcentrated Electrolyte for Fast-charging and High-voltage Lithium-ion Batteries

16:20 to 16:40

Coffee Break

16:40 to 17:00

Renaud Bouchet (LEPMI-UMR 5279, INPG, St. Martin d'Hères, France)

A new family of single-ion BAB triblock copolymers as efficient solid electrolytes

17:00 to 17:20

Chihiro Yada (Advanced Technology 1, Toyota Motor Europe NV/SA, Zaventem, Belgium), Christopher E. Lee, David Laughman, Louise Hannah, Brian Hayden

Tailor-made Electrolyte/Cathode Interfacial Buffer Layers for 5V-Class All-solid-state Lithium Batteries

17:20 to 17:40

Xinwei Chen (Department of Material Science and Engineering, Massachusetts Institute of Technology, Cambridge, USA), Brandon J. Hopkins, Ahmed Helal, Frank Fan, Zheng Li, Kyle C. Smith, Alexander H. Slocum, W. Craig Carter, Yet-Ming Chiang

Gravity-induced Flow Cell: An Interdisciplinary of Mechanical Engineering, Suspension Rheology and Electrochemistry

17:40 to 18:00

Leonard Berlouis (Pure and Applied Chemistry, University of Strathclyde, Glasgow, United Kingdom), Lauren Dickie, Eulalia Pujades Otero, Rory Cartwright, Georgios Nikiforidis

Studies on the Zn-Ce and $Zn-Br_2$ redox flow battery systems

18:00 to 18:20

David Lloyd (Department of Chemistry, Aalto University, Espoo, Finland), Laura Sanz, Lasse Murtomäki, Kyösti Kontturi

The aqueous all-copper Redox Flow Battery

18:20 to 18:40

Ingo Bardenhagen (Energy Storage, Fraunhofer IFAM, Bremen, Germany), Olga Yezerska, Daniela Fenske, Marcus Bäumer

Electrochemical Impedance Spectroscopy of a Carbon Xerogel GDE in the Li/O_2-System

Symposium 6: Electrochemical Energy Conversion and Storage: Capacitors

Room 2 - Garden

Chaired by : Kwang-Bum Kim

14:00 to 14:40 Keynote

Mikhael Levi (Department of Chemistry, Bar-Ilan University, Ramat-Gan, Israel)

In situ Investigations of EDL Charging with Focus on QCM-D Methodology

14:40 to 15:00

Laure Dagousset (Laboratoire de Chimie et de Matériaux Multifonctionnels, Thales Research and Technology, Palaiseau, France), Giao Nguyen, Christophe Galindo, Pierre-Henri Aubert, Frédéric Vidal

Physical and electrochemical properties of binary systems based on ionic liquids and organic solvents as supercapacitor electrolytes for extreme temperatures

15:00 to 15:20

Piotr Skowron (Faculty of Chemical Technology, Poznan University of Technology, Poznan, Poland), Krzysztof Fic, Elzbieta Frackowiak, François Béguin

Effect of iodide additives on the performance of electrochemical capacitors in ionic liquid

15:20 to 15:40

Nicolas Jäckel (Energy Materials Group, Leibniz Institute for new Materials, Saarbrücken, Germany), Marco Zeiger, Daniel Weingarth, Volker Presser

Carbon onions *versus* high and low surface area carbon black: What is the better conductive additive?

15:40 to 16:00

Fleur Thissandier (LEMOH, CEA Grenoble, INA, SPrAM (UMR 5819-CEA, CNRS-UJF), Grenoble, France), David Aradilla, Nicolas Berton, Mylène Brachet, Annaïg Le Comte, Dorian Gaboriau, Olivier Crosnier, Nicolas Pauc, Gérard Bidan, Thierry Brousse, Pascal Gentile, Saïd Sadki

Silicon based micro-supercapacitors: How to improve their performances?

16:00 to 16:20

Haegyeom Kim (Department of Materials Science and Engineering, Seoul National University, Seoul, Korea), Min-young Cho, Mok-Hwa Kim, Kyu-Young Park, Hyeokjo Gwon, Yunsung Lee, Kwang Chul Roh

High Energy Hybrid Lithium Ion Capacitors Using Graphene-based Electrodes Combined with Activated Carbon

16:20 to 16:40

Coffee Break

16:40 to 17:20 Keynote

John R. Miller (JME, Inc. and Case Western Reserve University, Beachwood, USA)

Fabricating and testing electrochemical capacitors

17:20 to 17:40

Etsuro Iwama (Department of Applied Chemistry, Tokyo University of Agriculture and Technology, Tokyo, Japan), Masayuki Abe, Takumi Furuhashi, Yuta Abe, Junichi Miyamoto, Wako Naoi, Katsuhiko Naoi

Ultrafast nc-TiO_2 (B) /CNF Composites for Negative Electrode of “Nanohybrid Capacitor”

17:40 to 18:00

Emanuele Gucciardi (Department of Accumulators Materials Research, ZSW, Ulm, Germany), Sonia Dsoke, Marco Secchiaroli, Bettina Fuchs, Xu Tian, Roberto Marassi, Margret Wohlfahrt-Mehrens

Ultrafast cathode and anode materials for high energy and high power asymmetric-hybrid supercapacitors

18:00 to 18:20

Ramendra S. Dey (Department of Chemistry, Technical University of Denamrk, Lyngby, Denmark), Qijin Chi

Three-dimensional Reduced Graphene Oxide Network on Copper Foam as High-performance Supercapacitor Electrodes

18:20 to 18:40

Ronald Outlaw (Department of Applied Science, College of William and Mary, Williamsburg, USA), Dilshan Premathilake, Sue Butler, John Miller

High Frequency Vertically Oriented Graphene Nanosheet Capacitors Synthesized from CH_4 and C_2H_2

Symposium 7: Dye Sensitized Solar Cells

Room 5 - Garden

Chaired by : Satoshi Uchida

14:00 to 14:40 Keynote

Niyazi Serdar Sariciftci (Linz Institute for Organic Solar Cells, Johannes Kepler University, Linz, Austria)

Organic and Bio-organic Devices for Sustainable Optoelectronics and Solar Energy Conversion

14:40 to 15:00

Shozo Yanagida (FRC, Faculty of Engineering, Osaka University, Suita, Japan), Kazuhiro Manseki, Hiroshi Segawa

Theoretical Evaluation of Electron Transport in Dye-sensitized Solar Cells

15:00 to 15:20 Invited

Jacques-E. Moser (Institute of Chemical Sciences and Engineering, Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland), Jan C. Brauer, Arianna Marchioro, Ahmad A. Oskouei, Arun A. Paraecattil

Charge Transfer States in Dye-sensitized Solar Cells

15:20 to 15:40

Takurou Murakami (Research Institute for Innovation in Sustainable Chemistry, Advanced Industrial Science and Technology (AIST), Tsukuba, Japan), Nagatoshi Koumura, Mutsumi Kimura, Shogo Mori

Recombination Inhibitive Donor Structure of Organic Dye for Cobalt Complex Redox Electrolyte in Dye-sensitized Solar Cells

16:20 to 16:40

Coffee Break

Symposium 8: Modern Electroactive Polymeric, Organic, Inorganic and Nanocomposite Materials

Room 1a - Garden

Chaired by : Jürgen Heinze, Renato Seeber, Magdalena Skompska and Vessela Tsakova

14:00 to 14:40 Keynote

Jürgen Heinze (Institute for Physical Chemistry, FMF, University of Freiburg, Freiburg, Germany)

Charging/Discharging Phenomena of Conducting Polymers - A Multifaceted Problem

14:40 to 15:00

Robert Hillman (Department of Chemistry, University of Leicester, Leicester, United Kingdom), Rachel Sapstead, Virginia Ferreira, Karl Ryder, Charlotte Beebee, Erik Watkins

Effect of Electrochemical Control Function on the Growth and Spatially Variant Composition of Conducting Polymer Films

15:00 to 15:20

György Inzelt (Department of Physical Chemistry, Eötvös Loránd University, Budapest, Hungary), Balázs Broda

Preparation and Characterization of Poly(aminoindoles) by Using Electrochemical Quartz Crystal Nanobalance

15:20 to 15:40

Hubert Perrot (LISE, CNRS, Paris, France), Ozlem Sel, Alain Pailleret, Claude Gabrielli

AC-Electrogravimetry Investigations of Birnessite type MnO_2 Thin Films

15:40 to 16:00

Christoffer Karlsson (Engineering Sciences, Uppsala University, Uppsala, Sweden), Hao Huang, Maria Strømme, Adolf Gogoll, Martin Sjödin

Charge Transport in Pyrrole/Quinone Conducting Redox Polymers

16:00 to 16:20

Valery Malev (Department of Chemistry, Saint-Petersburg State University, Saint-Petersburg, Russia)

Corrected approach to treating the polaron conductance of electroactive polymers

16:20 to 16:40

Coffee Break

16:40 to 17:00

Mikhail Vorotyntsev (Department of Novel Materials Chemistry, Institute for Problems of Chemical Physics, Russian Academy, Chernogolovka, Russia), Dmitry Konev, Charles Devillers, Kseniya Lizgina, Vladimir Baulin, Irina Kalashnikova

Novel Family of Porphine-Based Electroactive Materials. Electrocatalysis of Oxygen Reduction Reaction

17:00 to 17:20

Laurent Ruhlmann (Department of Chemistry, University of Strasbourg, Institute of Chemistry, Strasbourg, France), Zhaohui Huo, Iban Azcarate, Guillaume Izzet, Anna Proust, Christophe Bucher

Porphyrin-polyoxometalate electropolymers

17:20 to 17:40

Magdalena Skompska (Faculty of Chemistry, University of Warsaw, Warsaw, Poland), Piotr Piotrowski, Andrzej Kaim

Donor-acceptor Thiophene Copolymer with Pendant Fulleropyrrolidine Moieties

17:40 to 18:00

Ahmed Fakhry (Laboratoire Interfaces et Systèmes Electrochimiques, CNRS, UPMC, Paris, France), Françoise Pillier, Catherine Debiemme-Chouvy

How the pH and the Composition of Pyrrole Solutions Influence the Templateless Electrogeneration of Polymer Nanostructures

18:00 to 18:20

Alexander Nekrasov (Russian Academy of Sciences, Frumkin Institute of Physical Chemistry and Electrochemistry, Moscow, Russia), Oxana Gribkova, Victor Zolotorevsky, Victor Ivanov, Anatoly Vannikov

Real-Time *In Situ* AFM Study of the Templating Influence of Polymeric Sulfonic Acids on Aniline Electropolymerization

18:20 to 18:40

Delphine Schaming (ITODYS, Université Paris Diderot, Paris, France), Pascal Martin, Jean-Christophe Lacroix

Electrochemically tunable plasmon resonance of gold nanoparticles functionalized by covalently grafted oligomers or by deposited conducting polymers

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Symposium 9: Corrosion, Passivity and Oxide Films

Room 1bc - Garden

Chaired by : Francesco Di Quarto and Sachiko Ono

14:00 to 14:20 Invited

Xiaorong Zhou (School of Materials, The University of Manchester, Manchester, United Kingdom)

Integrity of Anodic Films Formed on Aluminium Alloys

14:20 to 14:40

Quentin Van Overmeere (Institute of Mechanics, Materials and Civil Engineering, Université Catholique de Louvain, Louvain-la-Neuve, Belgium), Frédéric Blaffart, Fabio La Mantia, Thomas Pardoen, Francesco Di Quarto, Joris Proost

In situ stress, strain and dielectric measurements to understand electrostriction in anodic oxides

14:40 to 15:00

Fabio La Mantia (Zentrum für Elektrochemie, Ruhr-Universität Bochum, Bochum, Germany), Mu Fan, Jelena Stojadinovic, Monica Santamaria, Francesco Di Quarto

A critical analysis of the theory of amorphous semiconductor Schottky barrier for oxides

15:00 to 15:20

Buddha Ratna Shrestha (Department of Interface Chemistry and Surface Engineering, Max-Planck-Institut für Eisenforschung, Dusseldorf, Germany), Theodoros Baimpos, Sangeetha Raman, Markus Valtiner

Ångstrom resolved growth and characterization of noble metal oxides

15:20 to 15:40

Alessandra Beni (Laboratory for Joining Technologies and Corrosion, EMPA, Duebendorf, Switzerland), Noemie Ott, Magdalena Pawelkiewicz, Marie-Genevieve Barthes-Labrousse, Lars P. H. Jeurgens, Patrik Schmutz

Hard X-Ray Photoelectron Spectroscopy (HAXPES) and Photoelectrochemistry Characterization of New Al-Cr-Fe Complex Metallic Alloys Passive Film Composition

15:40 to 16:00

Sachiko Ono (Department of Applied Chemistry, Kogakuin University, Tokyo, Japan), Tatsuya Masuda, Hidetaka Asoh

Cell Morphology of Anodic Porous Alumina Films

16:00 to 16:20

Marco Altomare (Department of Materials Science - LKO, University of Erlangen - Nuremberg, Erlangen, Germany), Kiyoung Lee, JeongEun Yoo, Patrik Schmuki

WO_3 Nanochannels by Anodization in Molten o-H_3PO_4

16:20 to 16:40

Coffee Break

16:40 to 17:20 Keynote

Shriram Ramanathan (SEAS, Harvard University, Cambridge, USA)

Point defects at oxide interfaces and their control at atomic scale

17:20 to 17:40

Alexander Mozalev (Central European Institute of Technology (CEITEC), Brno University of Technology, Brno, Czech Republic), Roza Maria Vazquez, Maria Bendova, Francesc Gispert-Guirado, Marian Marik, Jaromir Hubalek, Eduard Llobet

Smart Anodizing of Tungsten through the Alumina Nanopores: From Nanocolumns to Nanocapsules and Nanotubes

17:40 to 18:00

Francesco Di Franco (Electrochemical Materials Science Laboratory, DICAM, Università di Palermo, Palermo, Italy), Andrea Zaffora, Monica Santamaria, Francesco Di Quarto, Etsuji Tsuji, Hiroki Habazaki

Tuning of solid state properties of Al-Ta mixed oxides

18:00 to 18:20

Hiroki Habazaki (Faculty of Engineering, Hokkaido University, Sapporo, Japan), Fumitaka Kataoka, Etsushi Tsuji, Yoshitaka Aoki, Shinji Nagata

Efficient Growth of Anodic Films on Magnesium in Fluoride-containing Electrolytes

18:20 to 18:40

Delphine Veys-Renaux (Institut Jean Lamour, Université de Lorraine, Vandoeuvre lès Nancy, France), Emmanuel Rocca, Najat Chahboun

Aluminium alloys anodizing: Effect of the composition and the microstructure

Symposium 11: Electrochemical Technology: Crossroad for Energy and Environment

Room 3a - Garden

Chaired by : Yasuaki Einaga and Sandra Rondinini

14:00 to 14:20

Bahadir K. Körbahti (Chemical Engineering Department, University of Mersin, Mersin, Turkey), Selin Tasyürek

Determination of Reaction Kinetic Parameters for Electrochemical Oxidation of Ampicillin Antibiotic using Boron-doped Diamond Anode

14:20 to 14:40 Invited

Romeu C. Rocha-Filho (Department of Chemistry, S. Carlos Federal University, S. Carlos, Brazil), Nerilso Bocchi, Sonia R. Biaggio

Comparative use of different anode materials in the electrochemical degradation of organics

14:40 to 15:00 Invited

Helmut Baltruschat (Inst. of Physical and Theoretical Chemistry, University of Bonn, Bonn, Germany), Siegfried Ernst, Ana Stefanova

Mechanistic studies on BDD: The O_2 evolution reaction and the oxidation of small organic molecules

15:00 to 15:20

Yuri Pleskov (Department of Physical Electrochemistry, Frumkin Institute of Physical Chemistry and Electrochemistry, Moscow, Russia), M.D. Krotova, V.V. Elkin, V. P. Varnin, I. G. Teremetskaya, A. V. Saveliev, V. G. Ralchenko

Benzene Oxidation at Diamond Electrodes: Comparison of Microcrystalline and Nanocrystalline Diamond

15:20 to 15:40 Invited

Carlos Alberto Martinez-Huitle (Institute of Chemistry, Federal University of Rio Grande do Norte, Natal, Brazil), Danyelle Medeiros de Araujo, Salvador Cotillas, Manuel A. Rodrigo

Electrochemical Conversion/Combustion of a Model Organic Pollutant on BDD Anode: Role of sp^3/ps^2 Ratio

15:40 to 16:20 Keynote Invited

Gerardine G. Botte (Department of Chemical and Biomolecular Engineering, Ohio University, Athens, USA)

Ammonia Electrolysis: Recovery of Energy from Waste

16:20 to 16:40

Coffee Break

16:40 to 17:00 Invited

Ignacio González (Department of Chemistry, Universidad Autónoma Metropolitana-Iztapalapa, México, Mexico), Eligio P. Rivero, Martín R. Cruz-Díaz, Francisco J. Almazán-Ruiz, Angel Torres-Mendoza

The electro-oxidation of recalcitrant compounds in a new FM01-LC reactor by Hydrodynamic and Mass Transport Turbulence Modeling by CFD with a reaction term coupled with a continuous stirred tank (CST)

17:00 to 17:20

Dieter Woisetschläger (Technical Development Division, VTU Engineering GmbH, Graz, Austria), Bernd Humpl, Wolfgang Glasl, Matthäus Siebenhofer

Electrochemical wastewater treatment: Applications and development of full scale electrolysis cells

17:20 to 17:40

Gilberto Carreño Aguilera (Department of Geomatics and Hydraulic, University of Guanajuato, Guanajuato, Mexico)

Electrochemical Degradation of Azo Dye Disperse Blue 3

17:40 to 18:00

Onofrio Scialdone (Dipartimento di Ingegneria Chimica Gestionale Informatica, Università di Palermo, Palermo, Italy), Adriana D'Angelo, Sonia Sabatino, Alessandro Galia

Abatement of Acid Orange 7 in Water by Different Electrochemical Approaches

18:00 to 18:20 Invited

Karine Groenen Serrano (Laboratoire de Génie Chimique, CNRS, Université Paul Sabatier, Toulouse, France)

Does Electrochemistry have a role to play in the treatment of dilute solutions and micropollutants ?

18:20 to 18:40

Cristina Sáez (Department of Chemical Engineering, University of Castilla La Mancha, Ciudad Real, Spain), María José Martín de Vidales, Salvador Cotillas, Javier Llanos, Pablo Cañizares, Manuel A. Rodrigo

Scaling up of electro-irradiated processes for the removal of persistent organic pollutants from treated wastewater

Symposium 12: Electrochemistry Combined with Spectroscopic and Microscopic Techniques for Molecular Descriptions of ET Processes

Room 4 - Garden

Chaired by : Fabien Miomandre

14:00 to 14:20

Anisha Patel (Laboratoire ITODYS, Université Paris Diderot, Paris, France), Ariadna Martinez-Marrades, Christopher Batchelor-McAuley, Kristina Tschulik, Catherine Combellas, Richard G. Compton, Gilles Tessier, Frédéric Kanoufi

The coupling of amperometry with 3D Holography for simultaneous opto-electrochemical imaging of single Ag nanoparticle oxidation

14:20 to 14:40 Invited

Tomaso Zambelli (Laboratory of Biosensors and Bioelectronics, ETH Zurich, Zurich, Switzerland)

FluidFM: a Force-controlled Nanopipette for Spatially Resolved Stimulation of Electrochemical Reactions under the Tip Aperture

14:40 to 15:00

Dong Wang (Institute of Chemistry, Chinese Academy of Sciences, Beijing, China), Ting Chen, Jing-Ying Gu, Li-Jun Wan

Direct Probing the Electron Transfer and Reaction at the Electrode/Electrolyte Interface by *in-situ* Scanning Tunneling Microscopy

15:00 to 15:20

Ladislav Kavan (Department of Electrochemical Materials, J. Heyrovsky Institute of Physical Chemistry, Prague 8, Czech Republic), Zuzana Vlckova-Zivcova, Vaclav Petrak, Otakar Frank, Pavel Janda, Hana Tarabkova, Milos Nesladek

Boron-doped Diamond Electrodes: Electrochemical Impedance, AFM and Raman spectroelectrochemistry

15:20 to 15:40

Aleix Guell (Department of Chemistry, University of Warwick, Coventry, United Kingdom), Julie V. Macpherson, Patrick R. Unwin

Coupling Nanoscale Electrochemistry with micro-Raman Spectroscopy: New Views of sp2 Carbon Electrodes

15:40 to 16:20 Keynote

Christine Kranz (Institute of Analytical and Bioanalytical Chemistry, University of Ulm, Ulm, Germany), Alexander Eifert, Daniel Neubauer

Boron-doped diamond electrodes: From spectroelectrochemistry to AFM tip-integrated electrodes

16:20 to 16:40

Coffee Break

Symposium 13: Synergizing Theory and Experiment in Electrochemistry: State-of-the Art Developments

Room 5 - Garden

Chaired by : Jun Cheng and Jeffrey Greeley

16:40 to 17:20 Keynote Invited

Perla Balbuena (Department of Chemical Engineering, Texas A&M University, College Station, USA), Julibeth Martinez de la Hoz, Guadalupe Ramos-Sanchez, Yuguang Ma

Modeling Solid-electrolyte Interfacial Reactions of Li-ion Batteries

17:20 to 17:40

Michael Wessel (Theoretical Chemistry, Universität Duisburg-Essen, Essen, Germany), Eckhard Spohr

Probing the potential energy surface for the proton equilibrium on gold

17:40 to 18:00 Invited

Jeffrey Greeley (Department of Chemical Engineering, Purdue University, West Lafayette, USA), Andre Clayborne, Hee-Joon Chun, Rees Rankin, Zhenhua Zeng

Structure sensitivity of electrochemical reactions from first principles: Applications to nitrogen and water cycles

18:00 to 18:20

Mon-che Tsai (Department of Chemical Engineering, National Taiwan University of Science and Technology, Taipei, Taiwan), Rick John

Design of Pt-based bimetallic alloys for H_2O_2 oxidation: A combined computational and experimental approach

18:20 to 18:40 Invited

Jun Cheng (Department of Chemistry, University of Aberdeen, Aberdeen, United Kingdom)

Identifying Trapped Electronic Holes at the TiO_2 Water Interface

Symposium 15: General Session

Room 3bc - Garden

Chaired by : Hye Jin Lee and Justin Gooding

14:00 to 14:20 Invited

Jing-Juan Xu (Department of Chemistry, Nanjing University, Nanjing, China)

Electrochemiluminescence on bipolar electrodes for bioanalysis

14:20 to 14:40

Heili Kasuk (Institute of Chemistry, University of Tartu, Tartu, Estonia), Vitali Grozovski, Piret Pikkma, Enn Lust

Impedance and *in situ* STM study of 4,4’-bipyridine at Bi(111), Sb(111) and Cd(0001) electrode surfaces

14:40 to 15:00 Invited

Joohoon Kim (Department of Chemistry, Kyung Hee University, Seoul, Korea)

Use of Dendrimer-encapsulated Nanoparticles for Decoration of Electrode Surfaces

15:00 to 15:20

Egan Doeven (School of Life and Environmental Sciences, Deakin University, Waurn Ponds, Australia), Gregory Barbante, Paul Francis

Strategies towards Multi-color Electrochemiluminescence Sensors

15:20 to 15:40

Zhifeng Ding (Chemistry, The University of Western Ontario, London, Canada), Mark S. Workentin, Mahdi Hesari

Electrochemistry and electrogenerated chemiluminescence of $Au_{38}(SC_2H_4Ph)_{24}$ clusters

15:40 to 16:00

Miklos Gratzl (Department of Biomedical Engineering, Case Western Reserve University, Cleveland, USA), Disha Sheth

Differential Linear Scan Voltammetry:Analytical Performance in Comparison with Pulsed Voltammetry Techniques

16:00 to 16:20

Guy Denuault (Department of Chemistry, University of Southampton, Southampton, United Kingdom), Samuel Perry

Normalised Sampled-current Voltammetry at Microdisc Electrodes: Kinetic Information from Pseudo Steady State to Steady State Voltammetry

16:20 to 16:40

Coffee Break

16:40 to 17:00 Invited

Jingyuan Chen (Department of Applied Physics, University of Fukui, Fukui, Japan), Koichi Aoki

Fast electron-transfer kinetics at single nano disk electrodes

17:00 to 17:20

Mireille Turmine (LISE - UMR 8235, University Pierre et Marie Curie, Paris 6, Paris, France), Pierre Letellier

Displacement of Voltammetric Peaks with Nanoparticles Size: A Nonextensive Thermodynamic Approach

17:20 to 17:40

Koichi Aoki (Department of Applied Physics, University of Fukui, Fukui, Japan)

Frequency-dependent Electric Double Layer Capacitance

17:40 to 18:00

Marc Anderson (Environmental Chemistry & Technology Program, University of Wisconsin - Madison, Madison, USA), Enrique Garcia - Quismondo, Cleis Santos, Jesus Palma

Capacitive Deionization: An Electrochemical Technique to Store Energy and Treat Water

Wednesday 3 September 2014

Rooms	Auditorium A	Auditorium B	Auditorium C	Room 1a	Room 1bc	Room 2	Room 3a	Room 3bc	Room 4	Room 5
	S03	**S04**	**S05**	**S08**	**S09**	**S06**	**S11**	**S15**	**S02**	**S13**
08:30 - 09:30	**Plenary Lecture, Auditorium A** : Nenad M. Markovic									
09:30 - 09:50	Coffee Break									
09:50 - 10:10	N. Mano	A. Lamibrac	P. Adelhelm	A. Walcarius	S. Virtanen	K. Naoi	Guohua Chen	P. Liljeroth	W. Schuhmann	N. Bonnet
10:10 - 10:30	S. Tingry	T. Mashio	L. Nazar	F. Lisdat			A. Katsaounis			I. E. Castelli
10:30 - 10:50	S. Tsujimura	S. Abbou	R. Dominko	J. Cox	Takumi Haruna	A. Laheäär	A. Seferlis	Xing-Hua Xia	J. Rodriguez-L.	D. Pergolesi
10:50 - 11:10	K.i Yamagiwa	J. Mitzel	N. A. Cañas	Kang Cui	A. Atrens	E. Howe	M. A. Rodrigo	F. Paolucci	M. Etienne	M. Giesen
11:10 - 11:30	Poster Session 3 in Garden Foyer : Symposium 6, 10, 11, 13, 15									
11:30 - 11:50										
11:50 - 12:10										
12:10 - 12:30										

Wednesday, 3 September 2014 - Morning

Plenary

Auditorium A - Campus

Chaired by : Michael Eikerling

08:30 to 09:30
Nenad M. Markovic (Materials Science Division and Joint Center for Energy Storage Research, Argonne National Laboratory, Argonne, USA)
Interfacing Electrochemistry

09:30 to 09:50
Coffee Break

Symposium 2: Scanning Electrochemical Microscopy: Reading, Writing, Monitoring of Functional Interfaces

Room 4 - Garden

Chaired by : Fernando Cortes Salazar

09:50 to 10:30 Keynote Invited
Wolfgang Schuhmann (Analytische Chemie, Ruhr-Universität Bochum, Bochum, Germany), Alexander Botz, Aliaksandr Bandarenka, Artjom Maljusch, Justus Masa, Michaela Nebel, Rosalba Rincon, Xingxing Chen
SECM meets electrocatalysis and energy conversion

10:30 to 10:50 Invited
Joaquin Rodriguez Lopez (Department of Chemistry, University of Illinois at Urbana-Champaign, Urbana, USA), Burton Simpson, Mei Shen, Mark Burgess, Phillip Benson, Dong Kou Kim
Elucidating the reactive heterogeneity of water-splitting photoelectrocatalysts at the nano-scale through combined *in situ* surface-sensitive approaches

10:50 to 11:10
Mathieu Etienne (LCPME, CNRS, Villers-lès-Nancy, France), Manuel Dossot, Jérôme Grausem
Combined Raman Confocal and Shearforce Regulated SECM for Corrosion Analysis

Symposium 3: Bioelectrochemistry: From Fundamentals to Health Monitoring and Energy Conversion

Auditorium A - Campus

Chaired by : Lo Gorton

09:50 to 10:10 Invited

Nicolas Mano (CRPP, Université de Bordeaux, Pessac, France)

Towards implantable miniature glucose-O_2 biofuel cells

10:10 to 10:30

Sophie Tingry (CNRS, Institut Européen des Membranes, Montpellier, France), Adriana Both-Engel, Aziz Cherifi, David Cornu, Yoavi Holade, Karine Servat, Boniface Kokoh, Teko Napporn

Electrospun carbon fibers: A promising electrode material for abiotic and enzymatic catalysis in hybrid biofuel cell

10:30 to 10:50

Seiya Tsujimura (Faculty of Pure and Material Sciences, University of Tsukuba, Tsukuba, Japan), Kazuki Murata

Hundred mA cm^{-2} of glucose current on a hierarchically structured porous carbon electrode with “wired” glucose dehydrogenase

10:50 to 11:10

Kiyofumi Yamagiwa (Department of Applied Chemistry, Faculty of Science, Tokyo University of Science, Tokyo, Japan), Yutaka Handa, Naoaki Yabuuchi, Shinichi Komaba

Sucrose Biofuel Cell: Fabrication and Characterization of Multi-enzyme Immobilized Anodes

Symposium 4: Electrochemical Energy Conversion and Storage: Fuel Cells and Electrolysers

Auditorium B - Campus

Chaired by : Andrei Kulikovsky

09:50 to 10:10

Adrien Lamibrac (Department of Electrochemistry, Paul Scherrer Institut, Villigen, Switzerland), Jörg Roth, Federica Marone, Felix N. Büchi

Investigation of Pressure Driven Water Imbibition/Drainage of GDLs using X-ray Tomographic Imaging

10:10 to 10:30

Tetsuya Mashio (Nissan Research Center, Nissan Motor Co., Ltd., Yokosuka, Japan), Atsushi Ohma, Takashi Tokumasu

Molecular Dynamics Study of Ionomer Structure Formation in Catalyst Ink

10:30 to 10:50

Sofyane Abbou (LEMTA, Université de Lorraine - CNRS, Vandoeuvre-lès-Nancy, France), Jérôme Dillet, Dusan Spernjak, Rangachary Mukundan, Joseph D. Fairweather, Rodney L. Borup, Gaël Maranzana, Olivier Lottin

Time Evolution of Local Potentials during PEM Fuel Cell Operation with Dead-ended Anode

10:50 to 11:10

Jens Mitzel (Electrochemical Energy Technology, German Areospace Center, Stuttgart, Germany), Erich Gülzow, Juergen Hunger, Ludwig Jörissen

Relevance and Validation of Test Procedures for PEMFC Stack Performance Analysis

Symposium 5: Electrochemical Energy Conversion and Storage: Batteries

Auditorium C - Cloud

Chaired by : Robert Dominko and Linda Nazar

09:50 to 10:10 Invited

Philipp Adelhelm (Department of Physical Chemistry, Justus-Liebig-University Giessen, Giessen, Germany)

Sodium and chalcogens: On the chemistry of room-temperature Na/O_2 and Na/S batteries

10:10 to 10:30 Invited

Linda Nazar (Department of Chemistry, University of Waterloo, Waterloo, Canada), Quan Pang, Xiao Liang, Marine Cuisinier, Connor Hart

Controlling the Host-sulfur Cathode Interface for Improved Lithium-Sulfur Batteries

10:30 to 10:50 Invited

Robert Dominko (Laboratory for Materials Chemistry, National Institute of Chemistry, Ljubljana, Slovenia), Manu U.M. Patel, Iztok Arcon, Lorenzo Stievano, Giuliana Aquilanti

Migration of Polysulfides Detected by *In operando* Analytical Techniques

10:50 to 11:10

Natalia Andrea Cañas (Institute of Technical Thermodynamics, German Aerospace Center (DLR), Stuttgart, Germany), Norbert Wagner, K. Andreas Friedrich

Important Aspects on the Fabrication and Characterization of Lithium-Sulfur Batteries

Symposium 6: Electrochemical Energy Conversion and Storage: Capacitors

Room 2 - Garden

Chaired by : Elzbieta Frackowiak

09:50 to 10:30 Keynote

Katsuhiko Naoi (Department of Applied Chemistry, Tokyo University of Agriculture and Technology, Tokyo, Japan), Wako Naoi

New Generation Supercapacitors and Future Perspectives

10:30 to 10:50

Oronzio and Niccolò De Nora Foundation Young Author Prize

Ann Laheäär (Institute of Chemistry and Technical Electrochemistry, Poznan University of Technology, Poznan, Poland), Esther Gomez Calvo, Ana Arenillas, José Angel Menéndez, Indrek Tallo, Alar Jänes, Enn Lust, François Béguin

Effect of Carbon Surface Properties on the Charge Storage Ability of Ionic Liquid Based Supercapacitors

10:50 to 11:10

Elizabeth Howe (Department of Chemistry, University of Cambridge, Cambridge, United Kingdom), Phoebe Allan, Michael Casford, Stuart Clarke, Clare Grey

Using Sum Frequency Generation Spectroscopy to Study Electrochemical Double Layer Capacitors

Symposium 8: Modern Electroactive Polymeric, Organic, Inorganic and Nanocomposite Materials

Room 1a - Garden

Chaired by : Christopher M.A. Brett and Robert Hillman

09:50 to 10:10
Alain Walcarius (LCPME, CNRS, Université de Lorraine, Villers-Lès-Nancy, France), Neus Vilà
Vertically-aligned, ordered and ferrocene-functionalized, mesoporous silica films generated by electrochemically assisted self-assembly

10:10 to 10:30
Fred Lisdat (Biosystems Technology, Technical University of Applied Sciences Wildau, Wildau, Germany), Daniel Sarauli, Vitali Scherbahn, Gero Göbel, M.-T. Putze, Burkhard Schulz, Thorsten Heinlein, Jörg J. Schneider
Sulfonated polyaniline derivatives as interaction partner for a biocatalyst and application in an energy conversion system using vertically aligned carbon nanotubes

10:30 to 10:50
James Cox (Department of Chemistry and Biochemistry, Miami University, Oxford, USA), Michela Ciabocco, Silvia Zamponi, Mario Berrettoni, Marco Giorgetti
Fabrication of Silica-based Films with Controlled Nanoarrays of Cylindrical Pores

10:50 to 11:10
Kang Cui (Chemistry Department, KU Leuven, Leuven, Belgium), Oleksandr Ivasenko, Kunal Mali, Klaus Müllen, Stijn Mertens, Steven De Feyter
From Breathing Pores to 3-Dimensional Ionic Self-assembly under Electrochemical Control

Symposium 9: Corrosion, Passivity and Oxide Films

Room 1bc - Garden

Chaired by : Hiroki Habazaki and Monica Santamaria

09:50 to 10:30 Keynote
Sannakaisa Virtanen (Department of Materials Science, University of Erlangen-Nuremberg, Erlangen, Germany)
Biodegradable Mg Alloys: Corrosion, Surface Modification and Biocompatibility

10:30 to 10:50
Takumi Haruna (Department of Chemistry and Materials Engineering, Kansai University, Suita, Japan), Itsuki Shinohara
Corrosion Behavior of Ti-Ca Alloy in Aqueous Fluoride Solutions

10:50 to 11:10 Invited
Andrej Atrens (Department of Materials Engineering, The University of Queensland, Brisbane, Australia), Zhiming Shi, Fuyong Cao
Recent research on the measurement of the Mg corrosion rate and on the Mg corrosion mechanism

Symposium 11: Electrochemical Technology: Crossroad for Energy and Environment

Room 3a - Garden

Chaired by : Karel Busek

09:50 to 10:10 Invited

Guohua Chen (Department of Chemical and Biomolecular Engineering, The Hong Kong University of Science and Technology, Kowloon, China), Yang Zhao

The Effect of Ir Content on the Service Life of Ti/IrO_2-Sb_2O_5-SnO_2 DSA for O_2 evolution

10:10 to 10:30

Alexandros Katsaounis (Department of Chemical Engineering, University of Patras, Patras, Greece), Evangelos Kalamaras, Bjorn Hasa, Evangelos Papaioannou, Labrini Sygellou, Alexandros Katsaounis

Effect of TiO_2 Loading on Pt and Pt-Ru Catalysts During Methanol Electrooxidation

10:30 to 10:50

Andreas Seferlis (ICEHT, FORTH, Rion Patras, Greece), Stylianos Neophytides

Study of Photoelectrochemical Water Splitting on Nanocrystalline TiO_2 Films

10:50 to 11:10

Manuel Andrés Rodrigo (Chemical Engineering, Universidad de Castilla la Mancha, Ciudad Real, Spain), Justo Lobato, Pablo Cañizares, Francisco Javier Pinar, Hector Zamora, Francisco Jesús Fernandez, Diego Ubeda

Scale up of HTPEMFC: description of problems to be overcome

Symposium 13: Synergizing Theory and Experiment in Electrochemistry: State-of-the-Art Developments

Room 5 - Garden

Chaired by : Nicephore Bonnet and Daniele Pergolesi

09:50 to 10:10 Invited

Nicephore Bonnet (Nanosystem Research Institute, AIST, Tsukuba, Japan), Minoru Otani, Nicola Marzari, Osamu Sugino

Energetics and Dynamics in the Electrified Double Layer

10:10 to 10:30

Ivano Eligio Castelli (Department of Physics, Technical University of Denmark, Kongens Lyngby, Denmark), Kristian Sommer Thygesen, Karsten Wedel Jacobsen

Calculation of Pourbaix Diagrams as Descriptor for High-throughput Screening

10:30 to 10:50 Invited

Daniele Pergolesi (General Energy Research, Paul Scherrer Institut, Villigen, Switzerland), Aline Fluri, Thomas Lippert

Do Ionic Conductors Feel the Strain?

10:50 to 11:10

Margret Giesen (Peter Grünberg Institute PGI-6, Juelich Research Centre, Juelich, Germany), Guillermo Beltramo, Mohammad Al-Shakran

Steps on Electrodes: Kink Energies, Dipole Moments, Anisotropy Effects and their Relevance in Transport Phenomena

Symposium 15: General Session

Room 3bc - Garden

Chaired by : Aicheng Chen

09:50 to 10:30 Keynote

Peter Liljeroth (Department of Applied Physics, Aalto University School of Science, Aalto, Finland)

Single-molecule chemistry and physics studied by low-temperature scanning probe microscopy

10:30 to 10:50 Invited

Xing-Hua Xia (School of Chemistry and Chemical Engineering, Nanjing University, Nanjing, China)

Influence of surface properties of electrodes on biomolecular functions

10:50 to 11:10 Invited

Francesco Paolucci (Department of Chemistry G. Ciamician, Alma Mater Studiorum University of Bologna, Bologna, Italy)

Nanocarbon-based hybrid films for health and energy applications

Thursday 12 September 2013

Rooms	Auditorium A	Auditorium B	Auditorium C	Room 1a	Room 1bc	Room 2	Room 3a	Room 3bc	Room 4	Room 5
Symposium	**S03**	**S04**	**S05**	**S08**	**S09**	**S04**	**S11**	**S15**	**S02/03**	**S13**
08:30 - 09:30	**Plenary Lecture, Auditorium A** : Patrik Schmuki									
09:30 - 09:50	Coffee Break									
09:50 - 10:10	D. Waldeck	Y. Hashimasa	M. Obrovac	P. J. Kulesza	M. Orazem	A. Zeradjanin	C. Vayenas	M. Symes	K. Mayrhofer	I. Stephens
10:10 - 10:30		R. A. Rincón			N. Pebere	J. Polonský				
10:30 - 10:50	M. Gebala	E. Ticianelli	N. Ortiz-Vitoriano	R. Torresi	J. S. Fernandes	A. Bergmann	M. Tsampas	Jun-Jie Zhu	A. W. Hassel	Nagahiro Hoshi
10:50 - 11:10	T. Doneux	Kensaku Kodama	P. Barpanda	A. Viñuales	P. Córdoba-Torres	T.-P. Fellinger	A. de Lucas-C.	F. Maran	K. McKelvey	Hideo Daimon
11:10 - 11:30	11:20 - 12:20 General Assembly : Auditorium B - CAMPUS									
11:30 - 11:50										
11:50 - 12:10										
12:10 - 12:30										
12:30 - 12:50										
12:50 - 13:10		12:45 - 13:45 Division Lunches								
13:10 - 13:30										
13:30 - 14:00									**S02**	
14:00 - 14:20		F. Jaouen	Ch. Johnson	R. Seeber	F. Montemor	K.-M. Papazisi	G. Kelsall	N. Sojic	P. Hapiot	P. Krtil
14:20 - 14:40		A. Sarapuu	M. Á. Muñoz-M.		Anh Son Nguyen	M. Bernicke		Chia-Liang Sun		K. Stoerzinger
14:40 - 15:00		N. Ranjbar	Masafumi Nose	V. Tsakova	J. Tedim	J. Masa	K. Bickel	C. Ponce de Leon	K. Moeller	P. Rodriguez
15:00 - 15:20		Zhi-You Zhou	L. Gomes Chagas		M. Pawelkiewicz	Xiaoling Zhang	Z. Bitar	A. Rodgers	J. Huskens	J. Suntivich
15:20 - 15:40		Yanyu Liang	Yu-Ting Weng	E. Zolotukhina	V. Flexer	T. Rauscher	S. Rasul	Youngkook Kwon	S. Rapino	F. Calle-Vallejo
15:40 - 16:00		Hideharu Niwa	L. Monconduit	Ch. Brett	Ch. Cobet	S. Mitsushima	T. Wakamatsu	J. Gooding	L. Baker	
16:00 - 16:20			C. Villevieille	Z. Stojek	S. Kumar Ghosh	S. Bozdech	S. Chardon-Noblat	Ming-Yueh Wang	M. Yousaf	
16:20 - 16:40		Coffee Break							**S03**	
16:40 - 17:00		P. Atanassov	Shinichi Komaba	L. Bouffier	G. Grundmeier	Jun Maruyama	Ryosuke Suzuki	C. Cummings	D. Arrigan	T. Jaramillo
17:00 - 17:20		Kenichiro Ota	Mouad Dahbi	A. Boni		J. Durst	C. Lamy	Tso-Fu Mark Chang	J. Rusling	
17:20 - 17:40		M. Chisaka	B. Lestriez	Chun-Ting Li	J. Izquierdo	A. Kucernak	E. V. Dos Santos	D. Cook	B. Piro	YuYe Tong
17:40 - 18:00		K. Tammeveski	Wei-Ren Liu	P. R. Mussini	M. Seo	R. Hanke-Rausch	S. Rondinini		Haesik Yang	E. Herrero
18:00 - 18:20		P. Kanninen	Jong-Sung Yu	T. Magdesieva	Koji Fushimi	I. Katsounaros	R. Wuthrich		V. Noel	Yumin Qian
18:20 - 18:40		Reception								
18:40 - 19:00										

Thursday, 4 September 2014 - Morning

Plenary

Auditorium A - Campus

Chaired by : Mary Ryan

08:30 to 09:30

Patrik Schmuki (Materials Science, Uni Erlangen, Erlangen, Germany)

We like it orderly – Anodic growth and use of highly aligned metal-oxide nanostructures

09:30 to 09:50

Coffee Break

Symposium 2: Scanning Electrochemical Microscopy: Reading, Writing, Monitoring of Functional Interfaces

Room 4 - Garden

Chaired by : Shigeru Amemiya

09:50 to 10:30 Keynote

Karl Mayrhofer (Department of Interface Chemistry and Surface Engineering, Max-Planck-Institut für Eisenforschung GmbH, Düsseldorf, Germany), Serhiy Cherevko, Angel Topalov, Anna Schuppert, Aleksandar Zeradjanin, Ioannis Katsounaros

Combinatorial study of fundamental electrocatalyst performance - The scanning flow cell coupled to online analytics

10:30 to 10:50 Invited

Achim Walter Hassel (Institute for Chemical Technology of Inorganic Materials, Johannes Kepler University Linz, Linz, Austria)

Scanning Droplet Cell Microscopy: Reading and Writing of Functional Interfaces

10:50 to 11:10

Kim McKelvey (Department of Chemistry, University of Warwick, Coventry, United Kingdom), Sophie Kinnear, David Perry, Dmitry Momotenko, Joshua Byers, Patrick Unwin

Nanoscale Surface Charge Mapping using a Nanopipette

Symposium 3: Bioelectrochemistry: From Fundamentals to Health Monitoring and Energy Conversion

Auditorium A - Campus

Chaired by : Philip Bartlett

09:50 to 10:30 Keynote

David Waldeck (Department of Chemistry, University of Pittsburgh, Pittsburgh, USA), Xing Yin, Emil Wierzbinski

Fundamental Studies into Charge Transport with Peptide Nucleic Acids

10:30 to 10:50

Magdalena Gebala (Department of Biochemistry, Stanford University, Palo Alto, USA), George Giambasu, Maria Panteva, Darin York, Daniel Herschlag

Dissecting the ion atmosphere around nucleic acids

10:50 to 11:10

Thomas Doneux (Chimie Analytique et Chimie des Interfaces, Université Libre de Bruxelles, Bruxelles, Belgium), Aurore De Rache, Claudine Buess-Herman

Electrochemical Studies on the Discrimination Between G-Quadruplex and Duplex DNA

Symposium 4: Electrochemical Energy Conversion and Storage: Fuel Cells and Electrolysers

Room 2 - Garden

Chaired by : Thomas Rauscher

09:50 to 10:10

Aleksandar Zeradjanin (Interface Chemistry and Surface Engineering, Max Planck Institut für Eisenforschung, Düsseldorf, Germany), Angel Topalov, Serhiy Cherevko, Karl Mayrhofer

Enhancing Activity and Stability of Electrode Materials for Oxygen Evolution by Rational Design of Electrode Morphology

10:10 to 10:30

Jakub Polonský (Department of Inorganic Technology, Institute of Chemical Technology, Prague, Prague 6, Czech Republic), Martin Paidar, Karel Bouzek

Catalyst Supports for Anodes of PEM Water Electrolysers

10:30 to 10:50

Arno Bergmann (Department of Chemistry, Technische Universität Berlin, Berlin, Germany), Elias Martinez Moreno, Ivelina Zaharieva, Tobias Reier, Holger Dau, Peter Strasser

On the Active Catalyst State of Metal Oxide Electrocatalysts for Oxygen Evolution Reaction

10:50 to 11:10

Tim-Patrick Fellinger (Department of Colloids, Max-Planck Institute of Colloids and Interfaces, Potsdam, Germany), Ken Sakaushi, Karina Elumeeva

Bifunctional non-precious metal electrocatalysts for the oxygen reduction and evolution reaction

Symposium 4: Electrochemical Energy Conversion and Storage: Fuel Cells and Electrolysers

Auditorium B - Campus

Chaired by : Plamen Atanassov

09:50 to 10:10 Invited
Yoshiyuki Hashimasa (FC-EV Research Division, Japan Automobile Research Institute, Tsukuba, Japan), Yoshiyuki Matsuda, Takahiro Shimizu
Comparison of Potential Cycle Durability Test Methods of the PEFC

10:10 to 10:30
Rosalba A. Rincón (Analytische Chemie, Ruhr Universität Bochum, Bochum, Germany), Alberto Battistel, Edgar Ventosa, Xingxing Chen, Wolfgang Schuhmann
Using cavity microelectrodes for electrochemical noise measurements of oxygen evolving catalysts

10:30 to 10:50
Edson Ticianelli (Department of Physical Chemistry, Institute of Chemistry of S. Carlos - USP, Sao Carlos, Brazil), Ana Laura Biancolli
Activity of WC-supported Ag Catalysts for the Oxygen Reduction Reaction in Alkaline Media

10:50 to 11:10
Kensaku Kodama (Fuel Cell System Laboratory, Toyota Central R&D Labs. Inc, Nagakute, Japan), Kenta Motobayashi, Akihiro Shinohara, Naoki Hasegawa, Ryosuke Jinnouchi, Hajime Murata, Tatsuya Hatanaka, Yu Morimoto, Masatoshi Osawa
Pt /Ionomer Interface Analysis using *in-situ* SEIRAS with Solid-State Electrochemical Cell

Symposium 5: Electrochemical Energy Conversion and Storage: Batteries

Auditorium C - Cloud

Chaired by : Bernard Lestriez and Mark Obrovac

09:50 to 10:30 Keynote
Mark Obrovac (Department of Chemistry, Dalhousie University, Halifax, Canada)
Metal Oxide Negative Electrodes for Na-Ion Batteries

10:30 to 10:50
Nagore Ortiz-Vitoriano (Research Laboratory of Electronics, EEL, MIT, Cambridge, USA), Thomas Batcho, Binghong Han, David G. Kwabi, Thomas J. Carney, Carl V. Thompson, Yang Shao-Horn
Carbon nanotube electrodes for rechargeable Na-O_2 batteries

10:50 to 11:10
Prabeer Barpanda (Materials Research Center, Indian Institute of Science, Bangalore, India), Guandong Liu, Chris D. Ling, Maxim Avdeev, Atsuo Yamada
Alkali Metal Pyrophosphates: A Rich Family of Oxyanionic Cathodes for Secondary Sodium-ion Batteries

Symposium 8: Modern Electroactive Polymeric, Organic, Inorganic and Nanocomposite Materials

Room 1a - Garden

Chaired by : György Inzelt and Patrizia Romana Mussini

09:50 to 10:30 Keynote

Pawel J. Kulesza (Department of Chemistry, University of Warsaw, Warsaw, Poland)

Importance of Specific Metal-support Interactions in Efficient Charge Propagation and Electro(photo) catalysis

10:30 to 10:50

Roberto Torresi (Instituto de Química, Universidade de São Paulo, São Paulo, Brazil), Tânia Benedetti

An electrochromic poly(ionic liquid)

10:50 to 11:10

Ana Viñuales (Department of Materials, IK4-CIDETEC, San Sebastián, Spain), Bettina Herbig, Uwe Posset, Yolanda Alesanco, Jesús Palenzuela

Plastic Electrochromic Windows Based on Viologen-Modified TiO_2 Films Prepared at Low Temperature

Symposium 9: Corrosion, Passivity and Oxide Films

Room 1bc - Garden

Chaired by : Mark Orazem and Bernard Tribollet

09:50 to 10:10

Mark Orazem (Department of Chemical Engineering, University of Florida, Gainesville, USA), Shao-Ling Wu, Morgan Harding, Bernard Tribollet, Vincent Vivier

Frequency Dispersion caused by Coupled Faradaic and Charging Currents in Impedance Spectroscopy

10:10 to 10:30 Invited

Nadine Pebere (CIRIMAT, UPS/INPT/CNRS, ENSIACET, Université de Toulouse, Toulouse, France), Sabrina Marcelin

Synergistic effect between 8-hydroxyquinoline and benzotriazole for the corrosion protection of 2024 aluminium alloy: A local electrochemical impedance approach

10:30 to 10:50 Invited

Joao Salvador Fernandes (Chemical Engineering Department & ICEMS, Instituto Superior Tecnico / University of Lisbon, Lisbon, Portugal), Ricardo Pedro, Augusto Lopes, Mario Ferreira

EIS Studies on Aluminium after Sulphuric-Boric Acid Anodizing

10:50 to 11:10 Invited

Pedro Córdoba-Torres (Departamento de Física Matemática y de Fluidos, UNED, Madrid, Spain)

New Insights on the Constant-phase Element Behavior in Electrochemical Impedance Spectroscopy

Symposium 11: Electrochemical Technology: Crossroad for Energy and Environment

Room 3a - Garden

Chaired by : Geoff Kelsall

09:50 to 10:30 Keynote

Constantinos Vayenas (Department of Chemical Engineering, University of Patras, Patras, Greece)

Electrochemical Promotion of Catalysis: Novel Catalyst-electrodes and Reactors

10:30 to 10:50

Michail Tsampas (IRCELYON, CNRS, Université Claude Bernard Lyon 1, Villeurbanne, France), Maira Alves-Fortunato, Foteini Sapountzi, Antoinette Boreave, Philippe Vernoux

Role of lattice oxygen in the propane combustion over YSZ-supported nanoparticles and films of Pt

10:50 to 11:10

Antonio de Lucas-Consuegra (Department of Chemical Engineering, University of Castilla La Mancha, Ciudad Real, Spain)

Electrochemical promotion of novel catalyst-electrodes for the catalytic partial oxidation of methanol

Symposium 13: Synergizing Theory and Experiment in Electrochemistry: State-of-the-Art Developments

Room 5 - Garden

Chaired by : Hideo Daimon and Ifan Stephens

09:50 to 10:30 Keynote Invited

Ifan Stephens (Center for Individual Nanoparticle Functionality, Physics, Technical University of Denmark (DTU), Kongens Lyngby, Denmark)

Combining experiment and theory in the search for new electrocatalysts for oxygen electroreduction to H_2O and H_2O_2

10:30 to 10:50

Nagahiro Hoshi (Graduate School of Engineering, Chiba University, Chiba, Japan), Yuki Takesue, Masashi Nakamura

Structural Effects on the Oxygen Reduction Reaction and Durability on the High Index Planes of Pt_3Co

10:50 to 11:10 Invited

Hideo Daimon (Molecular Chemistry and Biochemistry, Doshisha University, Kyotanabe, Japan)

Scale-Up Synthesis of Pt/Pd/C Catalyst and Cu-Air Treatment for Enhancing Its ORR Activity

Symposium 15: General Session

Room 3bc - Garden

Chaired by : Neso Sojic

09:50 to 10:30 Keynote

Mark Symes (School of Chemistry, University of Glasgow, Glasgow, United Kingdom), Leanne Bloor, Pedro Molina, Leroy Cronin

Low pH Electrolytic Water Splitting Using Earth-abundant Metastable Catalysts That Self-assemble *in Situ*

10:30 to 10:50 Invited

Jun-Jie Zhu (School of Chemistry and Chemical Engineering, Nanjing University, Nanjing, China), Tingting Zheng

Using Nanoparticles as Electrocatalysts for Signal Amplification toward Ultrasensitive Electrochemical Cytosensing

10:50 to 11:10 Invited

Flavio Maran (Department of Chemistry, University of Padova, Padova, Italy), Sabrina Antonello, Giorgio Arrigoni, Tiziano Dainese, Marco De Nardi, Giulia Parisio, Lorena Perotti, Alice René, Alfonso Venzo

Electron Transfer through 3D Monolayers on Au_{25} Clusters

Thursday, 4 September 2014 - Afternoon

Symposium 2: Scanning Electrochemical Microscopy: Reading, Writing, Monitoring of Functional Interfaces

Room 4 - Garden

Chaired by : Gunther Wittstock

14:00 to 14:40 Keynote

Philippe Hapiot (Institut des Sciences Chimiques de Rennes, CNRS, Université de Rennes 1, Rennes, France)

Radical Based Electrografting and Localized Electrochemistry: Tools for Building and Analyzing Functional Surfaces

14:40 to 15:00 Invited

Kevin Moeller (Department of Chemistry, Washington University in St. Louis, St. Louis, USA)

Building Addressable Libraries: Using Site-selective Reactions to Control the Surface of a Microelectrode Array

15:00 to 15:20 Invited

Jurriaan Huskens (Molecular NanoFabrication group, University of Twente, MESA+ Institute for Nanotechnology, Enschede, Netherlands)

Interdigitated Microelectrodes for the Electrochemical Formation of Surface Gradients

15:20 to 15:40 Invited

Stefania Rapino (Chemistry Department G. Ciamician, University of Bologna , Bologna, Italy), Raluca Marcu, Alice Soldà, Alessandra Bigi, Massimo Marcaccio, Francesco Zerbetto, Marco Giorgio, PierGiuseppe Pelicci, Francesco Paolucci

Scanning ElectroChemical Microscopy for Health: Functional Imaging of Cancer Cell

15:40 to 16:00 Invited

Lane Baker (Department of Chemistry, Indiana University, Bloomington, USA)

Unconventional Pipetting for Bioanalysis

16:00 to 16:20 Invited

Muhammad Yousaf (Department of Chemistry, York University, Toronto, Canada)

Tailoring a range of surfaces with a convergent electroactive chemistry approach

16:20 to 16:40

Coffee Break

Symposium 3: Bioelectrochemistry: From Fundamentals to Health Monitoring and Energy Conversion

Room 4 - Garden

Chaired by : Nicolas Mano

16:40 to 17:00 Invited

Damien Arrigan (Nanochemistry Research Institute, Dept. of Chemistry, Curtin University, Perth, Australia), Eva Alvarez de Eulate, Shane O'Sullivan, Liang Qiao, Michael D. Scanlon, Hubert Girault

Protein accumulation at electrified soft interfaces – Bioanalytical opportunity and mass spectral characterization

17:00 to 17:20

James Rusling (Department of Chemistry, University of Connecticut, Storrs, USA), Karteek Kadimisetty, Naimish Sardesai, Spundana Malla, Ronaldo Faria, Amit Joshi

Automated Microfluidic Array for Multiple Proteins using Electrochemiluminescent Detection

17:20 to 17:40

Benoît Piro (Department of Chemistry, University Paris Diderot, Paris, France), Xue-Feng Wang, Steeve Reisberg, Guillaume Anquetin, Gregory March, Clément Nanteuil, Chang-Zhi Dong, Minh-Chau Pham

Label-free Electrochemical Immunoaffinity Sensor for Bisphenol A Detection

17:40 to 18:00

Haesik Yang (Department of Chemistry, Pusan National University, Busan, Korea)

Rapid Electrochemical Lateral-flow Immunoassay for One-Step Ultrasensitive Detection with Serum

18:00 to 18:20

Vincent Noel (ITODYS, UMR 7086, University Paris Diderot, Paris, France), Lylian Challier, Rebeca Miranda-Castro, François Mavré, Benoit Limoges

Rotating Droplet Electrochemistry: Kinetics Study of the Aptamer/L-Tyrosinamide Enantioselective Recognition

Symposium 4: Electrochemical Energy Conversion and Storage: Fuel Cells and Electrolysers

Auditorium B - Campus

Chaired by : Laetitia Dubau and Sanjeev Mukerjee

14:00 to 14:20 Invited

Frederic Jaouen (Institut Charles Gerhardt Montpellier, UMR 5253, CNRS, Montpellier, France), Vincent Goellner, Moulay Sougrati, Andrea Zitolo, Emiliano Fonda, Lorenzo Stievano

Spectroscopic Changes Induced by the Degradation of Fe(Co)/N/C Catalysts for the Oxygen Reduction in Acidic Medium

14:20 to 14:40

Ave Sarapuu (Institute of Chemistry, University of Tartu, Tartu, Estonia), Lars Samolberg, Kristiina Kreek, Mihkel Koel, Leonard Matisen, Kaido Tammeveski

Electrochemical reduction of oxygen on non-noble metal containing nitrogen-doped carbon aerogels

14:40 to 15:00

Nastaran Ranjbar (Department of Chemistry, TU Berlin, Berlin, Germany), Jens Peter Paraknowitsch, Arne Thomas, Peter Strasser

Multitechnique Characterization of Novel Heteroatom-doped-Metal-Carbons as Efficient Electrocatalysts for Oxygen Reduction Reaction (ORR) in Fuel Cells

15:00 to 15:20

Zhi-You Zhou (Department of Chemistry, Xiamen University, Xiamen, China), Yu-Jiao Lai, Xia-Ling Wu, Qiang Wang, Chi Chen, Qiu-Lian Zhang, Na Tian, Shi-Gang Sun

Active site study of pyrolyzed FeN_x/C electrocatalyst for oxygen reduction

15:20 to 15:40

Yanyu Liang (Department of Applied Chemistry, Nanjing University of Aeronautics and Astronautics, Nanjing, China), Qingxue Lai

Multiple Core/Shell Structured Transition Metal/Nitrogen-doped Nanocarbon Catalysts for Oxygen Reduction Reaction

15:40 to 16:00

Hideharu Niwa (The Institute for Solid State Physics, The University of Tokyo, Koto, Shingu, Tatsuno, Japan), Hisao Kiuchi, Jun Miyawaki, Yoshihisa Harada, Masaharu Oshima, Yusuke Nanba, Daisuke Asakura, Yuta Nabae, Tsutomu Aoki

In situ and *operando* Soft X-ray Emission Spectroscopy of Iron Phthalocyanine-based Oxygen Reduction Catalysts for Polymer Electrolyte Fuel Cells

16:20 to 16:40

Coffee Break

16:40 to 17:00 Invited

Plamen Atanassov (Chemical and Nuclear Engineering, University of New Mexico, Albuquerque, USA)

Non-platinum Group Metal Cathode Catalysts Derived by Sacrificial Support Method

17:00 to 17:20

Kenichiro Ota (Green Hydrogen Research Center, Yokohama National University, Yokohama, Japan), Koichi Matsuzawa, Shigenori Mitsushima, Akimitsu Ishihara

Development of Group 4 and 5 Metal Oxide Cathode Containing Carbon and Nitrogen for PEFCs

17:20 to 17:40

Mitsuharu Chisaka (Department of Electronics and Information Technology, Hirosaki University, Hirosaki, Japan), Hirohito Sasaki, Hirokazu Muramoto

Oxygen Reduction Reaction Activity of Hafnium Oxynitride Supported on Reduced Graphene-Oxides

17:40 to 18:00

Kaido Tammeveski (Institute of Chemistry, University of Tartu, Tartu, Estonia), Sander Ratso, Ivar Kruusenberg, Merilin Vikkisk, Urmas Joost, Eugene Shulga, Ilmar Kink, Tanja Kallio

Electrocatalytic oxygen reduction on nitrogen-doped few-layer graphene/multi-walled carbon nanotube composites in alkaline media

18:00 to 18:20

Petri Kanninen (Department of Chemistry, Aalto University, Espoo, Finland), Maryam Borghei, Olli Sorsa, Elina Pohjalainen, Esko I. Kauppinen, Virginia Ruiz, Tanja Kallio

N-doped carbon nanotubes as highly efficient cathode catalyst for alkaline direct methanol fuel cell

Symposium 4: Electrochemical Energy Conversion and Storage: Fuel Cells and Electrolysers

Room 2 - Garden

Chaired by : Julien Durst

14:00 to 14:20

Kalliopi-Maria Papazisi (Chemical Process and Energy Resources Institute, Centre for Research and Technology Hellas, Thessaloniki, Greece), Angeliki Banti, Kalliopi Limniotou, Stella Balomenou, Dimitrios Tsiplakides

Effect of Particle Size on the Performance of IrO_2 as Electrocatalyst for the Oxygen Evolution Reaction

14:20 to 14:40

Michael Bernicke (Fakultät II, Technische Universität Berlin, Berlin, Germany), Denis Bernsmeier, Erik Ortel, Ralph Kraehnert

Electro-chemical oxygen evolution reaction (OER) employing IrO_2 and Ir/TiO_x catalysts with micelle-controlled pore structure

14:40 to 15:00

Justus Masa (Analytical Chemistry and Center for Electrochemical Sciences, Ruhr-Universitaet Bochum, Bochum, Germany), Wei Xia, Ilya Sinev, Anqi Zhao, Martin Muhler, Wolfgang Schuhmann

MnxOy/NC and CoxOy/NC nanoparticles embedded in a nitrogen-doped carbon matrix for high performance bifunctional oxygen electrodes

15:00 to 15:20

Xiaoling Zhang (Department of R&D, Teer Coatings Limited, Miba Coating Group, Droitwich, United Kingdom) Joanne Hampshire, Kevin Cooke, Xiaohong Li, Derek Pletcher, Shaun Wright

High Surface Area Coatings for Hydrogen Evolution Cathodes Prepared by Magnetron Sputtering

15:20 to 15:40

Thomas Rauscher (Institute for Materials Science, Technische Universität Dresden, Dresden, Germany), Christian Immanuel Müller, Andreas Schmidt, Thomas Schubert, Bernd Kieback, Lars Röntzsch

Amorphous Ni-base Alloys as Electrode Materials for Alkaline Water Electrolysis

15:40 to 16:00

Shigenori Mitsushima (Green Hydrogen Research Center, Yokohama National University, Yokohama, Japan), Hiroki Ichikawa, Yuji Kohno, Ikuo Nagashima, Yoshio Sunada, Yoshinori Nishiki, Akiyoshi Manabe, Koichi Matsuzawa

Lithiated NiO Modified Ni Anode for Alkaline Water Electrolysis under Fluctuating Power Supply

16:00 to 16:20

Sébastien Bozdech (ICPEES, CNRS, Strasbourg, France), Saveleva Viktoriia, Pronkin Sergey, Bonnefont Antoine, Savinova Elena

Kinetics of hydrogen electrode reactions on supported Ni catalysts

16:20 to 16:40

Coffee Break

16:40 to 17:00

Jun Maruyama (Environmental Technology Research Division, Osaka Municipal Technical Research Institute, Osaka, Japan), Tsutomu Ioroi, Takahiro Hasegawa, Takuya Mori, Yuki Orikasa, Yoshiharu Uchimoto

Carbonaceous Hydrogen Evolution Catalyst Containing Cobalt Surrounded by Tuned Local Structure

17:00 to 17:20

Julien Durst (Department of Chemistry, Chair of Technical Electrochemistry, Technische Universität München, Garching, Germany), Armin Siebel, Christoph Simon, Frédéric Hasché, Juan Herranz, Hubert A. Gasteiger

New Insights into the Electrochemical Hydrogen Oxidation and Evolution Reaction Mechanism

17:20 to 17:40

Anthony Kucernak (Department of Chemistry, Imperial College London, London, United Kingdom), Matthew Markiewicz, Christopher Zalitis, Jonathon Sharman, Ed Wright

Performance measurements and modeling of the *her* and *orr* on fuel cell electrocatalysts

17:40 to 18:00

Richard Hanke-Rauschenbach (Process Systems Engineering, Max Planck Institute Dynamics of Complex Technical Systems, Magdeburg, Germany), Boris Bensmann, Kai Sundmacher

In-situ characterisation of hydrogen crossover in polymer electrolyte membrane water electrolysis

18:00 to 18:20

Ioannis Katsounaros (Department of Chemistry, University of Illinois at Urbana-Champaign, Urbana, USA), Pietro P. Lopes, Joshua Snyder, Justin G. Connell, Nemanja Danilovic, Jakub Jirkovsky, Dusan Strmcnik, Arvydas P. Paulikas, Vojislav R. Stamenkovic, Andrew Gewirth, Marc T.M. Koper, Nenad M. Markovic

Electrocatalysis of the Nitrogen and Carbon Cycle on Well-characterized Materials

Symposium 5: Electrochemical Energy Conversion and Storage: Batteries

Auditorium C - Cloud

Chaired by : Christopher Johnson, Shinichi Komaba and Petr Novák

14:00 to 14:20 Invited

Christopher Johnson (Chemical Sciences and Engineering Division, Argonne National Laboratory, Lemont, USA)

Na-Ion Batteries: A New Energy Storage Focus

14:20 to 14:40

Miguel Ángel Muñoz-Márquez (Structure and Surface Analysis - Electric Energy Storage, CIC energiGUNE, Miñano, Spain), Maider Zarrabeitia, Elizabeth Castillo-Martínez, Aitor Eguía-Barrio, Teófilo Rojo, Montserrat Casas-Cabanas

Study of the Electrode-Electrolyte Interphase in $Na_2Ti_3O_7$ Electrodes for Rechargeable Na-Ion Batteries

14:40 to 15:00

Masafumi Nose (Battery Research Division, Toyota Motor Corporation, Susono, Japan), Shinya Shiotani, Shinya Nagashima, Hideki Nakayama, Shinji Nakanishi, Hideki Iba

High Potential Electrode Materials of $Na_4M_3(PO_4)_2P_2O_7$ for Sodium-ion Batteries

15:00 to 15:20

Luciana Gomes Chagas (Institute of Physical Chemistry / University of Muenster, Helmholtz Institute Ulm / Karlsruhe Institute of Technology, Ulm, Germany), Daniel Buchholz, Christoph Vaalma, Stefano Passerini

Investigations of synthesis temperature on layered $NaxNi_{0.22}Co_{0.11}Mn_{0.66}O_2$ as cathode for Na-ion batteries

15:20 to 15:40

Yu-Ting Weng (Department of Chemical Engineering, National Taiwan University, Taipei, Taiwan), Chao-Yen Kuo, Hsieh-Tsung Li, Bing Joe Hwang, Nae-Lih Wu

Synthesize and application of novel nano-hierarchical hollow manganese oxide anode material with outstanding performance for sodium ion battery

15:40 to 16:00

Laure Monconduit (Department of Chemistry, Institut Charles Gerhardt, Montpellier, France), Ali Darwiche, Moulay Tahar Sougrati, Julien Fullenwarth, Bernard Fraisse, Bruno Donnadieu, Lorenzo Stievano

Performance and Mechanism of Negative Electrodes Based on p-Group Elements for Na Batteries

16:00 to 16:20

Claire Villevieille (ENE-Electrochemical Energy Storage Section, Paul Scherrer Institut, Villigen, PSI, Switzerland), Léonie Vogt, Sofía Pérez Villar, Mario El Kazzi

Sn Anode for Na-ion Batteries: A Bulk and Interfacial Study

16:20 to 16:40

Coffee Break

16:40 to 17:00 Invited

Shinichi Komaba (Department of Applied Chemistry, Tokyo University of Science, Tokyo, Japan), Naoaki Yabuuchi, Kei Kubota, Mouad Dahbi, Kiyofumi Yamagiwa

Sodium Insertion Materials

17:00 to 17:20

Mouad Dahbi (Department of Applied Chemistry, Tokyo University of Science, Tokyo, Japan), Naoaki Yabuuchi, Kei Kubota, Shinichi Komaba

Characterization of SEI Formed in Ionic Liquid Electrolyte on Phosphorus Electrodes in Na Cells

17:20 to 17:40

Bernard Lestriez (Institut des Matériaux Jean Rouxel, Université de Nantes, CNRS, Nantes, France), Binh Phuong Nhan Nguyen, Manuella Cerbelaud, Joël Gaubicher, Willy Porcher, Nicolas Mariage

Formulation of industry-relevant silicon negative composite electrodes for lithium ion-cells

17:40 to 18:00

Wei-Ren Liu (Department of Chemical Engineering, Chung Yuan Christian University, Chung Li, Taiwan)

The Effects of Functional Groups of Graphene Nanosheets Anode on Electrochemical Properties for Li-ion Battery

18:00 to 18:20

Jong-Sung Yu (Department of Advanced Materials Chemistry, Korea University, Sejong, Korea), Hyean-Yeol Park, Jong Deok Park, Sung Soo Kim, Eun Jin Bae

Carbon-Supported α-Fe_2O_3 Nanoparticles as an Ultrahigh Capacity Anode Material in Lithium Ion Battery

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Symposium 8: Modern Electroactive Polymeric, Organic, Inorganic and Nanocomposite Materials

Room 1a - Garden

Chaired by : Marilia Goulart, Achim Walter Hassel, Laurent Ruhlmann and Alain Walcarius

14:00 to 14:40 Keynote

Renato Seeber (Department of Chemical and Geological Sciences, University of Modena and Reggio Emilia, Modena, Italy), Laura Pigani, Fabio Terzi, Chiara Zanardi

Amperometric Sensing : A Melting Pot for Material, Electrochemical and Analytical Sciences

14:40 to 15:20 Keynote

Vessela Tsakova (Institute of Physical Chemistry, Bulgarian Academy of Sciences, Sofia, Bulgaria)

Some insights into the investigations of conducting polymers for electroanalytical purposes

15:20 to 15:40

Ekaterina Zolotukhina (Department of Functional Inorganic Materials, Institute for the Problems of Chemical Physics RAS, Chernogolovka, Russia)

One-stage periodical anodic-cathodic double pulse deposition of nanocomposite materials. Application to Prussian Blue/polypyrrole film coated electrodes

15:40 to 16:00

Christopher M.A. Brett (Departamento de Quimica, Universidade de Coimbra, Coimbra, Portugal), Krishna P. Prathish, Madalina M. Barsan, M. Emilia Ghica

Electroactive Polymer/Carbon Nanocomposite Modified Electrodes: Characterisation and Sensor Applications

16:00 to 16:20

Zbigniew Stojek (Faculty of Chemistry, University of Warsaw, Warsaw, Poland), Marcin Karbarz, Klaudia Kaniewska

Modification of Electrode Surface with Thermo- and pH Sensitive Composite Material. Electrochemically Induced Free-radical Polymerization of Two Interpenetrating Networks

16:20 to 16:40

Coffee Break

16:40 to 17:00

Laurent Bouffier (Institute of Molecular Sciences, University of Bordeaux, Pessac, France), Gabriel Loget, Zahra Fattah, Jérome Roche, Eugenio Gianessi, Stéphane Arbault, Dodzi Zigah, Alexander Kuhn

Preparation of Janus-type Composite Materials by Bipolar Electrochemistry

17:00 to 17:20

Alessandro Boni (Department of Chemistry, University of Bologna, Bologna, Italy), Giovanni Valenti, Matteo Cargnello, Stefania Rapino, Massimo Marcaccio, Paolo Fornasiero, Maurizio Prato, Francesco Paolucci

Nanostructures for Energy Conversion: Synergic Effects Between Carbon Nanotubes and Metal Oxides

17:20 to 17:40

Chun-Ting Li (Department of Chemical Engineering, National Taiwan University, Taipei, Taiwan), Miao-Syuan Fan, Yu-Ting Wen, Chuan-Pei Lee, Nae-Lih Wu, Kuo-Chuan Ho

Electrocatalytic nanocomposite film of carbon black nanoparticles/solfonated-polythiophene for triiodine ion reduction

17:40 to 18:00 Invited

Patrizia Romana Mussini (Dipartimento di Chimica, Università degli Studi di Milano, Milano, Italy), Francesco Sannicolò, Serena Arnaboldi, Valentina Bonometti, Monica Panigati, Rocco Martinazzo, Tiziana Benincori, Simona Rizzo, Giovanna Longhi, Roberto Cirilli, Marco Pierini, Wlodzimierz Kutner, Krzysztof Noworyta

Potential-driven Chirality Manifestations and Impressive Enantioselectivity by Inherently Chiral Electroactive Films

18:00 to 18:20

Tatiana Magdesieva (Department of Chemistry, Lomonosov Moscow State University, Moscow, Russia), Oleg Levitskiy, Yuri Grishin, Asmik Ambartsumyan, Konstantin Kochetkov

Electrochemically induced transformations in Ni(II) coordination environment: New possibilities for stereoselective amino acids functionalization and for creating precursors of metal-containing chiral materials

Symposium 9: Corrosion, Passivity and Oxide Films

Room 1bc - Garden

Chaired by : Guido Grundmeier and Fatima Montemor

14:00 to 14:20

Fatima Montemor (Department of Chemical Engineering, Instituto Superior Tecnico, Lisboa, Portugal), Amir Zomorodain, Catarina Santos, Maria João Carmezim, Maria Silva, Joao Salvador Fernandes

Functional Coatings Loaded With Hydroxyapatite for Bioresorbable Mg Alloys: Corrosion Behaviour and Biocompatibility

14:20 to 14:40

Anh Son Nguyen (CIRIMAT, ENSIACET, Toulouse, France), Marco Musiani, Mark Orazem, Nadine Pebere, Bernard Tribollet, Vincent Vivier

Determination of organic coatings properties with immersion time from constant-phase-element parameters

14:40 to 15:00

João Tedim (CICECO, Department of Materials and Ceramic Engineering, University of Aveiro, Aveiro, Portugal)

Layered double hydroxides for corrosion protection: From particle additives to layer reservoirs

15:00 to 15:20

Magdalena Pawelkiewicz (Joining Technologies and Corrosion, EMPA, Swiss Federal Laboratories for Materials Science and Technology, Dübendorf, Switzerland)

Localized corrosion ionic leaching mechanisms of stainless steel and CoCrMo alloys in simulated body fluids under static crevice and dynamic loading solicitation

15:20 to 15:40

Victoria Flexer (Analytical Chemistry, Ghent University, Ghent, Belgium), Elbeshary Ahmed, Mark G. Dowset, Annemie Adriaens

New Strategies for Corrosion Inhibition Coatings for Lead and Iron Heritage Metal Objects

15:40 to 16:00

Christoph Cobet (Center of Surface and Nanoanalytics, Johannes Kepler University Linz, Linz, Austria)

Probing of the atomic structure of the Cu(110) surface in electrolyte by polarization optical spectroscopy and scanning tunneling microscopy

16:00 to 16:20

Subir Kumar Ghosh (Materials Processing Division, Bhabha Atomic Research Centre, Mumbai, India), C. Srivastava, A.K. Sahoo, R.C. Hubli, J.K. Chakravartty

Structural and Corrosion Property Investigation of Electrodeposited Ni-Zn-P Alloy Coatings

16:20 to 16:40

Coffee Break

16:40 to 17:20 Keynote

Guido Grundmeier (Technical and Macromolecular Chemistry, University of Paderborn, Paderborn, Germany), Ozlem Ozcan

Surface Chemistry, Electrochemical Properties and Corrosion of Zinc Oxide - From Single Crystals to Protective Thin Films

17:20 to 17:40

Javier Izquierdo (Department of Chemistry, University of La Laguna, San Cristóbal de La Laguna, Spain), Alexander Eifert, Christine Kranz, Ricardo M. Souto

Local pit corrosion induction on iron surfaces using combined AFM-SECM

17:40 to 18:00
Masahiro Seo (Faculty of Engineering, Hokkaido University, Sapporo, Japan), Hiroki Habazaki, Masayuki Inaba, Mitsutoshi Yokomizo, Takumi Wakabayashi, Takenori Nakayama

Inhibition Effect of Sn^{2+} on Corrosion of Ni and Sn Adsorption Structure

18:00 to 18:20
Koji Fushimi (Faculty of Engineering, Hokkaido University, Sapporo, Japan), Yu Takabatake, Takayuki Nakanishi, Yasuchika Hasegawa

Micro-electrochemical Reactivity of Iron Single Crystal Grain during Anodic Polarisation in 0.05 mol dm^{-3} Sulphuric Acid Aqueous Solution

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Symposium 11: Electrochemical Technology: Crossroad for Energy and Environment

Room 3a - Garden

Chaired by : Guohua Chen and Constantinos Vayenas

14:00 to 14:40 Keynote Invited
Geoff Kelsall (Department of Chemical Engineering, Imperial College London, London, United Kingdom), Anna Hankin, Lisa Kleiminger

(Photo-)Electrochemical Energy Conversion and Storage

14:40 to 15:00
Katrin Bickel (Nonequilibrium Chemical Physics, Technical University of Munich, Garching, Germany), Simon Filser, Qi Li, Konrad Schönleber, Katharina Krischer

Pyridine catalyzed CO_2 reduction

15:00 to 15:20
Ziad Bitar (Electrochemistry and Materials Department, IFPEN, Solaize, France), David Pasquier, Antoine Fecant, Sylvie Chardon-Noblat, Alain Deronzier

Molecular Catalysts on Gas Diffusion Electrodes for Electrocatalytic Reduction of CO_2

15:20 to 15:40
Shahid Rasul (KAUST Catalysis Center (KCC), King Abdullah University of Science and Technology, Thuwal, Saudi Arabia), Dilshad Masih, Kazuhiro Takanabe

Designing the electrocatalyst for CO_2 conversion reaction utilizing Cu (I) based multi-metal oxides

15:40 to 16:00
Takafumi Wakamatsu (Faculty of Engineering, Hokkaido University, Sapporo, Japan), Takuya Uchiyama, Shungo Natsui, Tatsuya Kikuchi, Ryosuke O. Suzuki

CO_2 Decomposition by Electrolysis in Molten LiCl-Li_2CO_3

16:00 to 16:20
Sylvie Chardon-Noblat (Département de Chimie Moléculaire UMR-5250, Université Joseph Fourier Grenoble 1, CNRS, Grenoble, France), Marc Bourrez, Florian Molton, Maylis Orio, Carole Duboc, Alain Deronzier

Mechanism Pathway for Electrocatalytic Reduction of CO_2 by [Mn(bipyridyl)$(CO)_3$X] Derivative

16:20 to 16:40
Coffee Break

16:40 to 17:00
Ryosuke Suzuki (Department of Materials Science and Engineering, Hokkaido University, Sapporo, Japan), Takuya Uchiyama, Takafumi Wakamatsu, Koya Otake, Mika Kitamura, Shungo Natsui, Norihito Sakaguchi, Tatsuya Kikuchi

CO_2 Decomposition by Electrolysis in $CaCl_2$-CaO Melt

17:00 to 17:20 Invited

Claude Lamy (Institut Européen des Membranes, UMR CNRS n° 5635, University of Montpellier 2, Montpellier, France), Stève Baranton, Christophe Coutanceau

Production of Clean Hydrogen for Fuel Cells by the Electrochemical Decomposition of Organic Compounds in a Proton Exchange Membrane Electrolysis Cell (PEMEC)

17:20 to 17:40

Elisama Vieira Dos Santos (Institute of Chemistry, Federal University of Rio Grande do Norte, Natal, Brazil), Dayanne Chianca de Moura, Elisama Vieira Dos Santos, Carlos Alberto Martinez-Huitle

Decontamination of effluent generated by Federal University of Rio Grande do Norte by electrogenerated active chlorine species on $Ti/Ru_{0.3}Ti_{0.7}O_2$ electrode

17:40 to 18:00 Invited

Sandra Rondinini (Department of Chemistry, Università degli Studi di Milano, Milano, Italy), Cristina Locatelli, Ottavio Lugaresi, Alessandro Minguzzi, Alberto Vertova

Electroreductive Dehalogenation: Crossroads for Waste Detoxification and Conversion to Valued Compounds

18:00 to 18:20 Invited

Rolf Wuthrich (Mechanical and Industrial Engineering, Concordia University, Montreal, Canada), Jana D. Abou Ziki, Lucas A. Hof, Pouria Matoorian, Giuseppe Cusanelli, Damien Luthi

Glass Micro-machining by Contact Glow Discharge Electrolysis

Symposium 13: Synergizing Theory and Experiment in Electrochemistry: State-of-the-Art Developments

Room 5 - Garden

Chaired by : Thomas Jaramillo

14:00 to 14:20

Petr Krtil (Electrocatalysis, J. Heyrovsky Institute of Physical Chemistry, Prague, Czech Republic), Niels Bendtsen Halck, Valery Petrykin, Jan Rossmeisl

Breaking the Scaling Relationships in Oxygen Evolution - Theoretical and Experimental Aspects

14:20 to 14:40

Kelsey Stoerzinger (Materials Science and Engineering, Massachusetts Institute of Technology, Cambridge, USA), Liang Qiao, Michael Biegalski, Yang Shao-Horn

Orientation-dependent Oxygen Evolution Activities of Rutile IrO_2 and RuO_2

14:40 to 15:00

Paramaconi Rodriguez (School of Chemistry, University of Birmingham, Birmingham, United Kingdom), Francisco Javier Monzó, Fangquian Yin, Alex Yanson

Enhanced catalytic activity of unconventional alloy nanoparticles prepared by cathodic corrosion

15:00 to 15:20 Invited

Jin Suntivich (Materials Science and Engineering, Cornell University, Ithaca, USA)

Insights on the Influence of pH on Anode Electrocatalysis from Time-Resolved Raman Spectroscopy

15:20 to 15:40

Federico Calle-Vallejo (Laboratoire de Chimie, École Normale Supérieure de Lyon, Lyon, France), David Loffreda, Philippe Sautet

Fast Prediction of Adsorption Properties for Nanocatalysts by Means of Generalized Coordination Numbers

15:40 to 16:00

Stephen Thompson (Department of Chemistry, University of Southampton, Southampton, United Kingdom), Peter Richardson, Stephen Price, Andrea Russell, Scott Gorman, Xiahong Li, Richard Wills, Frank Walsh, Derek Pletcher

In situ XANES of oxide ORR and OER electrocatalysts

16:20 to 16:40

Coffee Break

16:40 to 17:20 Keynote

Thomas Jaramillo (Department of Chemical Engineering, Stanford University, Stanford, USA) Jakob Kibsgaard, Jesse Benck, Thomas Hellstern, Kara Fong, Ariel Jackson, Kendra Kuhl, Etosha Cave, David Abram, Toru Hatsukade, Christopher Hahn, Jeremy Feaster

Designing and Developing Catalysts for Electrochemical Reactions Involving H_2, O_2, and CO_2

17:20 to 17:40

YuYe Tong (Department of Chemistry, Georgetown University, Washington, USA), Dejun Chen, Dianne Atienza, Thomas Allison

In situ SEIRAS Investigation of MOR on PtRu and FAOR on PtPb at Low Electrode Potential: A Re-visit of CO Poisoning and Bi-functional Mechanism

17:40 to 18:00

Enrique Herrero (Instituto de Electroquímica, Universidad de Alicante, Alicante, Spain), Adolfo Ferre-Vilaplana, Juan V. Perales-Rondón, Juan M. Feliu

On the effects of the adatoms in the formic acid oxidation on platinum

18:00 to 18:20

Yumin Qian (Nanosystem Reseach Institute, FC-Cubic & AIST, Tsukuba, Japan), Tamio Ikeshoji, Minoru Otani

Multilayer water adsorption structure on the low index Pt(hkl) surface: First principle molecular dynamics study

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Symposium 15: General Session

Room 3bc - Garden

Chaired by : Mark Symes and Peter Liljeroth

14:00 to 14:20 Invited

Neso Sojic (ISM - ENSCBP, University of Bordeaux, Pessac, France), Patrick Garrigue, Bertrand Goudeau, Thibault Bombail, Dodzi Zigah, Laurent Bouffier, Stéphane Arbault

Nanostructured Microelectrodes for Combined Scanning Electrochemical Microscopy and Surface-enhanced Raman Scattering Detection

14:20 to 14:40 Invited

Chia-Liang Sun (Dept. of Chem. and Mater. Eng., Chang Gung University, Tao-Yuan, Taiwan), Min-Hsin Yeh, Lu-Yin Lin, Yow-An Leu, Kuo-Chuan Ho

Synthesis of Graphene-based Nanomaterials as Counter Electrodes for Dye-sensitized Solar Cells

14:40 to 15:00

Carlos Ponce de Leon (Faculty of Engineering and the Environment, University of Southampton, Southampton, United Kingdom), Rachel McKerracher, Frank Walsh

Use of 3-D Printing to Design and Construct a Laboratory Flow Cell for Electrochemical Applications

15:00 to 15:20

Andrew N. J. Rodgers (School of Chemistry, University of Manchester, Manchester, United Kingdom), Robert Dryfe

Interfacial Adsorption and Catalysis using Graphite Particles

15:20 to 15:40

Youngkook Kwon (Material Science Division, Lawrence Berkeley National Laboratory, Berkeley, USA), Ezra Clark, Alexis Bell

Electrochemical CO_2 Reduction: Combining Voltammetry with HPLC

15:40 to 16:00

Justin Gooding (School of Chemistry, UNSW Australia, Sydney, Australia), Simone Ciampi, Moinul Choudhury, Stephen Parker

Making Silicon Water Friendly: An Approach to Producing Stable Oxide Free Silicon for Electrochemical Applications

16:00 to 16:20

Ming-Yueh Wang (Department of Chemical Engineering, National Chung Hsing University, Taichung, Taiwan), Wei-Ping Dow, Wan-Yun Hsiung, Shih-Ming Lin

Cu Electroplating for Through Silicon Vias Filling Using a Dimensionally Stable Anode

16:20 to 16:40

Coffee Break

16:40 to 17:00 Invited

Charles Cummings (Department of Chemsitry, University of Southampton, Southampton, United Kingdom), David Pugh, David Cook, Jack Branch, Gill Reid, David Smith, Phillip Bartlett

Supercritical Fluid Electrochemistry: Advances in Germanium and Thin Film Formation

17:00 to 17:20

Tso-Fu Mark Chang (Precision and Intelligence Laboratory, Tokyo Institute of Technology, Yokohama, Japan), Wei-Hao Lin, Takashi Nagoshi, Nao Shinoda, Yung-Jung Hsu, Tatsuo Sato, Masato Sone

Metals and Metal Oxides Electrodeposited with Supercritical Carbon Dioxide Emulsified Electrolyte

17:20 to 17:40

David Cook (Department of Chemistry, University of Southampton, Southampton, United Kingdom), Philip Bartlett, David C. Smith, Gill Reid, Mike W. George, William Levason, Andrew Hector, Jeremy Sloan, Jie Ke, Richard Beanland, Wenjian Zhang

Supercritical Fluid Electrodeposition as a Potentially Disruptive Materials Technology

Friday 5 September 2014

Rooms	Auditorium A	Auditorium B	Auditorium C	Room 1a	Room 1bc	Room 2	Room 3a	Room 3bc	Room 4	Room 5
Symposium	**S03**	**S04**	**S05**	**S08**	**S09**	**S04**	**S11**	**S05**	**S03**	**S13**
08:30 - 09:30	**Plenary Lecture, Auditorium A** : Digby Macdonald (Frumkin Memorial Medal)									
09:30 - 09:50	Coffee Break									
09:50 - 10:10	Osamu Niwa	A. Kulikovsky	N. Yabuuchi	E. Madrid	X. R. Nóvoa	E. El Sawy	K. Bouzek	K. Wedlich	J. Lipkowski	M. Chatenet
10:10 - 10:30	E. Zabost	Byungchan Han	Shinji Oro	Changhui Chen		P. Gazdzicki		Wei Wei		
10:30 - 10:50	R. Bilewicz	Wei Wei	B. Breitung	J.-C. Moutet	B. Bozzini	R. Modibedi	M. Eikerling	E. Deunf	F. Bedioui	A. Bonnefont
10:50 - 11:10	J. Ulstrup	Yoong-Kee Choe	S. Freunberger	J. Conder	Shinji Fujimoto	H. de las Mercedes	M.E. H. Bergmann	Hyun-Kyung Kim	O. Buriez	L. Kibler
11:10 - 11:30		A. Meléndez-C.	Jia Liu	L. H. Dall'Antonia	S. Chakri	S. Iqbal	N. Simic	Min-young Cho	Hirosuke Tatsumi	A. Hubin
11:30 - 11:50	E. Magner	J. Schefold	E. J. Berg	J. P. Kollender	E. Gianessi	S. Rojas	S. Palmas	S. Brutti	F. J. Rawson	D. Morgan
11:50 - 12:10	Ch. Mousty	I. Osadebe	E. Paillard	D. Plana	B. Gwinner	T. Jurzinsky	F. Fischer	M. Pivko	L. Thouin	
12:10 - 12:30	Izumi Kubo	V. Lvovich	R. McKerracher	A. Tapley	E. Verlato	V. Muthukumar	S. Gorman	M. G. Mestres	A. M. Oliveira-Brett	M. Figueiredo
12:30 - 12:50	G. Loget		J. Moskon	Xiaoyin Xiao	H. G. de Melo		V. Amstutz	D. Yonekura	A. Ivaska	K. Motobayashi
12:50 - 13:10	G. Crespo		P. V. W. Sasikumar	A. Wieckowska	S. Munktell		M. V. Boldrin Z.	Y. Surace	E. Neumann	J. M. Feliu
13:15 - 13:30	Closing Ceremony, Auditorium A - CAMPUS									

Friday, 5 September 2014 - Morning

Plenary

Auditorium A - Campus

Chaired by : Hasuck Kim

08:30 to 09:30

Frumkin Memorial Medal

Digby Macdonald (Department of Materials Science and Engineering, University of California at Berkeley, Berkeley, USA)

How Well Do We Understand Passivity and Passivity Breakdown?

09:30 to 09:50

Coffee Break

Symposium 3: Bioelectrochemistry: From Fundamentals to Health Monitoring and Energy Conversion

Auditorium A - Campus

Chaired by : Damien Arrigan and Nicolas Plumeré

09:50 to 10:10

Osamu Niwa (Biomedical Institute, National Institute of Advanced Industrial Sci. and Tech., Tsukuba, Japan), Dai Kato, Tomoyuki Kamata, Qiang Xue, Shigeru Hirono, Masami Todokoro, Qiaohui Guo, Tianyan You

Nanocarbon-based electrochemical biosensors for drug development

10:10 to 10:30

Ewelina Zabost (Faculty of Chemistry, University of Warsaw, Warsaw, Poland), Wioletta Chmielowiec, Agnieszka Kowalczyk, Zbigniew Stojek

Electrospun nanocomposites of PLC, PNIPA, DNA and Au nanoparticles for storing and releasing of drugs

10:30 to 10:50

Renata Bilewicz (Department of Chemistry, University of Warsaw, Warsaw, Poland), Ewa Nazaruk, Monika Szlezak, Ehud Landau

pH-Dependent Drug Release from the Drug Carrier Monitored by Voltammetry

10:50 to 11:30 Keynote

Jens Ulstrup (Department of Chemistry, Technical University of Denmark, Kongens Lyngby, Denmark)

Single-molecule electrochemical dynamics and electronically based nanoparticle catalysis of transition metal complex and metalloprotein electrochemistry

11:30 to 11:50

Edmond Magner (Materials and Surface Science Institute, University of Limerick, Limerick, Ireland)

Specific Ion Effects on Protein Electrochemistry

11:50 to 12:10

Christine Mousty (Institut de Chimie de Clermont-Ferrand (ICCF UMR 6296), Université Blaise Pascal, Clermont-Ferrand, France), Nadia Touisni, Franck Charmantray, Claude Forano, Virgil Helaine, Laurence Hecquet

Amperometric Biosensors based on Galactose Oxidase for *E. coli* Transketolase Activity Detection

12:10 to 12:30

Izumi Kubo (Department of Bioinformatics, Soka University, Hachioji, Tokyo, Japan)

Study on electrochemical detection of insulin based on peroxidase activity of insulin binding DNA aptamer

12:30 to 12:50

Gabriel Loget (Department of Chemistry, University of California, Irvine, Irvine, USA), Jennifer B. Wood, Kyunghee Cho, Robert M. Corn

Electrodeposition of Polydopamine Thin Films for DNA Patterning and Microarrays

12:50 to 13:10

Gaston Crespo (Department of Inorganic and Analytical Chemistry, University of Geneva, Geneva, Switzerland), Majid Afshar, Eric Bakker

Dynamic Bioelectroanalysis of Polyions with Ion-selective Membranes

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Symposium 4: Electrochemical Energy Conversion and Storage: Fuel Cells and Electrolysers

Room 2 - Garden

Chaired by : Pawel Gazdzicki

09:50 to 10:10

Ehab El Sawy (Department of Chemistry, University of Calgary, Calgary, Canada), Viola Birss

Methanol Oxidation at Rucore@Ptshell Nanoparticles: Understanding the Different Roles of Rucore

10:10 to 10:30

Pawel Gazdzicki (Institute of Technical Thermodynamics, German Aerospace Center (DLR), Stuttgart, Germany), Mathias Schulze, Fausto Bresciani, Andrea Casalegno, Laure Guetaz, Jacob L. Bonde

Post Mortem Analysis of Degraded DMFC After Extended Operation

10:30 to 10:50

Remegia Modibedi (Materials Science and Manufacturing, Council for Scientific and Industrial Research, Pretoria, South Africa), Thembelihle Mehlo, Kenneth Ozoemena, Mkhulu Mathe

Synthesis, Characterization and Application of Pd-based Nanoelectrocatalysts in the Alkaline Direct Ethanol Fuel Cell (ADEFC)

10:50 to 11:10

Hebe de las Mercedes Villullas (Department of Physical Chemistry, Institute of Chemistry - UNESP, Araraquara (SP), Brazil), Fernanda G. Freitas, Denis R.M. Godoi

Enhancement of Catalytic Activity of PtSn for Ethanol Oxidation Promoted by the Addition of TiO_2

11:10 to 11:30

Shahid Iqbal (Inst. of Physical and Theoretical Chemistry, University of Bonn, Bonn, Germany)

Oxygen reduction at inductively heated modified chalcogenide surfaces and its morphology

11:30 to 11:50

Sergio Rojas (Department of Estructura y Reactividad, CSIC, Madrid, Spain), Tirma Herranz, María Ibañez, José Luis Gómez de la Fuente, Francisco J Perez-Alonso, Miguel A Peña, Andreu Cabot

IRRAs and DEMS study of the electrooxidation of ethanol with Pt_3Sn

11:50 to 12:10

Tilman Jurzinsky (Department for Applied Electrochemistry, Fraunhofer Institute for Chemical Technology, Pfinztal, Germany), Florina Jung, Carsten Cremers, Karsten Pinkwart, Jens Tübke

Ternary Palladium-based Catalysts for Anion Exchange Membrane Direct Alcohol Fuel Cells (AEM DAFCs)

12:10 to 12:30

Volga Muthukumar (Department of Chemical Engineering, Indian Institute of Technology Madras, Chennai, India)

Electrodeposited Pt-nanoflowers supported on Ru/C for methanol oxidation in direct methanol fuel cell

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Symposium 3: Bioelectrochemistry: From Fundamentals to Health Monitoring and Energy Conversion

Room 4 - Garden

Chaired by : Arkady Karyakin and Christophe Léger

09:50 to 10:30 Keynote

Jacek Lipkowski (Department of Chemistry, University of Guelph, Guelph, Canada), Zhangfei Su, Max Smetanin, Piotr Pieta, Slawomir Sek, Thamara Laredo, John R. Dutcher, Flavio Maran

Scanning Probe Microscopy, IR Spectroscopy and Electrochemical Studies of Antimicrobial Peptides Incorporated into Biomimetic Membranes Supported at a Au Electrode

10:30 to 10:50

Fethi Bedioui (UTCBS CNRS 8258 / INSERM 1022, Chimie ParisTech / CNRS, Paris, France), Abdulghani Ismail, Sophie Griveau, Fanny d'Orlyé, Anne Varenne

Copper-catalyzed nitric oxide release from S-nitrosoglutathione: Re-investigation of the analytical approaches using Savilla method and electrochemical sensing

10:50 to 11:10

Olivier Buriez (Department of Chemistry, Ecole Normale Supérieure, Paris, France), Pierluca Messina, Eric Labbé, François Huet, Kieu An Ngo, Vincent Vivier, Frédéric Lemaître, Christian Amatore

Monitoring and Quantifying the Passive Transport of Molecules Through Patch-clamp Suspended Real and Model Cell Membranes

11:10 to 11:30

Hirosuke Tatsumi (Department of Chemistry, Shinshu University, Matsumoto, Japan), Yui Tsuchiya, Koichi Sakamoto

Sensitive Electrochemical Measurement of Hydroxyl Radical Generation Induced by the Xanthine-Xanthine Oxidase System

11:30 to 11:50

Frankie James Rawson (School of Pharmacy, University of Nottingham, Nottingham, United Kingdom), Alison Downard, Keith Baroninan, Simon Jackson, Gyorgy Fejer, Paula Mendes

Electrocatalytic intracellular nanosensor for probing real-time ROS and delineating immune cell signalling

11:50 to 12:10

Laurent Thouin (Department of Chemistry, UMR CNRS 8640, Ecole Normale Supérieure, Paris, France), Yun Li, Catherine Sella, Manon Guille Collignon, Frédéric Lemaître, Christian Amatore

High-performance Electrochemical Detection of Reactive Oxygen / Nitrogen Species in Microfluidic Channels

12:10 to 12:30

Ana Maria Oliveira-Brett (Departamento de Química, Universidade de Coimbra, Coimbra, Portugal)

Imunossupressors leflunomide and sulfasalazine electrochemical behaviour at boron-doped diamond and glassy carbon electrodes

12:30 to 12:50

Ari Ivaska (Process Chemistry Centre, Åbo Akademi University, Turku-Åbo, Finland), Yasuhito Sugano, Rose-Marie Latonen, Marceline Akieh, Johan Bobacka

Electro-catalytic oxidation of cellulose at Au electrode

12:50 to 13:10

Eberhard Neumann (Department of Biophysical Chemistry of Faculty of Chemistry, University of Bielefeld, Bielefeld, Germany)

Chemical Thermodynamics of Membrane Electroporation for Applications in Clinical Electrochemotherapy and Electrotransfer of Genetic Poly- and Oligonucleotides

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Symposium 4: Electrochemical Energy Conversion and Storage: Fuel Cells and Electrolysers

Auditorium B - Campus

Chaired by : Vadim Lvovich and Josef Schefold

09:50 to 10:10

Alexander Kuznetsov Prize for Theoretical Electrochemistry

Andrei Kulikovsky (Institute of Electrochemical Process Engineering, Research Centre Juelich, Juelich, Germany)

Analytical Tools for Understanding Fuel Cell Life and Death

10:10 to 10:30

Byungchan Han (Department of Energy Systems Engineering, DGIST, Daegu, Korea), Seunghyo Noh, Dohyun Kwak, Minho Seo

First Principles Study on the Electrocatalytic Property of Doped Graphenes with Metallic Supports in Fuel Cell Application

10:30 to 10:50

Wei Wei (State Key Laboratory of Electroanalytical Chemistry, Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, Changchun, China)

Pd-Based Nanostructures Supported on Graphene Nanosheets as Efficient Fuel Cell Electrocatalysts

10:50 to 11:10

Yoong-Kee Choe (Nanosystem Research Institute, National Institute of Advanced Industrial Science and Technology, Tsukuba, Japan), Eiji Tsuchida

Nature of hydroxide ion transport in hydrated membranes for alkaline membrane fuel cells

11:10 to 11:30

Arturo Meléndez-Ceballos (I2E, IRCP, Paris, France), Suilma M. Fernandez Valverde, Valerie Albin, Armelle Ringuede, Michel Cassir

Could Nb serve as a catalytic material for MCFC cathodic reaction?

11:30 to 11:50

Josef Schefold (European Institute for Energy Research, EIFER, Karlsruhe, Germany), Annabelle Brisse

Long-term Steam Electrolysis with Electrolyte-supported Solid Oxide Cells

11:50 to 12:10

Isioma Osadebe (School of Chemistry, National University of Ireland Galway, Galway, Ireland), Rakesh Kumar, Peter O Conghaile, Domhnall Mac Aodha, Paul Kavanagh, Dónal Leech

Combining enzymes, mediators and carbon nanotube supports for preparation of high current density glucose-oxidising biofuel cell anodes

12:10 to 12:30

Vadim Lvovich (Electrochemistry, NASA Glenn Research Center, Cleveland, USA), William Bennett, Mark Hoberecht

Analysis of shunt currents and associated corrosion of bipolar plates in PEM fuel cells

Symposium 5: Electrochemical Energy Conversion and Storage: Batteries

Auditorium C - Cloud

Chaired by : Masashi Ishikawa, Stefano Passerini and Sigita Urbonaite

09:50 to 10:10

ISE Prize for Applied Electrochemistry
Naoaki Yabuuchi (Department of Green and Sustainable Chemistry, Tokyo Denki University, Tokyo, Japan)

Toward Development of High-energy Li/Na Insertion Materials for Rechargeable Batteries

10:10 to 10:30

Shinji Oro (Graduate School of Engineering, Nagasaki University, Nagasaki, Japan), Koki Urita, Isamu Moriguchi

Carbon Nanospace-Confinement Effect on Charge-Discharge Properties of SnO_2

10:30 to 10:50

Ben Breitung (Institute of Nanotechnology, Karlsruhe Institute of Technology, Eggenstein-Leopoldshafen, Germany), Christoph Erk, Christoph Weidmann, Heino Sommer, Jürgen Janek, Torsten Brezesinski

A Comparative Performance Study of Different Polymer Binders and Nano-Silicon Materials in High-capacity Anodes for Li-ion Batteries

10:50 to 11:10

Stefan Freunberger (Institute for Chemistry and Technology of Materials, Graz University of Technology, Graz, Austria), Yuhui Chen, Muhammed M. Ottakam Thotiyl, Chunmei Li, Lee Johnson, Zheng Liu, Zhangquan Peng, Olivier Fontaine, Andreas Dunst, Viktor Epp, Ilie Hanzu, Martin Wilkening, Peter G. Bruce

The Aprotic Lithium-Air Battery: Materials and Mechanistic Aspects

11:10 to 11:30

Jia Liu (Department of Chemistry, Uppsala University, Uppsala, Sweden), Matthew Roberts, Reza Younesi, Mohammed Dahbi, Kristina Edström, Torbjörn Gustafsson, Jiefang Zhu

Accelerated Electrochemical Decomposition of Li_2O_2 under X-ray Illumination

11:30 to 11:50

Erik J. Berg (General Energy Research Department, Paul Scherrer Institut, Villigen PSI, Switzerland), Petr Novák

In situ Gas Analysis to Study Li-O_2 Battery Cathode Performance during Multiple Cycles

11:50 to 12:10

Elie Paillard (Department of Chemistry, Institut of Physical Chemistry, Muenster, Germany)

Li-air battery with ionic liquid electrolyte flow: Main achievements of the LABOHR EU project

12:10 to 12:30

Rachel McKerracher (Faculty of Engineering and the Environment, University of Southampton, Southampton, United Kingdom), Carlos Ponce de Leon Albarran

A Bifunctional Air Electrode Based on Transition Metal Ferricyanide Derivatives

12:30 to 12:50

Joze Moskon (Laboratory for Materials Chemistry, National Institute of Chemistry Slovenia, Ljubljana, Slovenia), Robert Dominko, Miran Gaberscek

“Activation” phenomenon in lithium ion insertion electrodes

12:50 to 13:10

Pradeep Vallachira W. Sasikumar (FB Material- und Geowissenschaften, TU Darmstadt, Darmstadt, Germany), Dawit Gemechu Ayana, Magdalena Graczyk-Zajac, Ralf Riedel, Gian Domenico Soraru

Porous Carbon-rich SiOC Aerogels as Anode Materials for Rechargeable Lithium-ion Batteries

Symposium 5: Electrochemical Energy Conversion and Storage: Batteries

Room 3bc - Garden

Chaired by : Kwang-Bum Kim and Claire Villevieille

09:50 to 10:10
Klaus Wedlich (Institute of Energy and Climate Research (IEK-3), Forschungszentrum Jülich GmbH, Jülich, Germany), Timm Bergholz, Yulin Yan, Carsten Korte, Detlef Stolten

Investigation of the growth of a SEI-like surface layer on $LiNi_{0.5}Mn_{1.5}O_4$ high voltage cathodes

10:10 to 10:30
Wei Wei (Department of Chemistry, Ångström Laboratory, Uppsala University, Uppsala, Sweden), Gabriel Oltean, Kristina Edström, Fredrik Björefors, Leif Nyholm

Binder-free Oxide Nanotube Array Electrodes for High Energy Density and Power Density Li-ion Batteries

10:30 to 10:50
Elise Deunf (Institut des Matériaux Jean Rouxel, Université de Nantes, Nantes, France), Anne-Lise Barrès, Dominique Guyomard, Franck Dolhem, Philippe Poizot

Potentialities of benzenoid/quinonoid structures for promoting organic Li-ion batteries

10:50 to 11:10
Hyun-Kyung Kim (Department of Material Science and Engineering, Yonsei University, Seoul, Korea), Kwang-Bum Kim, Kwang Chul Roh

In situ Fabrication of Lithium Titanium Oxide by Microwave-assisted Alkalization for High-rate Lithium-Ion Batteries

11:10 to 11:30
Min-young Cho (Energy and Environmental Division, Korea Institute of Ceramic Engineering and Technology, Seoul, Korea) Kwang-Bum Kim, Sun-Min Park, Kwang Chul Roh

Size-selective Synthesis of Mesoporous $LiFePO_4$/C Microspheres based on Nucleation and Growth Rate Control of Primary Particles

11:30 to 11:50
Sergio Brutti (Department of Science, University of Basilicata, Potenza, Italy), Jessica Manzi, Francesco Vitucci, Francesco Trequattrini, Annalisa Paolone, Daniele Di Lecce, Stefania Panero

Self-discharge in $LiCoPO_4$ electrodes

FRIDAY AM

11:50 to 12:10
Maja Pivko (Laboratory for Materials Chemistry, National Institute of Chemistry, Ljubljana, Slovenia), Marjan Bele, Elena Tchernychova, Goran Drazic, Ivan Jerman, Vid Simon Selih, Milena Zorko, Miran Gaberscek, Robert Dominko

Post mortem analysis of $LiMnPO_4$ after several hundred cycles

12:10 to 12:30
Montserrat Galceran Mestres (Power Storage Batteries and Supercaps, CIC EnergiGUNE, Miñano, Spain), Montserrat Casas-Cabanas, Clare Grey, Jordi Cabana

Correlation between ion exchange route, microstructure and electrochemistry in $LiNi_{0.5}Mn_{0.5}O_2$

12:30 to 12:50
Daisuke Yonekura (Applied Chemistry, Tokyo University of Agriculture and Technology, Tokyo, Japan), Masanori Muramatsu, Naoki Ota, Morihiro Saito, Yuki Orikasa, Wako Naoi, Katsuhiko Naoi

Nanocrystalline Mn_3O_4/Nano-Carbon Composite Exhibiting Highly Reversible Conversion Capacity

12:50 to 13:10

Yuri Surace (Laboratory for Solid State Chemistry and Catalysis, EMPA - Swiss Federal Laboratories for Materials Science, Dübendorf, Switzerland), Mário Simões, James Eilertsen, Lassi Karvonen, Simone Pokrant, Anke Weidenkaff

Functionalization of size controlled $Ca_2MnO_{4-\delta}$ by calcium extraction: Activation for electrochemical lithium intercalation

Symposium 8: Modern Electroactive Polymeric, Organic, Inorganic and Nanocomposite Materials

Room 1a - Garden

Chaired by : Pawel J. Kulesza

09:50 to 10:10 Invited

Elena Madrid (Department of Chemistry, University of Bath, Bath, United Kingdom), Neil McKeown, Gary Attard, Frank Marken

Bistable Ionic Diodes Based on a Rigid Intrinsically Porous Polymer-Amine

10:10 to 10:30

Changhui Chen (Department of Chemistry, University of Warwick, Coventry, United Kingdom), Yangrae Kim, Stanley C.S. Lai

Nanoparticle-Substrate Interactions in the Electrochemical Detection of Nanoparticle Collisions

10:30 to 10:50

Jean-Claude Moutet (Department of Molecular Chemistry, Université Joseph Fourier, Grenoble, France), Alain Deronzier, Youssef Lattach, Tahya Bamine, Jérôme Fortage

H_2-Evolving Cathodes and Photocathodes Based on Functionalized Polymer-Mo Sulfide Nanocomposites

10:50 to 11:10

Joanna Conder (Department of General Energy Research (ENE), Paul Scherrer Institute, Villigen PSI, Switzerland), Sigita Urbonaite, Petr Novák, Lorenz Gubler

PP-based Ion-exchange Membrane for Li-S Batteries Prepared by Plasma Induced Graft Copolymerization

11:10 to 11:30

Luiz Henrique Dall'Antonia (Departamento de Quimica, Universidade Estadual de Londrina, Londrina, Brazil), Vanessa R. Liberatti, Adriana C. Lucilha, Renata Afonso, Elen R. Sartori

$Zn_{1-x}Co_xO$ Photoelectrodes obtained by Layer by Layer: Characterization and Photoelectroactivity

11:30 to 11:50

Jan Philipp Kollender (Institute for Chemical Technology of Inorganic Materials, Johannes Kepler University Linz, Linz, Austria), Jacek Gasiorowski, Andrei Ionut Mardare, Niyazi Serdar Sariciftci, Achim Walter Hassel

Localized screening of photovoltaic properties of organic semiconductors using scanning droplet cell microscopy

11:50 to 12:10

Daniela Plana (School of Chemistry, University of Bristol, Bristol, United Kingdom), Calder Manser, David J. Fermín

Photoinduced Multi-electron Transfer at Liquid/Liquid Interfaces Promoted by Semiconductor Nanostructures

12:10 to 12:30

Amy Tapley (Department of Chemistry, Western University, London, Canada), David Love, Zhifeng Ding

Novel Deposition Technique of $CuInS_2$ for use in Photovolatics

12:30 to 12:50
Xiaoyin Xiao (Department of Biosensors and Nanomaterials, Sandia National Labs, Albuquerque, USA), Art Fischer, Ping Lu, Daniel Koleske, Ganesh Subramania, George Wang

Precision Laser Assisted Photoelectrochemical Fabrication of III-V Semiconductor Quantum Structures

12:50 to 13:10
Agnieszka Wieckowska (Faculty of Chemistry, University of Warsaw, Warsaw, Poland)

Quantum-sized gold nanoparticles – Synthesis, properties and applications

Symposium 9: Corrosion, Passivity and Oxide Films

Room 1bc - Garden

Chaired by : Ricardo Nogueira and X. Ramón Nóvoa

09:50 to 10:30 Keynote
X. Ramón Nóvoa (Department of Chemical Engineering, ENCOMAT, Universidade de Vigo, Vigo, Spain), Alberte Reyes, Andrés Soage, Aránzazu Vázquez

Galvanic Effects by Temperature Gradient: The Case of Steel Rebars Embedded in Concrete

10:30 to 10:50 Invited
Benedetto Bozzini (Department of Innovation Engineering, University of Salento, Lecce, Italy)

Degradation of PEMFC and SOFC Components studied *in situ* by Synchrotron-based Soft X-ray Microspectroscopies

10:50 to 11:10
Shinji Fujimoto (Division of Materials and Manufacturing Science, Osaka University, Suita, Osaka, Japan)

Evaluation of Cathodic Reaction Rate on Passive Films on Stainless Steels by Transition of Corrosion Potential

11:10 to 11:30
Sara Chakri (Laboratoire Interfaces et Systèmes Electrochimiques, CNRS, Université Pierre et Marie Curie, Paris, France), Isabelle Frateur, Eliane Sutter, Bernard Tribollet, Vincent Vivier

Steady-state electrochemical behaviour of C15 steel reinforcement in various simulated concrete pore solutions

11:30 to 11:50
Eugenio Gianessi (Institut des Sciences Moleculaires, Université Bordeaux 1, Talence, France), Jerome Roche, Alexander Kuhn

Controlled bipolar corrosion for high precision milling of metallic microspheres

11:50 to 12:10
Benoît Gwinner (DEN/DANS/DPC/SCCME/LECNA, CEA, Gif-sur-Yvette, France), Elsa Tcharkhtchi, Vincent Vivier

Passivity and passivity breakdown of 304L stainless steel in hot and concentrated nitric acid

12:10 to 12:30
Enrico Verlato (Istituto per l'Energetica e le Interfasi, C.N.R.,Consiglio Nazionale delle Ricerche, Padova, Italy), Sandro Cattarin, Nicola Comisso, Luca Mattarozzi, Lourdes Vázquez-Gómez, Marco Musiani

EIS study of a galvanic exchange reaction used for the preparation of electrocatalysts

12:30 to 12:50
Hercilio G. de Melo (Department of Chemical Engineering, Universidade de São Paulo, Sao Paulo, Brazil), Camila Molena de Assis, Tiago Sawczen, Idalina Vieira Aoki, Vincent Vivier

Local Investigation of the Corrosion Process in Friction Stir Welded Aluminum Alloys

12:50 to 13:10

Sara Munktell (Department of Chemistry, Ångström, Uppsala University, Uppsala, Sweden), Mats Tydén, Jonas Högström, Leif Nyholm, Fredrik Björefors

Bipolar Electrochemistry for High-throughput Corrosion Screening

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Symposium 11: Electrochemical Technology: Crossroad for Energy and Environment

Room 3a - Garden

Chaired by : Simonetta Palmas and Manuel Andrés Rodrigo

09:50 to 10:30 Keynote

Karel Bouzek (Department of Inorganic Technology, Institute of Chemical Technology Prague, Prague, Czech Republic), Roman Kodým, Petr Pánek, Michal Nemecek

Novel Approach to Mathematical Modelling of the Complex Electrochemical Systems with Multiple Phase Interfaces

10:30 to 10:50 Invited

Michael Eikerling (Department of Chemistry, Simon Fraser University, Burnaby, Canada), Peter Berg, Pierre-Eric Alix Melchy, Motahareh Safiollah

Theory of Water Sorption and Swelling in Polymer Electrolyte Membranes

10:50 to 11:10 Invited

M.E. Henry Bergmann (Process and Electroengineering, Anhalt University, Köthen/Anhalt, Germany), José M. Bisang

Engineering studies on so-called inline electrolysis

11:10 to 11:30

Nina Simic (Process RD&I, AkzoNobel Pulp and Performance Chemicals, Bohus, Sweden), Anders Ekstrand, Jakub Jirkovsky, Petr Krtil, Elisabet Ahlberg

Hypochlorite oxidation on polycrystalline platinum electrodes - A DEMS approach

11:30 to 11:50 Invited

Simonetta Palmas (Dipartimento di Ingegneria Meccanica Chimica e dei Materiali, University, Cagliari, Italy), Annalisa Vacca, Michele Mascia, Pablo Ampudia

On the behavior of electrochemical capacitors based on nanostructured hybrid TiO_2 electrodes

11:50 to 12:10 Invited

Fabian Fischer (Institute of Life Technologies, University of Applied Sciences and Arts Western Switzerland, Sion, Switzerland), Marc Sugnaux, Manuel Happe, Géraldine Zufferey

Up-scale Phosphate Extraction from Sewage Sludge with a Microbial Fuel Cell

12:10 to 12:30

Scott Gorman (Faculty of Engineering and the Environment, University of Southampton, Southampton, United Kingdom), Richard Wills, Stephen Thompson, Stephen Price, Xiaohong Li, Frank Walsh, Derek Pletcher, Andrea Russell

Development of a Zinc-Air Flow Battery Operating with an Alkaline Electrolyte

12:30 to 12:50

Véronique Amstutz (Laboratory of Physical and Analytical Electrochemistry, Ecole Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland), Kathryn E. Toghill, Heron Vrubel, Joana Morgado, Pekka Peljo, Christos Comninellis, Hubert Girault

Adaptation of a redox flow battery to generate hydrogen from surplus renewable energy: Principle and pilot project

12:50 to 13:10

Maria Valnice Boldrin Zanoni (Department of Analytical Chemistry, UNESP, Araraquara, Brazil)

Application of TiO_2/WO_3 bicomponent photoanode under visible light on dye degradation and hydrogen generation

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Symposium 13: Synergizing Theory and Experiment in Electrochemistry: State-of-the Art-Developments

Room 5 - Garden

Chaired by : Juan M. Feliu and Dane Morgan

09:50 to 10:30 Keynote Invited

Marian Chatenet (LEPMI, UMR5279 CNRS/Grenoble-INP/UdS/UJF, Grenoble-INP, Saint Martin d'Hères, France), Pierre-Yves Olu, Antoine Bonnefont, Elena Savinova

Towards a borohydride oxidation reaction mechanism on Pt and Au surface – An experimental and modelling study

10:30 to 10:50

Antoine Bonnefont (Institut de Chimie, Université de Strasbourg, Strasbourg, France), Alfonso Crespo, Sébastien Bozdech, Rolf Schuster, Katharina Krischer, Elena Savinova

Oscillatory behaviour of globally coupled microelectrodes during a bistable reaction

10:50 to 11:10

Ludwig Kibler (Institut für Elektrochemie, Universität Ulm, Ulm, Germany), Mohammad Al-Shakran, Johannes Hermann, Heiko Müller, Martin Metzler, Timo Jacob

Elementary Reaction Steps in Electrocatalysis on Au(111)

11:10 to 11:30

Annick Hubin (Department of Electrochemical and Surface Engineering, Vrije Universiteit Brussel, Brussels, Belgium), Lucia Fernandez Macia, Manuela Petrova, Tom Breugelmans

Odd Random Phase Electrochemical Impedance Spectroscopy (ORP-EIS) as a tool to investigate the time evolution of charge transfer reactions due to film formation at the electrochemical interface

11:30 to 12:10 Keynote

Dane Morgan (Department of Materials Science and Engineering, University of Wisconsin, Madison, USA), Yueh-Lin Lee, Milind Gadre, Tam Mayeshiba, Anh Ngo, Yang Shao-Horn, Stuart Adler

Molecular Understanding of Solid Oxide Fuel Cell Catalysts

12:10 to 12:30

Marta Figueiredo (Department of Chemistry, Aalto University, Helsinki, Finland), Tuomas Vainikka, Tanja Kallio, Lasse Murtomäki

Oxygen reduction reaction in [BMP][Tf_2N] ionic liquid: A mechanistic study

12:30 to 12:50

Kenta Motobayashi (Catalysis Research Center, Hokkaido University, Sapporo, Japan), Kazuya Minami, Naoya Nishi, Tetsuo Sakka, Masatoshi Osawa

Potential-dependent Structure of Ionic Liquid/Electrode Interfaces: Effect of Additives studied by Surface-Enhanced Infrared Spectroscopy

12:50 to 13:10

Juan M. Feliu (Institute of Electrochemistry, University of Alicante, Alicante, Spain), Paula Sebastian, Nuria Garcia-Araez, Victor Climent

Determination of the potential of maximum entropy at Pt(111) in alkaline solutions

Poster presentations program

Symposium 1: Dynamic Ion Sensing: from ITIES to ISEs

Chemical sensors

S01-001

Junho Jang (Department of Chemistry, Yonsei University, Seoul, Korea)

Tris(2,2'-bipyridyl)ruthenium(II) Eletrogenerated Chemiluminescence Sensor Based on Graphene-Titania-Nafion Composite Films

S01-002

Dong-Hwan Kim *(*Department of Chemistry, Yonsei University, Seoul, Korea), Ji Yeon Kim

Electrochemical Determination of Bisphenol A at Graphene Titania-Nafion Composite Modified Electrode

S01-003

Yukihiro Shintani (School of Science and Engineering, Waseda University, Tokyo, Japan)

Characterization of Termination-controlled Boron-doped Polycrystalline Diamond Electrolyte-solution-gate Field-effect Transistor pH Sensor

S01-004

Anastasiya Stashkova (Chemistry Faculty, Saint Petersburg State University, Saint Petersburg, Russia), Maria Peshkova, Konstantin Mikhelson

Electrochemical Approach for Accessing Single Ion Activities with Ionophore-based Bulk Optodes

Electroanalytical data analysis

S01-005

Toshiyuki Osakai (Department of Chemistry, Graduate School of Science, Kobe University, Kobe, Japan), Wataru Murakami, Kazuo Eda, Masahiro Yamamoto

A Non-Bornian Theory of the Gibbs Energy of Ion Hydration

S01-006

Eduardo Sardinha (Electrochemistry and Nanoestrutured Materials Laboratory, Universidade Federal do ABC, Santo André, Brazil), Ailton Araújo, Hugo Suffredini

Antioxidant Potentials of Vitamins Determined by an Interfacial Electrochemical Technique

Electroanalytical methodology

S01-007

Henrik Jensen (Department of Pharmacy, University of Copenhagen, Copenhagen, Denmark), Nickolaj Petersen, Andrea Nadal, Steen Hansen, Stig Pedersen-Bjergaard

Rapid Electrochemically Mediated Extraction of Drug Compounds and Their Metabolites

S01-008

Alexander Kuhn (ENSCBP, University of Bordeaux, Pessac, France), Chularat Wattanakit, Yémima Bon Saint Côme, Veronique Lapeyre, Philippe A. Bopp, Mathias Heim, Sudarat Yadnum, Somkiat Nokbin, Chompunuch Warakulwit, Jumras Limtrakul

Enantioselective Recognition by Ion Partitioning at Chiral Imprinted Mesoporous Metal Surfaces

S01-009

Rejane Silva (CCNH, Universidade Federal do ABC, Santo André, Brazil), Marlon Maynart, Hugo Suffredini

Oil /Water Interface Electrochemistry for the Partition Coefficient of Ferrocene Calculation

Environmental electroanalysis

S01-010

Bastien Néel (Department of Analytical and Inorganic Chemistry, UNIGE, Genève-4, Switzerland)

Towards a reliable potentiometric detection of nutrients in sea water

Ion transfer voltammetry

S01-011

Wojciech Adamiak (Department of Electrode Processes, Institute of Physical Chemistry, Polish Academy of Sciences, Warsaw, Poland), Justyna Jedraszko, Wojciech Nogala, Hubert Girault, Marcin Opallo

Formation of Hydrogen Peroxide at a Non-polarized Liquid Interface

S01-012

Seung Hee Baek (Department of Chemistry, Kyungpook National University, Daegu, Korea), Farhana Sharmin Diba, Hye Jin Lee

Simultaneous Detection of Ca^{2+} and Na^{+} ions Utilizing Assisted Ion Transfer Processes in Conjunction with a Single Microhole Interface between Water and Organic Polymer Composites

S01-013

Teruo Hinoue (Department of Chemistry, Shinshu University, Matsumoto, Japan), Riho Watanabe

Determination of the Standard Entropy Changes of Ion Transfer for 1-Alkylpyridinium Ions by Thermal Modulation Voltammetry with Laser Heating at a Water/1,2-Dichloroethane Interface

S01-014

Justyna Jedraszko (Department of Electrode Processes, Institute of Physical Chemistry, Polish Academy of Sciences, Warsaw, Poland), Olga Krysiak, Wojciech Adamiak, Wojciech Nogala, Hubert Girault, Marcin Opallo

Electrocatalytic Generation of H_2O_2 at Liquid|Liquid Interface with Carbon Paste Electrode

S01-015

Martin Jönsson-Niedziolka (Department of Electrode Processes, Institute of Physical Chemistry, Polish Academy of Sciences, Warsaw, Poland), Dawid Kaluza, Marcin Opallo, Wojciech Adamiak

Studies of Ion Transfer Thermodynamics and Kinetics in Microfluidic Systems

S01-016

Hye Rim Kim (Chemistry, Kyungpook National University, Daegu, Korea), Woo Sik Hwang, Hye Jin Lee

Voltammetric Characterization of Anti-cancer Drug Molecules Using a Single Microhole-liquid/gel Interface for Sensing Applications

S01-017

Eduardo Laborda (Department of Physical Chemistry, University of Murcia, Murcia, Spain), Angela Molina

Simple Theoretical Approach to Ion Transfer Proceses at Asymmetric Nanoscopic Liquid|Liquid Interfaces

S01-018

Hirohisa Nagatani (Faculty of Chemistry, Kanazawa University, Kanazawa, Japan), Sho Yamamoto, Kotaro Morita, Hisanori Imura

Spectroelectrochemical Characterization of Ionic Dyes at Liquid|Liquid Interfaces by Polarization-Modulation Total Internal Reflection Fluorescence Spectroscopy

S01-019

Lukasz Poltorak (Department of Physical Chemistry and Microbiology, Univérsite de Lorraine, Nancy, France), Karima Morakchi, Grégoire Herzog, Alain Walcarius

Electrochemical Characterization of Micro-interfaces Modified with Mesoporous Silica

S01-020

Hiroki Sakae (Division of Material Sciences, Kanazawa University, Kanazawa, Japan), Hirohisa Nagatani, Kotaro Morita, Hisanori Imura

Ion Transfer and Adsorption Behavior of Organic Ions Associated with PAMAM Dendrimers at Liquid|Liquid Interfaces

S01-021

Zdenek Samec (Department of Biomimetic Electrochemistry, J. Heyrovský Institute of Physical Chemistry of ASCR, v.v.i., Prague, Czech Republic), Antonín Trojánek, Mareèek Vladimír

Specific Aspects of Electrochemical Measurements at Liquid-Liquid Interfaces Using a Four-electrode Cell

S01-022

Akihiro Uehara (Division of Nuclear Engineering Science, Research Reactor Institute, Kyoto University, Asashironishi, Kumatori, Osaka, Japan), Samuel Booth, Sin Yuen Chang, Sven Schroeder, J. Fred Mosselmans, Robert Dryfe

Electrochemical insight into the Brust-Schiffrin synthesis of Au nanoparticles

Ion-selective electrodes

S01-023

Kim Granholm (Laboratory of Analytical Chemistry, Åbo Akademi University, Turku, Finland), Zekra Mousavi, Tomasz Sokalski, Andrzej Lewenstam

A Composite Solid-state Reference Electrode

S01-024

Zdenka Jarolímová (Department of Inorganic and Analytical Chemistry, University of Geneva, Geneva, Switzerland), Gaston Crespo, Eric Bakker

All Solid State Membrane Electrodes Based on Ferrocene Functionalized PVC

S01-025

Takashi Kakiuchi (Department of Chemistry of Functional Molecules, Konan University, Kobe, Japan), Ryoga Nakamura, Yuta Otsuka, Ryo Hashimoto, Ryo Murakami, Masahiro Yamamoto

Activity of hydrogen ion in sulfuric acid solutions measured potentiometrically with ionic liquid salt bridge

S01-026

Antonio Moya (Física, Universidad de Jaén, Jaén, Spain)

Network Simulation of the Electrochemical Impedance of Ion-selective Electrodes

S01-027

Maria Peshkova (Department of Physical Chemistry, Saint Petersburg State University, Saint Petersburg, Russia), Konstantin Mikhelson

Taking Advantage of Current Polarization at Phase Boundary between Aqueous Solution and Solvent Polymeric Membrane of Ion-Selective Electrode

S01-028

Anca-Iulia Stoica (Department of Bioelectrochemistry, Centre of Electrochemical Surface Technology, Wiener Neustadt, Austria), Christina Bliem, Christoph Kleber, Clara Vinas, Francesc Teixidor

Development of Selective Membrane Sensors for Bioactive Nitrogen Containing Analytes Determination

S01-029

Ulriika Vanamo (Process Chemistry Centre, Laboratory of Analytical Chemistry, Abo Akademi University, Turku, Finland)

Adjusting the Standard Potential (E°) of Ion-selective Electrodes (ISE) by Controlling the Redox State of Conducting Polymer (CP) Solid Contact

Symposium 2: Scanning Electrochemical Microscopy: Reading, Writing, Monitoring of Functional Interfaces

Array techniques in electrochemistry

s02-001

Laurent Thouin (Department of Chemistry, UMR CNRS 8640, Ecole Normale Supérieure, Paris, France), Cécile Pebay, Catherine Sella, Christian Amatore

Investigation of Mass Transport at Infinite Regular Arrays of Microband Electrodes: Theory and Experiments

s02-002

Yudai Yamamoto (Graduate School of Chemical Sciences and Engineering, Hokkaido University, Sapporo, Japan), Koji Fushimi, Takayuki Nakanishi, Yasuchika Hasegawa, Mikiko Saito, Takayuki Homma

Redox Reaction Current on Multi-microdisc Electrode

Combinatorial electrochemistry

s02-003

Xinsheng Zhang (Department of Chemical Engineering, East China University of Science and Technology, Shanghai, China), Huicheng Li, Allen Bard

Enhanced Photoelectrochemical Performance of Hematite by Doping with Tantalum

Electrochemical process engineering and technology (d5)

s02-004

Dongping Zhan (Department of Chemistry, Xiamen University, Xiamen, China)

Constructing and Studying Solid-Solid Interface by Scanning Electrochemical Microscopy (SECM)

Electrochemical read-write systems

s02-005

Jean-Marc Noel (Laboratoire ITODYS, Université Paris Diderot, Paris, France), Catherine Combellas, Frédéric Kanoufi, Jerome Bibette, Nicolas Bremond, Philippe Poulin, Leopold Mottet

Localized electrochemistry for the caracterisation of soft conductive hydrogel beads

s02-006

David Perry (Department of Chemistry, University of Warwick, Coventry, United Kingdom), Kim McKelvey, Joshua Byers, Patrick Unwin

Nanoscale Bias Modulated Scanning Ion Conductance Microscopy

Electrochemical scanning probe techniques patterning with electrochemistry

s02-007

José Garcia-Anton (Department of Ingeniería Química y Nuclear, Universidad Politecnica de Valencia, Valencia, Spain), Ramon Manuel Fernandez-Domene, Rita Sánchez-Tovar

Application of Scanning Electrochemical Microscopy to evaluate pitting corrosion on AISI 304 in LiBr solutions

s02-008

Sebastien Lhenry (Institut des Sciences Chimiques de Rennes, Université de Rennes 1, Rennes, France), Yann R. Leroux, Christophe Orain, Francoise Conan, Nathalie Cosquer, Nicolas Le Poul, Olivia Rainaud, Yves Le Mest, Philippe Hapiot

Locally self-induced “electro-click” onto self-assembled monolayer: Evidence for surface self-catalysis propagation

s02-009

Dmitry Momotenko (Department of Chemistry, University of Warwick, Coventry, United Kingdom), Kim McKelvey, David Perry, Sophie Kinnear, Patrick Unwin

High Speed Functional Electrochemical Imaging with Nanoscale Resolution

s02-010

Mike O'Connell (Materials Division, National Physical Laboratory (UK), Teddington, United Kingdom), Joshua Lewis, Andy Wain

Advances in Combined High-Resolution Electrochemical and Topographical Imaging Techniques

s02-011

Jan Pawlowski (Faculty of Chemistry, Biological and Chemical Research Center, University of Warsaw, Warsaw, Poland), Slawomir Sek

Sphingomyelin-cholesterol interactions studied by EC-STM

s02-012

Evangelina Pensa (Nanoscale Science, Max Planck Institute for Solid State Research, Stuttgart, Germany)

Comparison of order structure and electrocatalytic properties of 2D arrays of phthalocyanines prepared by solid-liquid vs solid-gas phase

s02-013

Camille Perréard (UTCBS, Chimie ParisTech, Paris, France), Yoann Ladner, Sophie Griveau, Cyrine Slim, Fanny d'Orlyé, Anne Varenne, Frédéric Kanoufi, Fethi Bedioui

Functionalization of microfluidic plastic materials by SECM

s02-014

Nicolas Plumeré (Center for Electrochemical Sciences, Ruhr University Bochum, Bochum, Germany), Jan Clausmeyer, Wolfgang Schuhmann

Scanning Droplet Cell for Chemoselective Patterning via Local Electroactivation

Fundamentals of bioelectrochemical systems

s02-015

Sabine Kuss (Department of Chemistry, McGill University, Montreal, Canada), Christian Kuss, Dao Trinh, Steen Brian Schougaard, Janine Mauzeroll

Forced convection effect and kinetic studies during scanning electrochemical microscopy imaging of living cells

s02-016

Fei Li (Department of Chemistry, School of Sciences, Xi'an Jiaotong University, Xi'an, China)

Applications of Scanning Electrochemical Microscopy in Characterization of Functional Hydrogel Materials

s02-017

Tzu-En Lin (Institute of Chemical Sciences and Engineering, EPFL, Lausanne, Switzerland)

Scanning Electrochemical Microscopy Detection of Adsorbed Catalytically Active Enzymes on PVDF Membranes

s02-018

Alice Solda (Department of Chemistry, University of Bologna, Bologna, Italy), Stefania Rapino

Electrochemical Imaging of Single Cell Warburg Effect

Living systems

s02-019

Alexandra Bondarenko (Laboratory of Physical and Analytical Electrochemistry, Ecole Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland), Horst Pick, Tzu-En Lin, Andreas Lesch, Fernando Cortes Salazar, Gunther Wittstock, Horst Vogel, Hubert Girault

Contact Mode SECM Imaging of Living Cells: An Ultra-soft Story

s02-020

Yasufumi Takahashi (WPI-AIMR, Tohoku, Sendai, Japan), Hitoshi Shiku, Patrick Unwin, Yuri Korchev, Tomokazu Matsue

Development of High Resolution Scanning Electrochemical Microscopy for Nanoscale Topographical and Electrochemical Imaging of Living Cells

Non-invasive monitoring systems

s02-021

Marcin Opallo (Department of Electrode Processes, Institute of Physical Chemistry PAS, Warszawa, Poland), Justyna Jedraszko, Wojciech Nogala, Wojciech Adamiak, Hubert Girault

SECM studies of hydrogen peroxide generation and hydrogen evolution at liquid|liquid interface

Symposium 3: Bioelectrochemistry: From Fundamentals to Health Monitoring and Energy Conversion

Bioelectrocatalysis and photobioelectrochemistry

s03-001

Marine Cadet (Department of Biofuel Cells and Biosensors, Centre de Recherche Paul Pascal, Pessac, France), Xavier Brilland, Sébastien Gounel, Frédéric Louerat, Nicolas Mano

Utilization of a new efficient bilirubin oxidase from Magnaporthe oryzae for improved biocathodes

s03-002

Michael Füeg (Department of Chemistry and Biochemistry, University of Bern, Bern, Switzerland), Akiyoshi Kuzume, Ulmas Zhumaev, Jian-Feng Li, Yongchun Fu, Abraham Esteve-Nuñez, Thomas Wandlowski

Interfacial Electron Transfer from *G. Sulfurreducens* to a Gold Electrode via Self-assembled Monolayers

s03-003

Kumi Y. Inoue (Graduate School of Environmental Studies, Tohoku University, Sendai, Japan), Masahki Matsudaira, Kosuke Ino, Masanori Nakano, Kosuke Takara, Atsushi Suda, Ryota Kunikata, Shinya Yoshida, Takeshi Hayasaka, Yoshiyuki Kikuchi, Xijiang Chang, Tomohiro Kubota, Hitoshi Shiku, Shuji Tanaka, Seiji Samukawa, Tomokazu Matsue

Improvement of LSI-based amperometric sensor array for wide application of bioimaging and biosensing

s03-004

Nur Syakimah Ismail (Department of Applied Physics, Graduate School of Engineering, Osaka University, Suita, Japan), Hoa Quynh Le, Eiichi Tamiya

Electrochemiluminescence of Luminol on Gold Nanoparticle-Graphene-Oxide Nanoribbons Hybrid

s03-005

Marcos Pita (Biocatalysis, Institute of Catalysis, CSIC, Madrid, Spain), Diana M. Mate, David Gonzalez-Perez, Sergey Shleev, Victor M. Fernandez, Miguel Alcalde, Antonio L. De Lacey

Bioelectrochemical Oxidation of Water

Bioenergy conversion

s03-006

Mathieu Etienne (LCPME, CNRS, Villers-lès-Nancy, France), Stéphane Pinck, Wissam Ghach, Frédéric Jorand

'Artificial' Biofilms Applicable in Bioelectrochemical Systems

s03-007

Manuel Gacitua (Department of Engineering and Science, Universidad Adolfo Ibáñez, Santiago, Chile), Federico Aulenta, Bernardo Gonzalez, Mauro Majone

Improvement of a Microbial Bio-cathode through Electrode Material Selection

s03-008

Berenice López-González (División de Investigación y Posgrado, Facultad de Química, Universidad Autónoma de Querétaro, Querétaro, Mexico), Coral Cruz-Madrid, Francisco Cuevas-Muñiz, Ainhoa Arana-Cuenca, Luis Gerardo Arriaga, Janet Ledesma-García

Low cost crude extract laccase / alginate film as a cathode in a hybrid microfluidic fuel cell

Biomedical applications

s03-009

Byoung-Yong Chang (Chemistry, Pukyong National University, Busan, Korea), Habeen Park

Smartphone-based Colorimetry for Paper-based Sensor

s03-010

Fernando Cortes Salazar (Department of Chemistry, Ecole Polytechnique Federale de Lausanne, Lausanne, Switzerland), Andreas Lesch, Alexandra Bondarenko, Véronique Amstutz, Michel Prudent, Julien Delobel, Philippe Tacchini, Hubert Girault

Inkjet Printing of Carbon Nanotubes Electrodes for Environmental and Blood Bags Monitoring

s03-011

Shengyuan Deng (School of Environmental and Biological Engineering, Nanjing University of Science and Technology, Nanjing, China), Ying Wan, Yan Su

Label-free Biomimetic Electrocatalysis-induced Precipitation for Ultrasensitive Bioanalysis

s03-012

Victor Diculescu (Departamento de Química, Universidade de Coimbra, Coimbra, Portugal), Teodor Enache, Oana Popa

Electrochemical Characterisation of ABL1 Tyrosine-Kinase Activity, Inhibition and Interaction with Anticancer Drugs

s03-013

Marilia Goulart (Instituto de Química e Biotecnologia, Universidade Federal de Alagoas, Maceió, Brazil), Yen de Paiva, Fabricia Ferreira, Lourenço de Santana, Silvio Cunha

Redox activation, oxygen reactivity and supramolecular interactions of cytotoxic 1-azaanthracene-2,9,10-triones

s03-014

Sabine Kuss (Department of Chemistry, McGill University, Montreal, Canada), Janine Mauzeroll

Electrochemical response of single human cancer cells to green tea catechins investigated by scanning electrochemical microscopy

s03-015

Lingsong Lu (Central Laboratory, Hangzhou First People's Hospital, Hangzhou, China), Jianhang Leng, Zhong Lu

Electrochemical Aptamer Immunosensor for Screening and Prognostic Prediction of Ovarian Cancer

s03-016

Dorota Matyszewska (Faculty of Chemistry, University of Warsaw, Warsaw, Poland), Jan Biernat, Renata Bilewicz

Comparison of Different Types of Carbon Nanotubes Used as Drug Carriers and Their Interactions with Model Biological Membranes

s03-017

Modupe Ogunlesi (Department of Chemistry, University of Lagos, Lagos, Nigeria), Wesley Okiei, Omolara Akerele, Sulaiman Akanmu

Phenotyping of Various Human Haemoglobins by Cyclic Voltammetry Using Carbon Nanotubes and Polyaniline – Modified Electrodes Doped with Hydrochloric Acid and Sulphuric Acid.

s03-018

Jan Pawlowski (Faculty of Chemistry, Biological and Chemical Research Center, University of Warsaw, Warsaw, Poland), Slawomir Sek

AFM studies of cholesterol-dependent lysenin activity

s03-019

Mehdi Ravandeh (Department of Chemistry, Masaryk University, Brno, Czech Republic), Libuse Trnkova, Libor Gurecky

Electrochemical Oxidation Behavior of Guanosine and Guanosine-5´-Monophosphate at a Pencil Graphite Electrode

s03-020

Olga Swiech (Faculty of Chemistry, University of Warsaw, Warszawa, Poland), Paula Dutkiewicz, Kamila Zelechowska, Kazimierz Chmurski, Marcin Kruszewski, Renata Bilewicz

Application of New Derivatives of Cyclodextrin in pH-Sensitive, Multifunctional Drug

s03-021

Alexander Weremfo (School of Chemistry, University of New South Wales, Sydney, Australia), Paul Carter, Brynn Hibbert, Chuan Zhao

Electrochemically Roughened Platinum Microelectrode for Neural Stimulation

s03-022

Yuki Yoshimura (Graduate School of Material Science, University of Hyogo, Ako, Japan), Masahiro Tomita, Fumio Mizutani, Tomoyuki Yasukawa

Rapid fabrication of pairs of different types of cells on a microwell array based on dielectrophoresis

s03-023

Sepideh Yousefi (Department of Pharmaceutics, Shahid Beheshti University of Medical Sciences, Tehran, Iran), Mehdi Esfandyari-Manesh, Rasoul Dinarvand, Saeed Shahrokhian, Fatemeh Ghorbani-Bidkorbeh

Novel Biodegradable Nano-molecular Imprinted Electrochemical Sensor of Methotrexate

s03-024

Martina Zatloukalova (Department of Medical Chemistry and Biochemistry, Palacky University, Olomouc, Czech Republic)

Electrochemical Behavior of Flavonolignan Dimers and Hybrid Molecules

Biosensors

s03-025

Roberta Bianchi (Department of Centro de Ciencias Naturais e Humanas, Universidade Federal do ABC (UFABC), Santo André, Brazil), Emerson Silva, Luiz Henrique Dall'Antonia, Fabio Ferreira, Wendel Alves

A Rationally Designed Device for Ammonia and Urea Oxidation Based On Gold Electrodes Modified with L-Diphenylalanine Microstructures

s03-026

Soledad Bollo (Department of Pharmaceutical Chemistry, University of Chile, Santiago, Chile), Daniela Báez

Comparative study on electrochemical DNA biosensor of carbon related nanomaterials

s03-027

Daniela Báez (Pharmacological and Toxicological Department, University of Chile, Santiago, Chile), Soledad Bollo, Claudia Yañez, José Marco, Helena Pardo, Ignacio Laborda

Electrochemical ss-DNA biosensor based on graphene related materials

s03-028

Wioletta Chmielowiec (Faculty of Chemistry, University of Warsaw, Warsaw, Poland), Ewelina Zabost, Zbigniew Stojek

Micro- and regular electrodes modified with compositesconsisting of poly(N-isopropylamide), DNA and Au NPs

s03-029

Adriana Correia (Department of Analytical Chemistry and Physical Chemistry, Federal University of Ceara, Fortaleza, Brazil), Francisco Ribeiro, Helena Becker

Biosensor Based on Laccase and Multi-walled Carbon Nanotubes for Endosulfan Pesticide Quantification

s03-030

Cecilia Cristea (Department of Analytical Chemistry, Iuliu Hatieganu University of Medicine and Pharmacy, Cluj-Napoca, Romania)

Nanostructured Polymeric Platforms for Biosensors Development

s03-031

Anca Florea (Institute of Analytical Sciences, University of Lyon, Lyon, France), Cecilia Cristea, Robert Sandulescu, Francis Vocanson, Nicole Jaffrezic-Renault

Gemcitabine Detection by Molecular Imprinting Sensor Based on Electropolymerization of Microporous-Metal-Organic Framework

s03-032

Hedayatollah Ghourchian (Department of Biophysics, University of Tehran, Tehran, Iran), Seyed Mehdi Boutorabi

Nano-particle Based Electrochemical Immunosensor for Detection of Hepatitis B Surface Antigen

s03-033

Andrew Gross (Department of Chemistry, University of Bath, Bath, United Kingdom), Sara Dale, Frank Marken

Electrochemical redox cycling in small gaps for detection of biomarkers with high selectivity against background interferents

s03-034

Ludek Havran (Biophysical Chemistry and Molecular Oncology, Institute of Biophysics, ASCR, v.v.i., Brno, Czech Republic), Jana Balintová, Medard Plucnara, Pavlína Vidláková, Radek Pohl, Miroslav Fojta, Michal Hocek

Using of Benzofurazane and Nitrophenyl Redox Labels for Ratiometric Electrochemical Analysis of DNA Nucleotide Sequences

s03-035

Teodora Ignat (Department of Analytical Chemistry, Slovak University of Technology in Bratislava, Bratislava, Slovakia), Viktor Gajdos, Lenka Hlavata, Jan Labuda

A sensitive nanostructured biosensor based on gold nanoparticles for investigating DNA damage

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Jesus Iniesta (Physical Chemistry and Inst. of Electrochemistry, Alicante University, Alicante, Spain), Naiara Hernandez, Leticia García-Cruz, Craig E. Banks, Vicente Montiel

New approaches for the stability and long term storage of a lactate electrochemical biosensor for sensing in cell culture media

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Xiaoyong Jin (School of Chemistry and Chemical Engineering, Ningxia University, Yinchuan, China), Gang Ni, Xuming Zhang, Ran Yu, Huiqin Yao

A Novel DNA Detection Method with Bio-barcodes Amplification Technique

s03-038

Christos Kokkinos (Department of Chemistry, University of Ioannina, Ioannina, Greece), Mamas Prodromidis, Anastasios Economou, Panagiota Petrou, Sotirios Kakabakos

Microfabricated Tin-film Sensors for Detection of DNA Employing Quantum Dots Labels

s03-039

Christos Kokkinos (Department of Chemistry, University of Ioannina, Ioannina, Greece)

Screen-printed sensor modified with bismuth citrate for the quantification of C-reactive protein using quantum dot labels

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Elzbieta Kurowska (Faculty of Chemistry, Jagiellonian University in Krakow, Kraków, Poland), Karolina Gawlak, Grzegorz D. Sulka, Marian Jaskula

Nanoporous Silver Thin Films as Electrochemical Sensors to Detection and Determination H_2O_2

s03-041

Katarzyna Kurzatkowska (Department of Biosensors, Institute of Animal Reproduction and Food Research of PAS, Olsztyn, Poland), Agata Jargilo, Monika Puchalska, Liliya Zhukova, Aleksandra Wysluch-Cieszyñska, Wim Dehaen, Hanna Radecka, Jerzy Radecki

Oriented immobilization of His-tagged VC1 domain of Receptor for Advanced Glycation End Products on the dipyrromethene–Cu(II) monolayer – the base of biosensor for determination of S100B protein

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Jan Labuda (Department of Analytical Chemistry, Slovak University of Technology in Bratislava, Bratislava, Slovakia), Lenka Hlavata, Viktor Gajdos, Teodora Ignat, Vlastimil Vyskocil, Rene Kizek

An evaluation of effects of metallic nanomaterials and quantum dots on damage to DNA by using DNA based electrochemical biosensor

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Genxi Li (Department of Biochemistry, Nanjing University, Nanjing, China)

Electrochemical Analysis of Tumor Marker Proteins and Cancer Cells

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Yan Li (Department of Physics and Astronomy, KU Leuven, University of Leuven, Heverlee, Belgium), Willem Van Roy, Philippe Vereecken, Liesbet Lagae

Modelling of Convective Redox Cycling Enhanced ELISA Amperometric Biosensing within a Microfluidic Channel

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Fred Lisdat (Biosystems Technology, Technical University of Applied Sciences Wildau, Wildau, Germany)

“Smart” Polymer Interfaces on Gold Surface – Investigation of the Potential Electrochemical Biosensing Applications

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Xiaoqi Ni (Department of Chemistry, University of Rostock, Rostock, Germany)

Electrochemical Detection of DNA Hybridization using Osmium Tetroxide-labelled Reporter Strands

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Yoshinobu Oshikiri (Department of Architectural Environmental Engineering, Yamagata College of Industry & Technology, Yamagata, Japan), Ayumi Koyama

Fabrication of a Mite Allergen (Der f2) Sensor Based on Gold/Platinum Alloy Co-deposited on a Platinum Electrode

s03-048

Pragya Agar Palod (Department of Electrical Engineering, Indian Institute of Technology Indore, Indore, India), Vipul Singh

Development of High Sensitivity Biosensor: Enhancement of Surface-to-Volume Ratio By Controlling Electrosynthesis Parameters

s03-049

Liza Rassaei (TNW, TU Delft, Delft, Netherlands), Serge Lemay

Bioelectrochemical Detection in Nanofluidic Devices

s03-050

Simone Rizzardini (Dip. di Ingegneria Meccanica, Chimica e dei Materiali, Università degli Studi di Cagliari, Cagliari, Italy), Annalisa Vacca, Michele Mascia, Stefano Lai, Daliborka Jambrec, Wolfgang Schuhmann

Electrochemical Characterization of Oligonucleotides with Different Length Grafted on Gold Electrodes

s03-051

Anna Sloniewska (Department of Chemistry, University of Warsaw, Warsaw, Poland), Barbara Palys

Amperometric Enzyme Biosensor Based on Polyaniline Structures

s03-052

Jan Spacek (Department of Biophysical Chemistry and Molecular Oncology, Institute of Biophysics, Academy of Sciences of the Czech R, Brno, Czech Republic)

Controlled length homopolymer tailing with electrochemically labeled nucleotides

s03-053

Charlotte Steinbach (Department of Analytical and Bioanalytical Chemistry, Albert-Einstein-Allee 11, Ulm, Germany), Sascha Pöller, Corina Andronescu, Wolfgang Schuhmann, Christine Kranz

Poly(benzoxazine) as Immobilization Matrix for ATP-Microbiosensors

s03-054

Kai Stieger (Department of Biosystems Technology, Technical University of Applied Sciences Wildau, Wildau, Germany), Marc Riedel, Fred Lisdat

An impedimetric DNA sensor-effects of target length and recognition sequence position

s03-055

Wenzhi Tang (College of Biosystems Engineering and Food Science, Zhejiang University, Hangzhou, China)

Real-time monitoring of thiocholine generated by acetylcholinesterase and its application in pesticide detection

s03-056

Drochss Valencia (Departamento de Química Fundamental, Instituto de Química, Universidade de São Paulo, São Paulo, Brazil), L. Dantas, A. Lara, J. García, Z Rivera, J. Rosas, M. Bertotti

Fabrication of a sensor based on dispersion of a peptide derived of HPV L1 protein supported on gold electrodes with Nafion/DMF

s03-057

Laura Valero (Department of Electrochemestry and Intelligence Materials, Universidad Politécnica de Cartagena, Cartagena, Spain), Toribio Fernández Otero, Jose G. Martínez

Can human proprioception be described by electrochemical equations?. Proprioceptive artificial muscles.

s03-058

Pavlína Vidláková (Department of Biophysical Chemistry and Molecular Oncology, IBP AS CR v. v. i. Kralovopolska 135, Brno, Czech Republic), Jana Balintová, Ludek Havran, Michal Hocek, Miroslav Fojta

Electrochemical DNA labeling with using incorporation of modified nucleotides at the electrode surface

s03-059

Meng-Jiy Wang (Department of Chemical Engineering, National Taiwan University of Science and Technology, Taipei, Taiwan)

Application of Cuprous Oxide Containing Nanoparticles for Preparing Non-enzymatic Biosensors

s03-060

Shih-Han Wang (Department of Chemical Engineering, I-Shou University, Kaohsiung City, Taiwan), Yi-Cheng Shih, Liren Tsai, Ming-Der Ger

Ir/reduced graphene oxide nanocomposite for femto-molar level NADH sensing

s03-061

Ching-Chou Wu (Department of Bio-industrial Mechatronics Engineering, National Chung Hsing University, Taichung, Taiwan), Wen-Ching Huang

An Ultrasensitive Label-free Electrochemical Impedimetric DNA Biosensing Chip Integrated with A DC-biased AC Electroosmotic Vortex

s03-062

Shofarul Wustoni (Graduate School of Advanced Science and Engineering, Waseda University, Tokyo, Japan), Sho Hideshima, Shigeki Kuroiwa, Takuya Nakanishi, Masahiro Hashimoto, Yasuro Mori, Tetsuya Osaka

Effect of Metal Ion Addition on the Sensitivity of Prion Detection Using Field Effect Transistor Biosensor

s03-063

Huiying Xu (Department of Chemistry, Fudan University, Shanghai, China), Jingjing Xiao, Jilie Kong, Sophie Griveau, Fethi Bedioui

Cobalt Phthalocyanine/Nitrogen-doped Graphene Nanocomposite for Electroanalysis of Thiols

s03-064

Huiqin Yao (Department of Chemistry, Ningxia Medical, Yinchuan, China), Keren Shi, Xiaoyong Jin, Juqin Cao, Juan Peng, Hongyun Liu

Multi-switchable Biosensors Based on Binary Assembly of Weak Polyelectrolyte Multilayers and Hydrogel Films

s03-065

Tomoyuki Yasukawa (Graduate School of Material Science, University of Hyogo, Ako, Japan), Yuya Kiba, Yukako Otani, Fumio Mizutani

Quantitative immunochromatography by detection redox species flowing in a membrane

s03-066

Martina Zatloukalova (Department of Medical Chemistry and Biochemistry, Palacky University, Olomouc, Czech Republic)

Electroanalysis of Uncoupling Protein 1 after Solubilization by Poly(Ethylene Glycol) Octyl Ether and Incorporation into Liposomes

s03-067

Jie Zhao (School of Chemical and Biomolecular Engineering, University of Sydney, Sydney, Australia)

Ink-Jet Printed Nafion/MWCNT Chips Fabricated Bio-Electrochemical Sensors for Human Serum Dopamine Determination

Direct electrochemistry of biomolecules and electrified biointerfaces

s03-068

Ariadna Brotons (Institute of Electrochemistry, University of Alicante, Alicante, Spain), Leticia García-Cruz, Craig E. Banks, Vicente Montiel, Francisco José Vidal-Iglesias, José Solla-Gullón, Jesus Iniesta

How far is the use of screen printed electrodes based on carbon materials for the electroanalysis of cytosine and methylcytosine?

s03-069

Ariadna Brotons (Institute of Electrochemistry, University of Alicante, Alicante, Spain), Rosa M. Arán-Ais, Juan M. Feliu, Vicente Montiel, Jesus Iniesta, Francisco José Vidal-Iglesias, José Solla-Gullón

Spectroelectrochemical study of the adsorption of cytosine and methylcytosine on well-defined gold surfaces

s03-070

Shen-Ming Chen (Department of Chemical Engineering and Biotechnology, National Taipei University of Technology, Taipei, Taiwan), Chelladurai Karuppiah, Selvakumar Palanisamy

Fabrication and Characterization of biosensor and electrochemical sensors based on graphene/metal oxide and metal nanoparticles composites

s03-071

Min-Wen Chung (Department of of Chemistry, University of Oxford, Oxford, United Kingdom), Pathinan Paengnakorn, Benjamin Aucott, Suzannah Hexter, Philip A. Ash, Fraser A. Armstrong, Kylie A. Vincent

Infrared Spectroscopy Coupled with Protein Film Electrochemistry to Study Hydrogenase Inhibition by pi-acid Ligands

s03-072

Thi Quynh Nga Do (Department of Process System Engineering, Max Planck Institute, Magdeburg, Germany), Miroslava Varnicic, Richard Hanke-Rauschenbach, Tanja Vidakovic-Koch, Kai Sundmacher

Mathematical Modeling of a Porous Enzymatic Electrode with Direct Electron Transfer Mechanism

s03-073

Zuzana Ferencíková (Department of Structural Biology, Central European Institute of Technology, Masaryk University, Brno, Czech Republic), Aleš Danhel, Jan Reidl, Michal Hocek, Miroslav Fojta

4-aminophthalimide as a Potential Redox Label for Electrochemical Detection of DNA

s03-074

Stefanie Hild (Electrochemistry, DECHEMA-Forschungsinstitut, Frankfurt/M, Germany), Thomas Krieg, Markus Stöckl, Anne Sydow, Tom Zschernitz, Dirk Holtmann, Jens Schrader, Klaus-Michael Mangold

An interdisciplinary approach to optimize microbial electrosynthesis

s03-075

Dominika Janiszek (Faculty of Chemistry, University of Warsaw, Warsaw, Poland), Anna Banasiak, Hanna Elzanowska, Agnieszka Girstun, Pawel J. Kulesza

Electrochemical detection of DNA damage in Fenton reaction

s03-076

Joanna Juhaniewicz (Faculty of Chemistry, University of Warsaw, Warsaw, Poland), Michal Jamroz, Slawomir Sek

Interactions of Cecropin B with Lipidic Components of Gram-negative Bacteria Membrane

s03-077

Pawel Krysinski (Department of Chemistry, University of Warsaw, Warsaw, Poland), Dorota Nieciecka, Agata Królikowska, Aleksandra Joniec, Gary J. Blanchard

Partitioning of Doxorubicin into Langmuir and Langmuir-Blodgett Biomimetic Films. Electrochemical and Spectroscopic Studies

s03-078

Xiaoqing Liu (Department of Chemistry, Ecole Normale Supérieure, Paris, France), Marine Bretou, Ana-Maria Lennon-Duménil, Christian Amatore, Frédéric Lemaître, Manon Guille Collignon

ITO Microsystem for Electrochemical Detection of Macropinosome Exocytosis in Migrating Dendritic Cells

s03-079

Barbara Palys (Department of Chemistry, University of Warsaw, Warsaw, Poland), Piotr Olejnik, Agnieszka Swietlikowska, Anna Sloniewska

Probing enzymes immobilized on nanostructured gold electrodes

s03-080

Manuela Rueda (Department of Physical Chemistry, University of Seville, Seville, Spain), Julia Alvarez-Malmagro, Francisco Prieto, Antonio Rodes

Adsorption and co-adsorption of adenine and thymine on gold electrodes as a function of pH

s03-081

Yasuhito Sugano (Process Chemistry Centre, Åbo Akademi University, Turku, Finland), Tiina Saloranta, Chunlin Xu, Johan Bobacka, Ari Ivaska

Structural change of cellulose in Au mediated electro-catalytic oxidation

s03-082

Markus Valtiner (Department of Interface Chemistry and Surface Engineering, Max-Planck-Institut für Eisenforschung GmbH, Düsseldorf, Germany), Thomas Utzig, Stephen Donaldson, Sangeetha Raman, Matthew Gebbie, Buddha Shrestha, Theodoros Baimpos, Jacob Israelachvili

Specific and non-specific interaction forces at electrified PEG-functionalized lipid-bilayers

s03-083

Richard Webster (School of Physical and Mathematical Sciences, Nanyang Technological University, Singapore, Singapore), Maria Novianti, Yanni Yue

Modifying the Structure of Vitamin E to Extend the Lifetime of its Diamagnetic Cation

s03-084

Iranaldo da Silva (Instituto de Química, USP, São Paulo, Brazil), Silvia H. P. Serrano

Redox Behavior of Nifuroxazide on Pre-treated Boron-doped Diamond Electrodes

Enzymatic catalysis

s03-085

Victor Climent (Institute of Electrochemistry, University of Alicante, Alicante, Spain), Yongchun Fu, Sara Chumillas, Beatriz Maestro, Jian-Feng Li, Akiyoshi Kuzume, Stephan Keller, Thomas Wandlowski, Juan M. Feliu

Electrocatalytic Reduction of Oxygen Using Immobilized Multicopper Oxidase CueO

s03-086

François Mavré (Laboratoire d'Electrochimie Moléculaire, Paris Diderot University, Paris, France), Rebeca Miranda-Castro, Ling Zhang, Claire Stines-Chaumeil, Nicolas Mano, Benoit Limoges

Enzyme reconstitution on electrode surface: Apo-enzyme vs. prosthetic group immobilization strategies

Modified electrodes

s03-087

Magdalena Blicharska (Department of Chemistry, University of Warsaw, Warsaw, Poland), Anna Dobrzeniecka, Sylwia Zoladek, Katarzyna Grzejszczyk, Pawel J. Kulesza

Polyoxometallate-modified gold nanoparticles in biofuel cells for bioanode and biocathode application

s03-088

Fatemeh Ghorbani-Bidkorbeh (Department of Pharmaceutics, School of Pharmacy, Shahid Beheshti University of Medical Sciences, Tehran, Iran), Shirin Hooshfar, Masoumeh Ghalkhani, Farzad Kobarfard, Saeed Shahrokhian

Electrochemical Study of Cetrorelix Acetate Using GCE Modified with CNPs and its Analytical Application in Pharmaceutical Dosage Forms

s03-089

Hun-Gi Hong (Department of Chemistry Education, Seoul National University, Seoul, Korea), Jong-Hyeok Lee

Non-enzymatic hydrogen peroxide sensor based on Polyaniline-MnO_2 nanocomposites modified electrode

s03-090

Daliborka Jambrec (Analytische Chemie, Ruhr Universtät Bochum, Bochum, Germany), Magdalena Gebala, Wolfgang Schuhmann

Fast Potential-assisted Immobilization of ssDNA on Au Electrode Surfaces

s03-091

Lauro Kubota (Department of Analytical Chemistry, Institutte of Chemistry, Unicamp, Campinas, Brazil), Murilo Santhiago

Different Approaches for the Paper-based Electrochemical Devices for Electroanalytical Applications

s03-092

Magdalena Kundys (Department of Electrode Processes, Institute of Physical Chemistry PAS, Warsaw, Poland), Katarzyna Szot, Martin Jönsson-Niedziolka, Ewa Rozniecka, Frank Marken, Marcin Opallo

Electrochemical determination of selected neurotransmitters at electrodes modified with oppositely charged carbon nanoparticles

s03-093

Alan Le Goff (Department of Molecular Chemistry, UMR CNRS 5250, Université de Grenoble Alpes, Grenoble, France)

Supramolecular immobilization of redox enzymes on functionalized carbon nanotube electrodes

s03-094

Agnieszka Pietrzyk-Le (Department of Physical Chemistry of Supramolecular Complexes, Institute of Physical Chemistry, Polish Academy of Sciences, Warsaw, Poland), Katarzyna Bartold, Tan-Phat Huynh, Zofia Iskierko, Marta Sosnowska, Anna Ciesielczuk, Chandra Bikram KC, Francis D'Souza, Wlodzimierz Kutner, Francesco Sannicolò, Patrizia R. Mussini

Determination of the TATAAA oligonucleotide via hybridization of the electrosynthesized molecularly imprinted polymer (MIP) bearing complementary adenine and thymine nucleobases

s03-095

F. Javier Recio (Department of Electrocatalysis, Universiad Santiago de Chile, Santiago, Chile), Sebastian Calderón, Diego Farias, Federico Tasca, José Zagal

Electrocatalytic Activity of Immobilized Cobalt Phthalocyanines towards Hydrogen Peroxide Oxidation

s03-096

Yukari Sato (Biomedical Research Intitute, National Institute of Advanced Industrial Science and Techno, Tsukuba, Japan), Kyoko Yoshioka, Teiichi Murakami, Mutsuo Tanaka, Osamu Niwa

Monolayer Recognition Interface for Highly Effective Protein Detection and Sufficient Signal Enhancement

s03-097

Sylwia Strzalkowska (Faculty of Chemistry, University of Warsaw, Warsaw, Poland), Wioleta Dzialak, Dariusz Zabost, Maciej Siekierski, Wladyslaw Wieczorek, Michael Leitner, Andreas Ebner, Magdalena Maj-Zurawska

Guanine oxidation process on modified glassy carbon platform for biosensor application

s03-098

Miroslava Varnicic (Department of Process Systems Engineering, Max Planck Institute for Dynamics of Complex Technical Syste, Magdeburg, Germany), Tanja Vidakovic-Koch, Kai Sundmacher

Partial Glucose Oxidation in Electroenzymatic Reactor

s03-099

Ana S. Viana (Chemistry and Biochemistry Department, Faculty of Sciences, Lisbon University, Lisboa, Portugal), Joaquim T. Marquês, Inês Almeida, Yu Niu, Wei Liu, Gang Jin, Rodrigo F. M. Almeida

Biomimetic Lipid-based Platforms for Electrochemical and Optical Biosensing

Surface architectures

s03-100

Ana-Maria Chiorcea-Paquim (Chemistry Department, University of Coimbra, Coimbra, Portugal), Ana Dora Rodrigues Pontinha, Ramon Eritja, Ana Maria Oliveira-Brett

G-rich DNA Quadruplex Nanostructures: Influence of Sodium and Potassium Ions

s03-101

Mamantos Prodromidis (Department of Chemistry, University of Ioannina, Ioannina, Greece), Apostolos Michopoulos, Antonios Kouloumpis, Dimitrios Gournis

Screen-printed graphite electrodes modified with a Langmuir- Blodgett layer-by-layer deposited tailored functional single nanoblock of graphene-prussian blue

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Symposium 4: Electrochemical Energy Conversion and Storage: Fuel Cells and Electrolysers

Asymmetric and hybrid systems

s04-001

Koichi Matsuzawa (Department of Science and Enginerring, Yokohama National University, Yokohama, Japan), Akimitsu Ishihara, Yuji Kohno, Ken-ichiro Ota, Shigenori Mitsushima, Gregory Jerkiewicz

Oxygen Reduction Reaction at Niobium Oxide-based Catalyst in Alkaline Solution

Electrolyser

s04-002

Maniya Aghasibeig (Department of Mechanical & Industrial Engineering, Concordia University, Montreal, Canada), Ali Dolatabadi, Christian Moreau, Rolf Wuthrich

Manufacturing Engineered 3-Dimensional Electrode Coatings by Atmospheric Plasma Spraying for Hydrogen Evolution

s04-003

Albert Albert (Electrochemistry Laboratory, General Energy Research, Paul Scherrer Institut, Villigen PSI, Switzerland), Thomas Justus Schmidt, Lorenz Gubler

Radiation grafted polymer electrolyte membranes for water electrolysis cells – characterization of key membrane properties

s04-004

Mirko Battaglia (Dipartimento di Ingegneria Chimica, Gestionale, Informatica, Università di Palermo, Palermo, Italy), Rosalinda Inguanta, Salvatore Piazza, Carmelo Sunseri

Ni and Ni-IrO_2 electrodes prepared by electrochemical deposition for alkaline water electrolyzers

s04-005

Qiong Cai (Department of Chemical and Process Engineering, University of Surrey, Guildford, United Kingdom), Claire Adjiman, Nigel Brandon

Optimal control strategies for hydrogen production when coupling solid oxide electrolysers with intermittent renewable energies

s04-006

Serhiy Cherevko (Department of Interface Chemistry and Surface Engineering, Max-Planck-Institut für Eisenforschung GmbH, Düsseldorf, Germany), Angel A. Topalov, Aleksandar R. Zeradjanin, Gareth P. Keeley, Karl Mayrhofer

Dissolution of Noble Metals during Electrocatalysis of Oxygen Reduction and Oxygen Evolution

s04-007

Sergey Grigoriev (Chemistry and Electrochemical Power Engineering, Moscow Power Engineering Institute, Moscow, Russia)

Synthesis and characterization of carbon-supported platinum group metal nanoparticles using magnetron-ion technologies. Application to low-temperature polymer electrolyte technology

s04-008

Sergey Grigoriev (Chemistry and Electrochemical Power Engineering, Moscow Power Engineering Institute, Moscow, Russia)

Water treatment using PEM electrochemical systems

s04-009

Jong Hyun Jang (Fuel Cell Research Center, Korea Institute of Science and Technology (KIST), Seoul, Korea), Sang Hyun Ahn, Byung-Seok Lee, Insoo Choi, Hee-Young Park, Young-Hoon Chung, Sung Jong Yoo, Hyoung-Juhn Kim, EunAe Cho, Dirk Henkensmeier, Suk Woo Nam, Soo-Kil Kim

Development of Electrodeposited Ni/CP Electrodes for Water Electrolysis with Alkaline Anion Exchange Membranes

s04-010

Philippe Jeanty (CT RTC SET CPS-DE, Siemens AG, München, Germany), Nicolas Kohler, Roland Pohle, Kerstin Wiesner, Maximilian Fleischer, Olaf Hinrichsen

Mechanistic investigation of direct electrochemical conversion of CO_2 to ethene using isotope marked $^{13}CO_2$

s04-011

Paul Kenis (Department of Chemical & Biomolecular Engineering, University of Illinois at Urbana-Champaign, Urbana, USA), Molly Jhong, Sichao Ma, Claire Tornow, Andrew Gewirth, Tsuyohiko Fujigaya, Stephen Lyth, Naotoshi Nakashima

New Catalysts for Electroreduction of CO_2 to CO

s04-012

Sun-Dong Kim (Materials Research Laboratory, Korea Institute of Energy Research, Daejeon, Korea), Doo-Won Seo, Young-Hum Na, Sang-Kuk Woo

Electrochemical Performances of Flat-tubular Solid Oxide Electrolysis Cells

s04-013

Lisa Kleiminger (Department of Chemical Engineering, Imperial College, London, United Kingdom), Tao Li, Kang Li, Geoff Kelsall

CO_2 Reduction in Micro-tubular Solid Oxide Electrolysers

s04-014

David Pasquier (Electrochemistry and Materials Department, IFPEN, Solaize, France), Ziad Bitar, Antoine Fecant, Sylvie Chardon-Noblat

Electroreduction of CO_2 to Formic Acid Using Gas Diffusion Electrodes

s04-015

Jelena Stojadinovic (Department of Chemistry and Biochemistry, Ruhr-University Bochum, Bochum, Germany), Fabio La Mantia

Influence of the Temperature on the Electrochemical Properties and Morphology of Composite Materials for Gas Separation

s04-016

Federica Vico (Department of Energy Conversion and Storage, Technical University of Denmark, Roskilde, Denmark)

High pressure characterization of $BaCe_{1-x-y}Zr_yYxO_{3-d}$ for electrochemical reduction of CO_2

s04-017

Kay Waltar (ENE, Paul Scherrer Institute, Zürich, Switzerland), Emiliana Fabbri, Dmitry Lebedev, Alexey Fedorov, Christophe Coperet, Thomas Schmidt

Insight into the application of the rotating ring disk electrode technique for the oxygen evolution reaction

s04-018

Youngmi Yi (Department of Inorganic Chemistry, Fritz Haber Institute of the Max Planck Society, Berlin, Germany), Chinmoy Ranjan, Elena Willinger, Marc Willinger, Julian Tornow, Robert Schlögl

Electrochemical degradation of carbon nanotubes under electrocatalytic water splitting

Fuel Cell

s04-019

Sidney Aquino Neto (Department of Chemistry, University of Sao Paulo, Ribeirão Preto, Brazil), Thiago S. Almeida, Rodrigo G. Da Silva, Laís B. Crepaldi, Shelley D. Minteer, Adalgisa R. De Andrade

The Use of Metallic Nanoparticles to Enhance Biofuel Cell Performance

s04-020

Rosa M. Arán-Ais (Institute of Electrochemistry, University of Alicante, Alicante, Spain), Yingchao Yu, José Solla-Gullón, Enrique Herrero, Héctor D. Abruña, Juan M. Feliu

IL-TEM Images on Shaped Pt Nanoparticles: Electrochemical Activation and Surface Disordering

s04-021

Yulia Budnikova (Department of Chemistry, A.E. Arbuzov Institute of Organic and Physical Chemistry, Kazan, Russia)

Unexpected Ligand Effect on the Catalytic Reaction Rate Acceleration for Hydrogen Production/Oxidation Using Biomimetic Nickel Electrocatalysts with Eight-membered Cyclic Functional Bisphosphines

s04-022

Luis Castanheira (Department of Electrochimie Interfaciale, LEPMI, Grenoble, France), Laetitia Dubau, Frédéric Maillard

Effect of the Electrochemical Potential, the Gas Atmosphere and the Carbon Support Surface Chemistry on Electrochemically Active Surface Area Losses

s04-023

Ana Castro Luna (Conversion y Almacenamiento de Energia, INIFTA UNLP CONICET, La Plata, Argentina), Mariano Asteazaran, Silvina Bengió, Mario Sergio Moreno, Walter E. Triaca

Catalysts for the Oxygen Reduction Reaction. Analysis of their Tolerance to Alcohol Crossover

s04-024

Sheng-Pei Chen (Department of Chemistry, Xiamen University, Xiamen, China), Yuan-Rong Cai, Rui Huang, Long Huang, Zhi-You Zhou, Shi-Gang Sun

Effect of Treatment of Carbon Black on the Behavior of Ethanol Oxidation at Carbon Supported Pt Nanocatalyst

s04-025

Simone Congiu (Department of Civil, Chemical and Environmental Engineering, University of Genoa, Genoa, Italy), Marco Panizza, Alice Giuliano, Giacomo Cerisola, Marina Delucchi

Development of a High-temperature Solid Oxide Cell Via YSZ Monolithic Trilayer with Nanocatalyst Impregnated Electrodes

s04-026

Francisco Cuevas-Muñiz (Investigación, CIDETEQ, Querétaro, Mexico), Euth Ortiz-Ortega, Angélica Janeth Armenta-González, Minerva Guerra-Balcázar, Janet Ledesma-García, Gerardo Arriaga

AuPd/C as Cathodic Selective Catalyst for a Single-stream Microfluidic Formic Acid Fuel Cell

s04-027

Rodrigo G. Da Silva (Department of Chemistry, FFCLRP, University of São Paulo, Ribeirão Preto, Brazil), Adalgisa R. De Andrade

Intrinsic catalytic activity of Pd-based nanocatalysts for C2 and C3 alcohols oxidation in alkaline medium

s04-028

Nick Daems (Centre for Surface Chemistry and Catalysis, K.U. Leuven, Heverlee, Belgium), Xia Sheng, Bart Geboes, Tom Breugelmans, Annick Hubin, Ivo Vankelecom, Paolo Pescarmona

Doped Ordered Mesopours Carbons as Electrocatalysts for the Oxygen Reduction Reaction

s04-029

Olesia Danyliv (Group ELSA, LEPMI, Saint-Martin d'Heres, France), Cristina Iojoiu, Jean-Yves Sanchez

New Ionomers with Pendant Perfluorosulfonic Acid Chains for Proton-conducting Fuel Cells

s04-030

Carlota Domínguez Fernández (Department of Catalytic Structure and Reactivity, Institute of Catalysis and Petrochemistry, Madrid, Spain), F.J. Pérez-Alonso, M.A. Salam, J.L. Gómez, S.A. Al-Thabaiti, M.A. Peña, S. Rojas

Effect of carbon structure for N incorporation and repercussions for the ORR in acid media

s04-031

Christian Durante (Department of Chemical Sciences, Università di Padova, Padova, Italy), Emilia Gradzka, Roberto Pilot, Zheng Jian, Renato Bozio, Gaetano Granozzi, Armando Gennaro

Comparison of Differently Doped Mesoporous Carbons: Activity and Stability vs Oxygen Reduction Reaction

s04-032

Ali Ehsani (Department of Chemistry, University of Qom, Qom, Iran)

Electrosynthesis and electrocatalytic activity of graphene oxide/conducting polymer nanocomposite film

s04-033

Paul Ejikeme (Department of Chemistry, University of Pretoria, Pretoria, South Africa), Katlego Makgopa, Volker Presser, Kenneth I. Ozoemena

One-pot Microwave-assisted Solvothermal Synthesis of Pd-MnO_2 Nanocatalysts for Alkaline Direct Alcohol Fuel Cells

s04-034

Ehab El Sawy (Department of Chemistry, Memorial University, St. John's, Canada), Peter Pickup

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Tom Engl (Electrochemistry Laboratory, Paul Scherrer Insitut, Villigen, Switzerland)

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Emiliana Fabbri (Electrochemistry Laboratory, Energy Department, Paul Scherrer Institut, Villigen, Switzerland), Susan Taylor, Annett Rabis, Pieter Levecque, Olaf Conrad, Rüdiger Kötz, Thomas J. Schmidt

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Omobosede Fashedemi (Materials Science and Manufacturing, CSIR, Pretoria, South Africa), Kenneth Ozoemena

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Marta Figueiredo (Department of Chemistry, Aalto University, Helsinki, Finland), Olli Sorsa, Nguyet Doan, Tanja Kallio

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Amanda Cristina Garcia (Institute of Chemistry of São Carlos, Universidade de São Paulo, São Carlos, Brazil), Julia Oliveira Caliman, José Joaquim Linares, Germano Tremiliosi-Filho

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Armando Gennaro (Department of Chemical Sciences, University of Padova, Padova, Italy), Emilia Gradzka, Marco Favaro, Gaetano Granozzi, Christian Durante

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Marc-Antoni Goulet (School of Mechatronic Systems Engineering, Simon Fraser University, Surrey, Canada), Erik Kjeang

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Jeffrey Greeley (Department of Chemical Engineering, Purdue University, West Lafayette, USA), Zhenhua Zeng, Joseph Kubal

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Oc Hee Han (Western Seoul Center, Korea Basic Science Institute, Seoul, Korea)

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Mazdak Hashempour (Department of Chemistry, Materials and Chemical Engineering, Politecnico di Milano, Milan, Italy), Surbhi Sharma, Daniel Gonzalez, Gaurav Gupta, Antonello Vicenzo, Massimiliano Bestetti

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Yaovi Holade (Department of Chemistry, University of Poitiers, IC2MP, UMR-CNRS 7285, Poitiers, France), Karine Servat, Cláudia Morais, Têko W. Napporn, Boniface Kokoh

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Eneli Härk (Institute of Chemistry, University of Tartu, Tartu, Estonia), Rutha Jäger, Piia Ereth Kasatkin, Vahur Steinberg, Enn Lust

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David Inwood (Department of Chemistry, University of Southampton, Southampton, United Kingdom), Andrea Russell, Jonathan Sharman, Alex Martinez

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Thomas Jahnke (Institute of Technical Thermodynamics, CEC, German Aerospace Center, Stuttgart, Germany), Arnulf Latz

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Deborah Jones (ICGM Aggregates, Interfaces and Materials for Energy, CNRS Montpellier, Montpellier, France), Michael Schuster, Bernd Bauer, Kristina Angjeli, Marc Dupont, Jacques Rozière, Antonino Arico, Vincenzo Baglio, Jacob Lindner Bonde

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Sang Hoon Joo (School of Energy and Chemical Engineering, UNIST, Ulsan, Korea), Jae Yeong Cheon, Young Jin Sa

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Primoz Jovanovic (Laboratory for Materials Chemistry, National Institute of Chemistry, Ljubljana, Slovenia), Andraž Pavlišic, Nejc Hodnik, Vid Simon Selih, Martin Sala, Marjan Bele, Samo Hoèevar, Miran Gaberscek

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Vladislava Jovanovic (Department of Electrochemistry, ICTM University of Belgrade, Belgrade, Serbia), Dusan Tripkovic, Vladimir Tripkovic, Amalija Tripkovic, Andrzej Kowal

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Rutha Jäger (Institute of Chemistry, University of Tartu, Tartu, Estonia), Eneli Härk, Piia Ereth Kasatkin, Vahur Steinberg, Enn Lust

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Hyunuk Kim (Energy Materials Laboratory, Korea Institute of Energy Research, Daejeon, Korea), Young-Ju Lee, Sung-Jin Lee, Yong-Sik Chung, Yoonjong Yoo

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Hirokazu Kitazawa (Chemical Resources Laboratory, Tokyo Institute of Technology, 4259 Nagatutacho Yokohama, Japan), Takane Imaoka, Wang Jae Chun, Kimihisa Yamamoto

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Carsten Korte (Institut für Energie und Klimaforschung (IEK-3), Forschungszentrum Jülich, Jülich, Germany), Fosca Conti, Jürgen Wackerl, Pierre Dams, Werner Lehnert

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Ruud Kortlever (Catalysis and Surface Chemistry, Leiden University, Leiden, Netherlands), Ines Peters, Collin Balemans, Youngkook Kwon, Marc T.M. Koper

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Ivar Kruusenberg (Institute of Chemistry, University of Tartu, Tartu, Estonia), Jayanta Mondal, Leonard Matisen, Väino Sammelselg

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Da-Hee Kwak (Department of Chemical Engineering, Soonsil University, Seoul, Korea), Young-Woo Lee, Min-Cheol Kim, Seul Lee, Jin-Yeon Lee, Kyung-Won Park

M-N_4 Complex Doped Graphene Nanostructures as an Oxygen Reduction Electrocatalyst

s04-060

Sang-Young Lee (Fuel Cell Center, Department of Fusion Chemical Engineering, Korea Institute of Science & Technology, Hanyang University, Seoul, Ansan, Korea), Hee-Young Park, Namgee Jung, Young-Hoon Chung, Injoon Jang, Jaeyune Ryu, Docheon Ahn, Il-Kyu Park, Yeung-Ho Park, Jong Hyun Jang

Pd_3Au@Pt/C Core-Shell Electrocatalysts with Enhanced Stability and Activity for Oxygen Reduction Reaction

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Jang Yong Lee (Energy Materials Research Center, Korea Research Institute of Chemical Technology, Daejeon, Korea), Tae-Ho Kim, Duk Man Yu

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Seung-Bok Lee (Fuel Cell Research Center, Korea Institute of Energy Research, Daejeon, Korea), Bilal Ahmed, Rak-Hyun Song, Jong-Won Lee, Tak-Hyoung Lim, Seok-Joo Park

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Sang-Young Lee (Fuel Cell Research Center, Korea Institute of Science and Technology, Seoul, Korea), Hee-Young Park, Namgee Jung, Young-Hoon Chung, Injoon Jang, Jaeyune Ryu, Docheon Ahn, Il-Kyu Park, Jong Hyun Jang

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Pieter Levecque (HySA/Catalysis - Department of Chemical Engineering, Univeristy of Cape Town, Rondebosch, South Africa), Colleen Jackson, Olaf Conrad

Highly efficient Direct Methanol Fuel Cell catalysts prepared by metal organic chemical vapour deposition

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Yan Li (Department of Physics and Astronomy, KU Leuven, University of Leuven, Heverlee, Belgium), Willem Van Roy, Philippe Vereecken, Liesbet Lagae

On Chip Microfluidic Fuel Cell under Ultraslow Laminar Flow to Deliver a Net Power

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YuPing Liu (Department of Chemistry, Monash University, Melbourne, Australia), Si-Xuan Guo, Yurii V. Geletii, Craig L. Hill, Alan Bond, Jie Zhang

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s04-067

Jianguo Liu (Department of Materials Science, Nanjing University, Nanjing, China)

Two-step Method to Prepare Nanoporous Gold and Its Electrochemical Performance

s04-068

Mariangela Longhi (Department of Chemistry, University of Milan, Milano, Italy), Leonardo Formaro, Roberto Bresciani, Marzorati Stefania, Theodoros Tsoufis, Fotis Katsaros, Zili Sideratou

Modified Carbon Nanostructures as Catalysts For Oxygen Reduction Reaction

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Frédéric Maillard (LEPMI, French National Center for Scientific Research, Saint Martin d'Hères, France), Laetitia Dubau, Tristan Asset, Céline Bonnaud, Raphaël Chattot, Victor van Peene

Optimizing Pt “hollow” Nanostructures for the Oxygen Reduction Reaction

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Gaël Maranzana (LEMTA, Université de Lorraine - CNRS, Vandoeuvre les Nancy, France), Anthony Thomas, Jérôme Dillet, Sophie Didierjean, Olivier Lottin

On coupled heat and water transfers in proton exchange membrane fuel cells

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Eftychia Martino (Department of Chemical Engineering, University of Patras, Patras, Greece), Andreas Gousev, Alexandros Katsaounis, Constantinos Vayenas

Triode Fuel Cell Operation under CO-poisoning Conditions

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Stefania Marzorati (Dipartimento di Chimica, Universita' degli Studi di Milano, Milano, Italy), Mariangela Longhi, Leonardo Formaro

Templating-induced Enhancement of the Electrocatalytic Activity of Pt-free Carbons for Oxygen Reduction Reaction

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Yoshihiro Mugikura (Energy Engineering Research Laboratory, Central Research Institute of Electric Power Industry, Yokosuka, Japan), Kenji Yasumoto, Hiroshi Morita, Masahiro Yoshikawa, Tohru Yamamoto

Performance evaluation technology for long-term durability and reliability of SOFCs

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Yotaro Nishijima (Department of Materials Science and Engineering, Yokohama National University, Yokohama, Japan), Yuji Kohno, Koichi Matsuzawa

Electrochemical Method for Electro-hydrogenation of Toluene in Two-phase System of Toluene and H_2SO_4

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Patrick Nonjola (Department of Material Science and Manufacturing, CSIR, Pretoria, South Africa), Mkhulu Mathe, Mmalewane Modibedi, Kenneth Ozoemena, Nomthandazo Mutangwa

Alkaline Nanocomposite Membranes for Fuel Cell Applications

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Reza Ojani (Department of Analytical Chemistry, University of Mazandaran, Babolsar, Iran), Ehteram Hasheminejad, Jahan-Bakhsh Raoof

Electrocatalytic Oxidation of Methanol and Formic Acid at 3D Nano/Micro-porous PtPd Structures Prepared Via Hydrogen Evolution Assisted Electrodeposition

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Paulo Olivi (Quimica, Universidade de São Paulo, Ribeirão Preto, Brazil), Layciane Soares, Fabiana Purgato

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Emma M. Ortega (ISIRYM, Universitat Politècnica de València, Valencia, Spain), Juan José Giner-Sanz, Valentín Perez-Herranz

Hydrogen Crossover and Internal Short Circuit Modelling in a Commercial Individual PEM Fuel Cell

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Alexandra Patru (Electrochemistry Laboratory, Paul Scherrer Institut, Villigen, Switzerland)

Membrane-electrode Assembly with Platinum Supported on Oxide Catalyst Prepared by Spray Coating - Fabrication and Performance

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Andraž Pavlišic (Laboratory for Materials Chemistry, National Institute of Chemistry Slovenia, Ljubljana, Slovenia), Vid Simon Selih, Martin Sala, Nejc Hodnik, Samo Hocevar, Miran Gaberscek

The Influence of Chloride Impurities on Pt/C Fuel Cell Catalyst Corrosion

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Huayu Qian (Key Laboratory of Soft Chemistry and Functional Materials, Nanjing University of Science and Technology, Nanjing, China), Wenyao Zhang, Xin Wang

Palladium Nanoparticles on Nitrogen-Containing Carbon, an Anode Electrocatalyst for Formic Acid Oxidation

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R. Rahul (Department of Energy Science and Engineering, Indian Institute of Technology Bombay (IITB), Mumbai, India), Ramesh K. Singh

Kinetics and Mechanism of Electrochemical Reduction of Palladium Oxide in Acid Electrolyte

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Jahan Bakhsh Raoof (Department of Analytical Chemistry, University of Mazandaran, Babolsar, Iran), Sayed Reza Hosseini, Sharifeh Rezaee

Preparation of Platinum Nano-particles by Galvanic Replacement of Nickel Deposits and its Application for Methanol Electrooxidation

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Bertrand Reuillard (Department of Chimie Moléculaire, Université de Grenoble, Grenoble, France)

Wiring redox enzymes in functionalized carbon nanotube matrixes for high power glucose-oxygen biofuel cells

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Lucie Rivier (Department of Chemistry, Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland), Manuel A. Méndez, Hubert Girault

Elucidation of Multi-step Photoproduction of Hydrogen by Decamethylruthenocene at Liquid/Liquid Interfaces

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Patrick Ruch (Science & Technology, IBM Research, Rüschlikon, Switzerland), Sarmenio Saliba, Julian Marschewski, Vinit Mittal, Stefan Jung, Dimos Poulikakos, Bruno Michel

Toward Miniaturized Redox Flow Cell Systems for On-chip Power Delivery

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Jing Shen (Department of Chemistry, Leiden University, Leiden, Netherlands)

Electrochemical reduction of CO_2 to CH_4 on an immobilized cobalt protoporphyrin in aqueous solution

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Sayoko Shironita (Department of Materials Science and Technology, Nagaoka University of Technology, Niigata, Japan), Shengnan Hua, Minoru Umeda, Kazuma Miura, Kunio Nakatsuyama, Kenichi Souma

Heat Treatment Conditions on Nitriding Stainless Steel as Bipolar Plate in Polymer Electrolyte Fuel Cell

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Turgut Sonmez (Department of Chemistry, University of Southampton, Southampton, United Kingdom), Stephen J. Thompson, Andrea E. Russell

Investigation of Non-platinum Catalysts for Low Temperature Fuel Cells

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Sotiris Sotiropoulos (Department of Chemistry, Aristotle University of Thessaloniki, Thessaloniki, Greece), Ioanna Mintsouli, Jenia Georgieva, Eugenia Valova, Stephan Armyanov, Kalliopi Papazisi, Stella Balomenou, Dimitris Tsiplakides

Pt-Cu and Pt-Ni Electrocatalysts Prepared by Galvanic Replacement on Carbon and Titanium Dioxide / Tungsten Trioxide Supports

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Serban Nicolae Stamatin (Department of Chemical Engineering, Biotechnology and Enviro, University of Southern Denmark, Odense, Denmark), Shuang Ma Andersen, Eivind Skou

The interaction effect between Pt and NbO_2 support with enhanced stability in PEMFC

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Sanja Stevanovic (Department of Electrochemistry, University of Belgrade, Belgrade, Serbia)

PtSn versus $PtSnO_2$ Carbon Supported Catalysts

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Svetlana Strbac (Institute of Electrochemistry, ICTM, University of Belgrade, Belgrade, Serbia), Aleksandar Maksic, Milutin Smiljanic, Zlatko Rakocevic

Methanol and Ethanol Oxidation on Pd/Pt(poly) in Alkaline Solution

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Wei-Nien Su (Graduate Institute of Applied Science and Technology, National Taiwan University of Science and Technology, Taipei, Taiwan), Trung-Thanh Nguyen, Chun-Jern Pan, Jyong-yue Liu, Hung-Lung Chou, John Rick, Bing Joe Hwang

Functional Pd tetrapod core of heterogeneous Pd-Pt nanodendrites for enhanced oxygen reduction reaction

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Susan Margaret Taylor (Electrochemistry Laboratory, Paul Scherrer Institut, Villigen, Switzerland)

Investigation of Redox Reactions for High-Performance Flow Cells

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Na Tian (Department of Chemistry, Xiamen University, Xiamen, China), Shuo Liu, Jing Xiao, Ai-Yun Xie, Jia-Huan Du, Zhi-You Zhou, Shi-Gang Sun

Synthesis of sub-10 nm tetrahexahedral Pt nanocrystals

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Edson Ticianelli (Department of Physical Chemistry, Institute of Chemistry of S. Carlos - USP, Sao Carlos, Brazil), Waldemir J. Paschoalino Jr., Stephen J. Thompson, Andrea E. Russell

Investigation of the Borohydride Oxidation Processes on Hydrogen Storage Alloys

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Kathryn Toghill (Laboratory of Physical and Analytical Electrochemistry (LEPA, Ecole Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland), Véronique Amstutz, Pekka Peljo, Heron Vrubel, Hubert Girault

The Development of a Sulfur Dioxide Fuel Cell

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Outi Toikkanen (Department of Chemistry, Aalto University, Espoo, Finland), Mikko Nisula, Tanja Kallio

Novel coatings for polymer electrolyte membranes for improved fuel cell performance

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YuYe Tong (Department of Chemistry, Georgetown University, Washington, USA), Honghui Wang, Dejun Chen, Yanyan Wang, Shi-Gang Sun

Highly Active and Stable Iodide-Modified PtCu and PtNi Alloy Nanoparticles for ORR

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Jakub Tymoczko (Department of Analytical Chemistry, Ruhr-Universität Bochum, Bochum, Germany), Wolfgang Schuhmann, Aliaksandr Bandarenka

Tailoring the electrocatalytic activity of Pt(111) for hydrogen evolution and oxidation reactions with atomic layers of Cu

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Dong-Ying Tzou (Department of Chemical Engineering and Materials Science, Yuan Ze University, Chung-Li, Taiwan), Chien-Te Hsieh, Po-Yuan Yu

Atomic Layer Deposition of Pt Nanocatalysts on Thermally-reduced Graphene Sheets

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Ana M. Valenzuela-Muñiz (Graduate Studies and Research Department, Instituto Tecnologico de Cancun, Cancun, Mexico), Beatriz Escobar Morales, Ysmael Verde-Gómez

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Ysmael Verde Gomez (Division of Research and Graduate, Instituto Tecnologico de Cancun, Cancun, Mexico), Ivonne Alonso Lemus, Daniel Lardizabal Gutierrez, Beatriz Escobar Morales, Ana María Valenzuela Muñiz

Study of nitrogen doped carbon nanostructures as platinum-free electrocatalyst

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Jie Wang (School Chemistry and Chemical Engineering, Huazhong University of Science and Technology, Wuhan, China), Sufen Liu, Jing Zhu, Deli Wang

Template-Free Synthesis of Hollow Structured Co_2FeO_4/C Composite with High Methanol Tolerance for Direct Methanol Fuel Cells

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Lianqin Wang (Istituto di Chimica dei Composti Organometallici, National Research Council of Italy, Sesto Fiorentino (FI), Italy), Marco Bellini, Manuela Bevilacqua, Jonathan Filippi, Alessandro Lavacchi, Andrea Marchionni, Hamish Miller, Francesco Vizza

Understanding Palladium Electrocatalyst Deactivation

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Pei Wang (Institut für Chemie, Martin-Luther-Universität Halle-Wittenberg, Halle (Saale), Germany), Michael Bron

Pt supported on hierarchically nanostructured CNT- and RGO-based electrodes for methanol electrooxidation

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Chen-Hao Wang (Department of Materials Science and Engineering, National Taiwan University of Science and Technology, Taipei, Taiwan)

Sulfide-based materials as cathode catalysts for alkaline anion exchange membrane fuel cell application

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Yuzhen Xia (ENSIC, University of Lorraine, Nancy, France), Sébastien Fontana, Gaël Maranzana, Thomas Gaumont, Alexandre Desforges, Caroline Bonnet, François Lapicque

Development of less-Nafion electrodes for PEM fuel cells based on sulfonated Pt/Vulcan catalysts

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Ke Ye (College of Materials Science and Chemical Engineering, Harbin Engineering University, Harbin, China), Dianxue Cao, Kui Cheng, Guiling Wang

Facile Fabrication of Porous $(Co, Mn)_3O_4$ Nanowire Array Freestanding on Ni Foam with Enhanced Catalytic Activity for H_2O_2 Electroreduction

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Chung-Yul Yoo (Advanced Materials and Devices Laboratory, Korea Institute of Energy Research, Daejeon, Korea), Si Young Jang, Jong Hoon Joo, Ji Haeng Yu

Direct one-pot synthesis, characterization and the role of $KH_5(PO_4)_2$ in a composite electrolyte based on KH_2PO_4

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Jong-Sung Yu (Department of Advanced Materials Chemistry, Korea University, Sejong, Korea), Dae-Soo Yang, Min Young Song

Nitrogen-doped Porous Carbon Nanofibers and the Effect of Their Properties on Oxygen Reduction Performance

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Jose H. Zagal (Departmento de Quimica de los Materiales, F. Quim y Biol., Universidad de Santiago de Chile, Santiago, Chile), Francisco Recio, Ricardo Venegas, Ingrid Ponce, Federico Tasca, Fernando Mendizabal, Ramiro Arratia-Perez

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Eleonora Zamburlini (Department of Physics, Technical University of Denmark, Nærum, Denmark), Ifan Stephens, Maria Escudero-Escribano, Paolo Malacrida, Christoffer Mølleskov Pedersen, Ib Chorkendorff

Thin film Pt – rare earth alloys for highly active oxygen reduction reaction catalysts

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Wenyao Zhang (Key Laboratory of Soft Chemistry and Functional Materials, Nanjing University of Science and Technology, Nanjing, China), Huayu Qian, Xin Wang

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Drielly Cristina de Oliveira (Instituto de Química de São Carlos, Universidade de São Paulo (USP), Saint Martin dHères, France)

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Anusha Abhayawardhana (Department of Chemistry, University of Calgary, Calgary, Canada), Viola Birss

Ta-based Catalyst Support for Proton Exchange Membrane Fuel Cell Applications

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Tobias Binninger (Electrochemistry Laboratory, Paul Scherrer Institut, Villigen PSI, Switzerland), Marios Garganourakis, Jun Han, Alexandra Patru, Emiliana Fabbri, Olha Sereda, Rüdiger Kötz, Thomas J. Schmidt

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Felix N. Büchi (Electrochemistry Laboratory, Paul Scherrer Institut, Villigen PSI, Switzerland), Immanuel Mayrhuber, Jens Eller, Jörg Roth, Federica Marone, Marco Stampanoni

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Griselda Caballero De Sánchez (Department of Physical Chemistry, Universitat de Barcelona, Barcelona, Spain), Enric Brillas, Francesc Centellas, José Antonio Garrido, Rosa María Rodríguez

Synthesis and Characterization of Carbon-supported Pt(Cu) and Pt-Ru(Cu) Core-shell Nanoparticles as Electrocatalysts for Polymer Electrolyte Fuel Cells

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Min-Hsing Chang (Department of Mechanical Engineering, Tatung University, Taipei, Taiwan), Huang-Chun Yu

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Yuji Chino (Interdisciplinary Graduate School of Medicine and Engineerin, University of Yamanashi, Kofu, Japan), Yuichi Senoo, Koji Taniguchi, Makoto Uchida, Katsuyoshi Kakinuma, Hiroyuki Uchida, Shigehito Deki, Masahiro Watanabe

Single Cell Performances of Membrane Electrode Assemblies using Pt/Nb-$SnO_{2-\delta}$ Cathode Catalysts for PEFCs

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Lei Du (Institute of Advanced Chemical Power Sources, Harbin Institute of Technology, Harbin, China), Sheng Zhang, Guangyu Chen, Chunyu Du, Yunzhi Gao, Geping Yin

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Sebastian Eberhardt (Department of Electrochemistry, Paul Scherrer Institut, Villigen PSI, Switzerland), Felix N. Büchi, Federica Marone, Thomas Schmidt

Imaging Phosphoric Acid in High-temperature Polymer Electrolyte Fuel Cells by X-Ray Tomographic Microscopy

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Mika Eguchi (College of Engineering, Ibaraki University, Hitachi, Japan), Koki Baba, Hiraku Ota, Mikka Nishitani-Gamo, Toshihiro Ando

Corrosion of Carbon Supports for PEFC Under Current Cycled Conditions

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Mika Eguchi (Department of Biomolecular Functional Engineering, Ibaraki University, Hitachi, Ibaraki, Japan), Hiroyuki Gunji, Kazuma Huruhashi, Ryo Nobehara, Hiraku Ota, Mikka Nishitani-Gamo, Toshihiro Ando

Preparation of the Pt-M Bimetallic Catalyst on the Marimo Carbon for Polymer Electrolyte Fuel Cell

s04-127

Thomas Erler (Institut für Chemie, Martin-Luther-Universität Halle-Wittenberg, Halle (Saale), Germany), Marcus Gebhard, Michael Bron

Influence of different carbon support materials on the activity and stability of FeN_x-C-based ORR catalysts

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Akari Hayashi (International Research Center for Hydrogen Energy, Kyushu University, Fukuoka, Japan), Xiaojing Zhao, Yasuto Minamida, Masahiko Kitamura, Kazunari Sasaki

Investigation on Degradation Mechanism of Pt/carbon Electrocatalyst Layers for PEFC

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Stefan Helmly (Institute of Technical Thermodynamics, German Aerospace Center, Stuttgart, Germany), K. Andreas Friedrich

The Role of the Pt-Band for Membrane Degradation in PEMFC – An Investigation Using an Artificial Pt Band

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Andrew Herring (Chemical and Biological Engineering, Colorado School of Mines, Golden, USA), Vinh Nguyen, Madhura Joglekar, Rajeswari Janarthanan, Brian Trewyn

Direct Hydrocarbon Polymer Electrolyte Fuel Cells Utilizing Novel Catalysts and/or Next Generation Membrane Materials

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Tsutomu Ioroi (Research Institute for Ubiquitous Energy Devices, AIST, Ikeda, Japan), Tsukasa Nagai, Masafumi Asahi, Shin-ichi Yamazaki, Zyun Siroma, Naoko Fujiwara, Kazuaki Yasuda

PEFC Cathode Catalysts Using Sub-stoichiometric Titanium Oxides as Support Materials

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Deborah Jones (ICGM Aggregates, Interfaces and Materials for Energy, CNRS Montpellier, Montpellier, France), Yannig Nedellec, Aurelien Kreisz, Nicolas Donzel, Jacques Rozière

Performance of HT-PEMFC on operation as automotive range extender

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Ryo Kamai (Research Center for Advanced Science and Technology, The University of Tokyo, 1-5-3 Komaba, Meguro-ku, Tokyo, Japan), Kazuhide Kamiya, Kazihito Hashimoto, Shuji Nakanishi

Instantaneous one-pot synthesis of Fe-N-codoped graphene as an efficient electrocatalyst for oxygen reduction reaction in acidic solutions

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Erik Kjeang (School of Mechatronic Systems Engineering, Simon Fraser University, Surrey, Canada), Steven Holdcroft, Shanna Knights, Kourosh Malek, Ned Djilali, Michael Eikerling, Farid Golnaraghi, Gary Wang, Nimal Rajapakse, Peter Wild, Jake Devaal, Mike Lauritzen, Mark Watson, Erin Rogers

Development of Next Generation Heavy Duty Bus Fuel Cells with Enhanced Durability

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Qiao-Xia Li (College of Environmental and Chemical Engineering, Shanghai University of Electric Power, Shanghai, China), Hong-Min Mao, Long-Long Wang, Xiao-Lu Cao

Carbon-supported PdSn-SnO_2 Catalyst for Enhancing Ethanol Electro-oxidation in Alkaline Media

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Immanuel Mayrhuber (Electrochemistry Laboratory, Paul Scherrer Institut, Villigen, Switzerland), Jörg Roth, Thomas Justus Schmidt, Felix N. Büchi

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Ian J. McPherson (Department of Chemistry, University of Oxford, Oxford, United Kingdom), Philip A. Ash, Robert M.J. Jacobs, Kylie A. Vincent

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Haruna Nagai (Department of Chemistry, Ochanomizu University, Bunkyo-ku, Japan), Hikaru Aso, Sae Shibata, Misako Hirota

Electrochemical Construction of Pt Monolayer Covered Ni and Co Core-shell Nanoparticles as Catalysts for Oxygen Reduction Reaction

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Mehtap Oezaslan (Department of General Energy, Paul Scherrer Institute, Villigen PSI, Switzerland), Maarten Nachtegaal, Wei Liu, Anne-Kristin Herrmann, Céline Laugier Bonnaud, Matthias Werheid, Nikolai Gaponik, Alexander Eychmüller, Thomas-Justus Schmidt

XAS Degradation Studies on unsupported Pt-Pd Aerogels

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Yohei Okada (Materials Science and Engineering, Green Hydrogen Research Center, Yokohama National University, Yokohama, Japan), Akimitsu Ishihara, Shihong Yin, Mitsuharu Chisaka, Masashi Matsumoto, Hideto Imai, Yuji Kohno, Koichi Matsuzawa, Shigenori Mitsushima, Ken-ichiro Ota

Enhancement of oxygen reduction activity of zirconium oxide-based electrocatalysts for PEFC cathode

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Ivonne Karina Pena Arias (Department of Process Systems Engineering, Max Planck Institute Dynamics of Complex Technical Systems, Magdeburg, Germany), Sebastian Kirsch, Richard Hanke-Rauschenbach, Kai Sundmacher

Experimental study of autonomous oscillations and patterns in a PEM fuel cell operated with H_2/CO mixtures

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Francisco Jose Perez-Alonso (Institute of Catalysis and Petrochemistry, CSIC, Madrid, Spain), Carlota Domínguez Fernández, Mohammed A. Salam, Jose Luis Gomez, Miguel Antonio Peña, Sergio Rojas

Influence of the electrolyte for the oxygen reduction reaction activity with Fe/N/C based catalysts

s04-143

Tiziana Ruiu (Institute of Technical Thermodynamics, German Aerospace Center (DLR), Stuttgart, Germany), Andreas Dreizler, Daniel García Sánchez, Erich Gülzow

A PEMFC Stack with Extended Operating Temperature Range up to 120 °C and Related Water Management Considerations

s04-144

Monica Santamaria (Electrochemical Materials Science Laboratory, DICAM, Università di Palermo, Palermo, Italy), Patrizia Bocchetta, Lucia Di Pasquale, Alberto Ferraro, Claudio Maria Pecoraro, Francesco Di Quarto

Chitosan-heteropolyacid complex as high performance membranes for low temperature H_2-O_2 fuel cell

s04-145

Silver Sepp (Institute of Chemistry, University of Tartu, Tartu, Estonia), Jaak Nerut, Eneli Härk, Kersti Vaarmets, Indrek Tallo, Ester Tee, Alar Jänes, Enn Lust

Oxygen Electroreduction Studied on Carbon Materials Synthesized from SiC and Post-Activated with Reactive Gases

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Sae Shibata (Department of Chemistry, Ochanomizu University, Bunkyo-ku, Japan), Misako Hirota, Haruna Nagai

Construction of Pt Ultrathin Layers on Co Surface Using Galvanic Replacement

s04-147

Kazuma Shinozaki (Department of Chemistry, Colorado School of Mines, Golden, USA), Jason Zack, Svitlana Pylypenko, Bryan Pivovar, Shyam Kocha

Analysis of the Effect of Thin-film Properties on the Measured ORR Activity in RDE Studies

s04-148

Gustav Sievers (Department of Catalytic Materials, Institute for Plasma Science and Technology, Greifswald, Germany), Angela Kruth, Volker Brüser

Mesoporous Pt Catalysts by Alternating Sputtering

s04-149

Yasumasa Takagi (Department of Molecular Structure, Institute for Molecular Science, Okazaki, Japan), Heng Wang, Yohei Uemura, Oki Sekizawa, Tomoya Uruga, Mizuki Tada, Yasuhiro Iwasawa, Toshihiko Yokoyama

In-situ Investigation of an Oxidation Reaction on a Pt/C Electrode Using Ambient Pressure Hard X-ray Photoelectron Spectroscopy

s04-150

Li Wang (Institute of Technical Thermodynamics, German Aerospace Center, Stuttgart, Germany), Marc Widenmeyer, Aldo Saul Gago, Pawel Gazdzicki, Norbert Wagner, Rainer Niewa, K. Andreas Friedrich

Oxynitride Catalysts for ORR in Acid and Alkaline Medium

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Heng Wang (Department of Materials Molecular Science, Institute for Molecular Science, Okazaki, Japan), Yasumasa Takagi, Yohei Uemura, Oki Sekizawa, Tomoya Uruga, Mizuki Tada, Yasuhiro Iwasawa, Toshihiko Yokoyama

In situ ambient pressure X-ray photoelectron spectroscopy studies of oxidation reaction on Pt nanoparticles

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Klaus Wippermann (IEK-3, Forschungszentrum Jülich, Jülich, Germany), Jürgen Wackerl, Carsten Korte, Werner Lehnert

Proton conducting Ionic Liquids as Substitutes for Phosphoric Acid in High Temperature PEM Fuel Cells

s04-153

Yoshinori Yamashita (Department of Materials Science and Technology, Nagaoka University of Technology, Niigata, Japan), Kazutaka Sato, Sayoko Shironita, Minoru Umeda

Carbon Dioxide Reactivity at Pt-based Anode Catalyst of Polymer Electrolyte Fuel Cell

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Weiqi Zhang (Department of Materials Science and Technology, Nagaoka University of Technology, Niigata, Japan), Sayoko Shironita, Minoru Umeda

Anode and Cathode Degradation Modeling of Polymer Electrolyte Fuel Cell Using a Porous Microelectrode

s04-155

Yuanyuan Zhao (FC-Cubic, FC-Cubic, Tsukuba, Japan), Eiji Tsuchida, Yoong-Kee Choe, Tamio Ikeshoji, Akihiro Ohira

First-principles Calculations on the Structure and Dynamic Properties of New Hydrocarbon Copolymer Used in Fuel Cells

SOFC

s04-156

Stella Balomenou (CPERI, CERTH, Thessaloniki, Greece), Ioanna Petrakopoulou, Dimitrios Tsiplakides

Triode Operation of Hydrocarbon Fueled SOFCs

s04-157

Symeon Bebelis (Department of Chemical Engineering, University of Patras, Patras, Greece), Vassilios Kournoutis, Frank Tietz

Electrochemical Characterization of the $La_{0.8}Sr_{0.2}Co_{0.2}Fe_{0.8}O_{3-\delta}/CeO_2(Gd_2O_3)/ZrO_2(Y_2O_3)$ System under Polarization Conditions

s04-158

Priscilla Caliandro (Institute of Mechanical Engineering, Faculty of Engineering, École Polytechnique fédérale de Lausanne, Lausanne, Switzerland), Arata Nakajo, Stefan Diethelm, Jan Van Herle

Triode Solid Oxide Fuel Cell Electrochemical Model Validated by Electrochemical Impedance Spectroscopy

s04-159

Jong Hoon Joo (Advanced Materials & Devices Laboratory, Korea Institute of Energy Research, Daejeon, Korea), Jaewon Jeong, Se Young Kim, Chung-Yul Yoo, Hee Jung Park, Ji Haeng Yu

Mosaic-Shaped Cathode for Highly Durable SOFC under Thermal Stress

s04-160

Hiroyuki Kato (Applied Physics, Tokyo University of Science, Katsushika, Tokyo, Japan), Masaki Kobayashi, Hiroshi Kumigashira, Tohru Higuchi

Electron and Ion Mixed Conductions of $Ce_xSr_{1-x}TiO_{3-\delta}$ Thin Films Prepared by RF Magnetron Sputtering

s04-161

Ho-Sung Kim (Energy & Applied Optics Research Group, Korea Institute of Industrial Technology (KITECH), Gwangju, Korea), Hyeon-Jong Jeon, Kyeong-Joon Kim, Seung-Woo Choi

Synthesis and electrochemical performance of Yb doped ScSZ electrolyte materials for IT-SOFC

s04-162

Seung-Bok Lee (Fuel Cell Research Center, Korea Institute of Energy Research, Daejeon, Korea), Wandi Wahyudi, Rak-Hyun Song, Jong-Won Lee, Tak-Hyoung Lim, Seok-Joo Park

Microstructural Characterization of NiO-YSZ Anode Support for SOFCs by Image Analysis Technique

s04-163

Hossein Madi (Department of Mechanical Engineering, FUELMAT Group, EPFL, Lausanne, Switzerland)

Study of the effect of H_2S on SOFC Anode Material by Electrochemical Impedance Spectroscopy

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Aditya Maheshwari (Institute of Inorganic Chemistry, University of Muesnter, Muenster, Germany), Aditya Maheshwari, Hans-Dieter Wiemhöfer

Various Doping and Co-doping Strategies in CeO_2: Desired Electrolyte for SOFCs

s04-165

Hidetoshi Nagamoto (Department of Environmental and Energy Chemistry, Kogakuin University, Hachioji, Japan)

Enhanced Performance of $La_{0.5}Sr_{0.5}Co_{1-x}Ti_xO_{3-\delta}$ Air Electrodes by Phase Decomposition

s04-166

Arata Nakajo (FuelMAT Group, Faculty of Engineering (STI), École Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland), Marco Cantoni, Matthew B. DeGostin, Alex P. Cocco, George J. Nelson, Aldo A. Peracchio, Brice N. Cassenti, Wilson K. S. Chiu, Jan Van herle

Degradation of LSM-YSZ cathodes during exposure tests analyzed by focused ion beam–scanning electron microscopy

s04-167

Asuka Oda (Applied Physics, Tokyo University of Science, Tokyo, Japan), Masaki Kobayashi, Hiroshi Kumigashira, Tohru Higuchi

Structural and Electrical Properties of $BaPrO_3$ Thin Film Prepared by RF Magnetron Sputtering

s04-168

Keiichi Ueda (Department of Materials Science, University of Hyogo, HImeji, Japan), Atsushi Mineshige, Hideki Yoshioka, Tetsuo Yazawa

Oxyapatite Glass-Ceramics as Novel Electrolytes for Solid Oxide Fuel Cells

s04-169

Hideki Yoshioka (Materials and Analysis Division, Hyogo Prefectural Institute of Technology, Kobe, Japan), Mitsumasa Sakao, Tsuguo Ishihara, Hiroyuki Mieda, Atsushi Saito, Atsushi Mineshige, Tetsuo Yazawa, Ryohei Mori

Fuel Cell Properties of Anode Supported SOFCs using Pasted Apatite-type Lanthanum Silicate Films

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Symposium 5: Electrochemical Energy Conversion and Storage: Batteries

Advanced materials for batteries

s05-001

Hatem Akbulut (Metallurgical and Materials Engineering, Sakarya University, Engineering Faculty, Sakarya, Turkey), Tugrul Cetinkaya, Seyma Ozcan, Mahmud Tokur, Mehmet Oguz Guler

Optimized Graphene/a-MnO_2 Nanocomposite Cathodes for High Capacity Li-O_2 Batteries

s05-002

Yusuke Asari (Central Research Laboratory, Hitachi, LTD., TOKYO, Japan), Yuji Suwa, Tomoyuki Hamada, Van an Dinh, Jun Nara, Takahisa Ohno

First-principles Study of Two-phase Boundary of $LiFePO_4$

s05-003

Yury Baikov (Department of Solid State Physics, Ioffe Physical Technical Institute of RAS, St-Petersburg, Russia)

Hydroxide ion as promising proton acceptor and electrochemically active species in little known heterostructures solid alkaline protonic-electronic conductors

s05-004

Jeng-Kuei Chang (Institute of Materials Science and Engineering, National Central University, Jhong-Li, Taiwan), Xu-Feng Luo, Yi-Chen Wang, Cheng-Hsien Yang

Reduced Graphene Oxide as an Anode Material for Sodium-ion Batteries

s05-005

Chun-Yi Chen (Research Institute for Science and Engineering, Waseda University, Tokyo, Japan), Tokihiko Yokoshima, Hiroki Nara, Toshiyuki Momma

SnS_2/SnO_2/C Hierarchical Heterostructures for Li-ion Batteries Anode with High Rate Capabilities

s05-006

Sungho Choi (Department of Advanced Battery Materials Group, Korea Research Institute of Chemical Technology, Daejeon, Korea), Sue Jin Kim, Young Jun Yun, Sunho Jeong, Sun Sook Lee, Ha-kyun Jung

Facile Synthesis of MnOx/reduced Graphene Oxide Composites for High Performance Lithium Rechargeable Battery Electrodes

s05-007

Francesca Colo (Department of Applied Science and Technology - DISAT, Politecnico di Torino, Torino, Italy), Nerino Penazzi, Giuseppina Meligrana, Claudio Gerbaldi, Michela Di Stefano, Matteo Destro, Federico Bella, Jijeesh R. Nair

Novel Cellulose-based Composite Polymer Electrolytes for Green All-solid Na-ion Batteries

s05-008

Koichi Hamamoto (Advanced Manufacturing Research Institute, National Institute of Advanced Industrial Science and Techno, Nagoya, Japan), Toshiaki Yamaguchi, Hirofumi Sumi, Toshio Suzuki, Yoshinobu Fujishiro

Bilayer Solid Electrolyte for All-solid-state Lithium-ion Battery

s05-009

Minoru Inaba (Department of Molecular Chemistry and Biochemistry, Doshisha University, Kyotanabe, Japan), Takashi Okubo, Yuta Masuo, Takayuki Doi, Akira Tomita, Chihiro Sakakibara, Akika Kamei, Masato Hirota, Toshio Takenaka

Importance of Additives on Cycleability of Pure Silicon Nano-flake Anodes in Lithium-ion Cells

s05-010

Jan Kaspar (Institut für Materialwissenschaft, Technische Universität Darmstadt, Darmstadt, Germany), Mahdi Seifollahi Bazarjani, Ralf Riedel

Electrochemical performance of mesoporous NiO nanosheets as advanced anode for Li-ion batteries

s05-011

Christian Kuss (Department of Chemistry, Université du Québec à Montréal, Montréal, Canada), Guoxian Liang, Steen Brian Schougaard

An atomistic model of the complete $LixFePO_4$ ($0 \leq x \leq 1$) system

s05-012

Marie Lachal (LEPMI, Grenoble-INP, Saint Martin d'Hères, France), Suzy Surblé, Cécile Rossignol, Renaud Bouchet, Fannie Alloin, Saïd Obbade

Kinetic and mechanisms of the chemical delithiation process of olivine $LiFePO_4$

s05-013

Bernard Lestriez (Institut des Matériaux Jean Rouxel, Université de Nantes, CNRS, Nantes, France), Binh Phuong Nhan Nguyen, Manuella Cerbelaud, Raphaël Fredon, Erik Kelder

Design of the formulation of $LiNi_{0.5}Mn_{1.5}O_4$ based positive electrode for Lithium ion battery applied to electric traction

s05-014

Jun-Tao Li (College of Energy, Xiamen Uinversity, Xiamen, China), Ya-Ping Deng, Fang Fu, Huang Ling, Shi-Gang Sun

Synthesis and Electrochemical Performances of Lithium-rich Layered Cathode Materials with High Capacity

s05-015

Jun-Tao Li (College of Energy, Xiamen Uinversity, Xiamen, China), Ling Huang, Qian Zhang, Zhan-Yu Wu, Ling Huang, Shi-Gang Sun

High-performance Si-based Anode of Lithium-ion Battery

s05-016

Rui Liang (Department of Chemical and Biomolecular Engineering, The Hong Kong University of Science and Technology, Hong Kong, China), Guohua Chen

A Polydopamine-coated Sulfur/Carbon Composite as a Cathode Material for Lithium/Sulfur Batteries

s05-017

Jiwei Ma (Institut für Informatik VI, Technische Universität München, Garching, Germany), Jiwei Ma, Lukas Seidl, Oliver Schneider, Ulrich Stimming

Nanostructured oxide-based electrode materials for advanced Li-ion batteries

s05-018

Jijeesh R. Nair (Department of Applied Science and Technology - DISAT, Politecnico di Torino, Torino, Italy), Claudio Gerbaldi, Luca Porcarelli, Federico Bella, Matteo Destro, Nerino Penazzi

Novel Multipurpose Polymer Electrolytes for Smart and Efficient Energy Power Sources

s05-019

Petr Novák (Electrochemistry Laboratory, Paul Scherrer Institute, Villigen, Switzerland), Christa Bünzli, Dario Cericola, Thomas Hucke, Michael E. Spahr, Juan Luis Gómez-Cámer

Electrochemistry of Carbon/Silicon Electrodes

s05-020

Eun-Suok Oh (Department of Chemical Engineering, School of Chemical Engineering, University of Ulsan, Ulsan, Korea), Dong-Won Jung, Jae-Hun Jeong

Synthesis of a Lamellar-Structured Potassium Iron Oxide and its Application to Lithium-ion Battery Anodes

s05-021

Francois Ozanam (Physique de la Matiere Condensee, CNRS-Ecole Polytechnique, Palaiseau, France), Abdelhak Cheriet, Larbi Touahir, Daniel Alves Dalla Corte, Jean-Noel Chazalviel, Catherine Henry de Villeneuve, Ionel Solomon, Aissa Keffous, Noureddine Gabouze, Catherine Pereira-Nabais, Jolanta Swiatowska, Michel Cassir, Philippe Marcus, Michel Rosso

Improvement of Silicon Anodes for Li-ion Batteries by Incorporation of Methyl Groups

s05-022

Julie Pires (Department of Chemistry, Université François Rabelais, Laboratoire PCM2E, Tours, France), Jesùs Santos-Peña, Laure Timperman, Erwan Dumont, Cécile Tessier, Mérièm Anouti

A Comparative Study of Electrolyte Additives for Batteries Based on Lithium-rich Lamellar Oxide Cathodes

s05-023

Martin Reichardt (Electrochemical Energy Storage Section, Paul Scherrer Institut, Villigen PSI, Switzerland), Claire Villevieille, Petr Novák, Sébastien Sallard

Lithium chromium pyrophosphate as new insertion material for Li-ion batteries

s05-024

Sébastien Sallard (Elecrochemistry Laboratory, Paul Scherer Institut, Villigen PSI, Switzerland), Elias Castel, Claire Villevieille, Petr Novák

One-pot synthesis by anhydrous sol-gel chemistry of mixtures of greigite and magnetite, and their use for electrodes in Li-ion batteries

s05-025

Lionel Santinacci (Center for Interdisciplinary Nanoscience of Marseille, Aix-Marseille University, CNRS, Marseille, France), Nareerat Plylahan, Maïssa Barr, Loïc Assaud, Margrit Hanbücken, Thierry Djenizian

Fabrication of Composite Li-ions Negative Electrode by Atomic Layer Deposition of SnO_2 onto TiO_2 Nanotubes

s05-026

T. Jane Stockmann (Laboratoire d'Electrochimie Physique et Analytique, École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland), Michael Scanlon, Hubert Girault

Evaluation of Li^+ and proton transport in protic phosphonium ionic liquids using biphasic elelctrochemistry

s05-027

Yiping Tang (School of Materials Science and Engineering, Zhejiang University of Technology, Hangzhou, China)

Structural features and phase transformation of TiO_2 nanowire arrays formed on titanium substrate by a facile method

s05-028

Mahmud Tokur (Department of Metallurgical & Materials Engineering, Sakarya University, Sakarya, Turkey), Mahmud Tokur, Hasan Algul, Tugrul Cetinkaya, Mehmet Uysal, Mehmet Oguz Guler, Hatem Akbulut

Stability of N-methyl-2-pyrrolidone Based Composite Polymer Electrolytes in Lithium Oxygen Batteries

s05-029

Ivan Trussov (Department of Chemistry, Al-Farabi Kazakh National University, Almaty, Kazakhstan), Andrey Kurbatov, Maxim Lepikhin, Alina Galeyeva

Influence of MW Assisted Synthesis Condition on $LiFePO_4$ Forming

s05-030

Dong-Ying Tzou (Department of Chemical Engineering and Materials Science, Yuan Ze University, Chung-Li, Taiwan), Chien-Te Hsieh, Yu-Fu Chen, Cheng-En Lee

Synthesis of Aluminum-doped Lithium Nickel Cobalt Oxide Cathode Materials by Induction Heating Technique

s05-031

Jiri Vondrak (Department of Electrotechnology, Faculty of Electrical Engineering and Communications, TU Brn, Brno, Czech Republic), Josef Maca, Marie Sedlarikova

Safe Electrolytes for Lithium Batteries with High Cell Voltage

s05-032

Liming Wu (Institute of Physical Chemistry & MEET Battery Research Cent, University of Muenster, Muenster, Germany), Daniel Buchholz, Dominic Bresser, Stefano Passerini

Anatase TiO_2 nanoparticles as High Power Anode for Sodium ion Batteries

s05-033

Tomohiro Yoshida (Department of Graduate School of Science and Engineering, Yamaguchi University, Ube, Japan), Masahiro Miura, Yuki Morita, Hiroaki Okamoto

Electrochemical Properties of The Gel Electrolyte Formed From Novel Low Molecular-mass Organic Gelator

s05-034

Hee-Chang Youn (Department of Material Science and Engineering, Yonsei University, Seoul, Korea), Kwang-Bum Kim

Graphene Wrapped Selenium as a Cathode Material for Lithium-Selenium Secondary Battery Applications

s05-035

Aishui Yu (Department of Chemistry, Fudan University, Shanghai, China), Tao Huang, Xiujing Lin

Free-standing Electrodes Used in Lithium-oxygen Batteries

s05-036

Lijuan Zhang (Advanced Materials Laboratory, Fudan University, Shanghai, China)

Metal-Organic Frameworks as Electrode Materials for Lithium Ion Battery

s05-037

Guoqu Zheng (School of Materials Science and Engineering, Zhejiang University of Technology, Hangzhou, China)

TiO_2(B) nanowire arrays as three-dimensional anode for lithium ion batteries

Aging phenomena

s05-038

Ting Guan (Institute of Advanced Chemical Power Sources, Harbin Institute of Technology, Harbin, China), Yunzhi Gao, Xinqun Cheng, Pengjian Zuo, Chunyu Du, Geping Yin

Method of Accelerated Aging Based on the Degradation Mechanism of $LiCoO_2$/MCMB Battery

s05-039

Simon Hein (Department of Computational Electrochemistry, German Aerospace Center and Helmholtz Institute Ulm, Ulm, Germany), Mathias Petzl, Michael Danzer, Arnulf Latz

Simulation of Lithium Plating in electrode microstructures

s05-040

Abdilbari Shifa Mussa (Chemical Engineering and Technology, The Royal Institute of Technology (KTH), Stockholm, Sweden), Matilda Klet, Rakel Wreland Lindström, Göran Lindbergh, Mårten Behm

Side reaction rate dependence on the state of charge at the graphite electrode

s05-041

Tim Nordh (Department of Chemistry Ångström, Uppsala University, Uppsala, Sweden), Rickard Eriksson, Maria Hahlin, Carl Tengstedt, Mihaela Giorgi, Mårten Rooth, Daniel Brandell, Kristina Edström

Manganese Dissolution in $Li_4Ti_5O_{12}||LiMn_2O_4$ Battery Cells Investigated by XPS and NEXAFS

s05-042

Hai-Jung Peng (General Energy Research Department, Paul Scherrer Institut, Villigen, Switzerland), Claire Villevieille, Sigita Urbonaite, Hannes Wolf, Klaus Leitner, Petr Novák

Influence of Electrolyte on the Performance and Lifetime of NCM Family Materials

s05-043

Shuichi Taniguchi (Department of Materials Science and Technology, Nagaoka University of Technology, Niigata, Japan), Omar S. Mendoza-Hernandez, Hiroaki Ishikawa, Yoshitsugu Sone, Minoru Umeda

Comparison of Apparent Thermal Deterioration and Charge/discharge Activation Energies of Commercial Lithium-ion Secondary Cell

In situ and *ex situ* characterization methods

s05-044

Alfred Amon (Mobility Department, Electric Drive Technology, Austrian Institute of Technology, Vienna, Austria), Erwin Rosenberg, Atanaska Trifonova

In-situ Characterization of Gaseous Emissions from Lithium Ion Batteries by Coupled FTIR-GC/MS

s05-045

Zachary Barton (Department of Chemistry, University of Illinois at Urbana-Champaign, Urbana, USA), Burton Simpson, Mei Shen, Joaquín Rodríguez-López

In Situ Nano-imaging of Li-ion Battery Interfaces

s05-046

Peter Bleith (Electrochemical Energy Storage Section, Paul Scherrer Institut, Villigen PSI, Switzerland), Petr Novák, Claire Villevieille

Combined in situ XRD and XAS studies on materials for Li-ion batteries

s05-047

Natalia Andrea Cañas (Institute of Technical Thermodynamics, German Aerospace Center (DLR), Stuttgart, Germany), David N. Fronczek, Norbert Wagner, Arnulf Latz, K. Andreas Friedrich

Experimental and Theoretical Analysis of Discharge Process in Lithium-sulfur Batteries

s05-048

Andreas Dunst (Institute for Chemistry and Technology of Materials, University of Technology, Graz, Austria), Michael Sternad, Viktor Epp, Martin Wilkening

Li Self-Diffusion in Amorphous Li/Si Prepared from Monocrystalline Si - A Li NMR Relaxometry Study

s05-049

Antonio Guerrero (Department of Physics, Universitat Jaume I, Castelló, Spain), Nuria Vicente, Gonzalo Molina, Marta Haro, Germà Garcia Belmonte

Probing lithiation kinetics of conversion-reaction battery materials

s05-050

Asim Khan (School of Chemistry, University of New South Wales, Sydney, Australia), Chuan Zhao

Ionic Liquid-based Mixed Electrolyte for High Performance Rechargeable Li-O_2 Batteries

s05-051

Reinhold Koch (RP6, TUM CREATE, Singapore, Singapore), Christian Vergote, Patrick Osswald, Andreas Jossen, Robert Kuhn

Direct and Indirect Measurement of Reversible and Irreversible Heat in Lithium-ion Batteries

s05-052

Christian Kuss (Department of chemistry, Université du Québec à Montréal, Montréal, Canada), David Lepage, Murielle Carmant-Dérival, Ngoc Duc Trinh, Guoxian Liang, Steen Brian Schougaard

'Chemical Cycling' of $LiFePO_4$ – A Look at its Ultra-Fast Kinetics under Optimal Conditions.

s05-053

Elena Kuzmina (Department of Physical Chemistry, IOChem USC RAS, Ufa, Russia), Vladimir Kolosnitsyn, Sergey Mochalov, Azat Nurgaliev

The effect of temperature and current density on the energy conversion efficiency of lithium-sulphur batteries

s05-054

Matthew Lacey (Department of Chemistry, Ångström Laboratory, Uppsala University, Uppsala, Sweden), Carl Tengstedt, Anurag Yalamanchili, Kristina Edström, Daniel Brandell

A Study of the Anode in the Lithium-sulfur System and its Influence on Cycle Life

s05-055

Patrick Lanz (General Energy Research Department, Paul Scherrer Institute, Villigen PSI, Switzerland)

Investigation of Electrode Materials for Lithium-ion Cells by Combined In Situ Raman and IR Microscopy

s05-056

Hiroki Nara (Faculty of Science and Engineering, Waseda University, Tokyo, Japan), Daikichi Mukoyama, Tokihiko Yokoshima, Toshiyuki Momma, Tetsuya Osaka

Impedance Analysis for Deterioration Evaluation of Laminated Lithium-ion Battery Containing Vinylene Carbonate Additive with Micro Reference Electrode

s05-057

Petr Novák (Electrochemistry Laboratory, Paul Scherrer Institute, Villigen, Switzerland), Elias Castel, Erik J. Berg, Claire Villevieille

Gas evolution from Li_2MnO_3-stabilized $Li(Ni_xCo_yMn_z)O_2$ electrode materials at different cycling temperatures: a DEMS study.

s05-058

Silvia Real (Department of Electrochemistry, INIFTA University of La Plata, La Plata, Argentina), Mariela Ortiz, Elida Castro

Effect of Different Additives on the Electrochemical Behaviour of Nickel Hydroxide Electrodes Employed in Batteries

s05-059

Vanesa Ruiz (Institute for Energy and Transport, European Commission, DG Joint Research Centre, Petten, Netherlands), Akos Kriston, J. Ungeheuer, Theodora Kosmidou, Denis Dams, Natalia Lebedeva, Andreas Pfrang, Lois Boon-Brett

A New Energy Storage Safety Testing Facility for Electromobility: The BESTEST Project

s05-060

Vanesa Ruiz (Institute for Energy and Transport, European Commission, DG Joint Research Centre, Petten, Netherlands), Akos Kriston, Emilio Napolitano, Andreas Pfrang, Natalia Lebedeva, Lois Boon-Brett

Development of IR and optically transparent battery cells and their application for *in situ* evaluation of Li-ion battery ageing

s05-061

Ricardo Schrebler (Department of Chemistry, P Catholic University, Valparaiso, Chile), Luis Ballesteros, Ana Burgos, Paula Grez, Rodrigo Schrebler, Humberto Gómez, Ricardo Cordova, Eduardo Muñoz

Comparative study of the water oxidation on α-Fe_2O_3 nanotube photoanodes obtained by sonoelectrochemical technique onto iron sheets

s05-062

Isao Shitanda (Department of Pure and Applied Chemistry, Tokyo University of Science, Chiba, Japan), Taiki Kawado, Keiichiro Honda, Yoshinao Hoshi, Masayuki Itagaki, Atsuhisa Fukuizumi, Shigeo Aoyagi

In-situ Electrochemical Impedance Measurement System for Healthcare of Lithium Battery

s05-063

Yoshiharu Uchimoto (Graduate School of Human and Environmental Studies, Kyoto University, Kyoto, Japan)

Reaction distribution on composite electrode of lithium-ion batteries

s05-064

Tokihiko Yokoshima (Faculty of Science and Engineering, Waseda University, Shinjuku, Japan), Daikichi Mukoyama, Hidehiko Isawa, Yumiko Ito, Hiroki Nara, Toshiyuki Momma, Yasurou Mori, Tetsuya Osaka

Introduction of Square-current Electrochemical Impedance Spectroscopy (SC-EIS) to Diagnosis Technology of Lithium Ion Battery

s05-065

Giorgia Zampardi (Analytical Chemistry, Ruhr-University Bochum, Bochum, Germany), Fabio La Mantia, Wolfgang Schuhmann

Stability and Insulating Properties of the Solid Electrolyte Interphase on Carbonaceous Materials Using Scanning Electrochemical Microscopy

Lithium ion batteries

s05-066

Docheon Ahn (Beamline Research Division, Pohang Accelerator Laboratory, Pohang, Korea), Kug-Seung Lee, Jeong Hui Son, Ha Na Won, Yongjae Lee, Sung Jong Yoo, Il-Kyu Park

Effect of Various Cation Substitutions on the Structure and Electrochemical Properties of Mn Based Olivine Cathode Materials

s05-067

Pamina Bohn (I/PG-B5E, AUDI AG, Ingolstadt, Germany), Lidiya Komsiyska, Gunther Wittstock

Analysis of the influence of a short term thermal stress on the performance and the characteristics of lithium-ion cells

s05-068

Stefanie Braun (Institute of Technical Thermodynamics, German Aerospace Center, Stuttgart, Germany), Arnulf Latz

A Thermodynamically Consistent Model for Electric Double Layers in Li All-solid-state Batteries

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Chenwei Cao (Department of Physics and Materials Science, City University of Hong Kong, Hong Kong, China), Fanji Yuan, C.Y. Chung

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Anne Westphal (Electrical Energy Storage, Fraunhofer IFAM, Oldenburg, Germany), Johannes Neumann, Philipp Thiele, Ralf Ludwig

Electrical Energy Storage by a Mg/CuS Accumulator

s05-178

Juqin Zeng (Department of Applied Science and Technology, Politecnico di Torino, Turin, Italy), Carlotta Francia, Alessandro H.A. Monteverde Videla, Silvia Bodoardo, Stefania Specchia, Penazzi Nerino

Reduced Graphene Oxide as Cathode Materials for Rechargeable Li-O_2 Cells

Reactions at interfaces in batteries

s05-179

Ewelina Bolimowska (CEA-Liten, CPE Lyon, CEA-Liten, Université de Lyon, Institut de Chimie de Lyon, Grenoble, France), Catherine Santini, Helene Rouault

Investigation of the solid electrolyte interphase between graphite electrode/ionic liquid electrolyte

s05-180

Lucien Boulet (ECL-ENE, Paul Scherrer Institute, Villigen, Switzerland), Mario El Kazzi, Petr Novák, Claire Villevieille

Full cells HE-NCM vs. graphite: Cycling rate effects

s05-181

Ernesto Julio Calvo (Inquimae, Facultad de Ciencias Exactas y Naturales, Univ. Buesnos Aire, Buenos Aires, Argentina)

The Oxygen Electroreduction Reaction in $LiPF_6$ DMSO: Effect of the Electrode Surface

s05-182

Mario El Kazzi (General Energy, Paul Scherrer Institut (PSI), Villigen, Switzerland), Erik Jämstorp Berg, Claire Villevieille, Petr Novák

Electrochemical Performance and XPS Surface Analyses of HE-NCM|LTO Cells in (LP30 vs. IL) Electrolytes

s05-183

Attila Farkas (Helmholtz Institute Ulm (HIU), Karlsruhe Institute of Technology, Ulm, Germany), Ji Yang Xu, Carsten Köntje, Timo Jacob

In-situ Quartz Crystal Microbalance Study of Lithium Deposition on Model Electrodes

s05-184

Aurélie Guéguen (Electrochemistry Laboratory, Paul Scherrer Institute, Villigen, Switzerland), Erik Jämstorp Berg, Petr Novák

XPS study of the evolution upon cycling of the interface layers on porous graphite electrodes for Li-O_2 batteries

s05-185

Minglong He (Electrochemical Energy Storage Section, Paul Scherrer Institut, Villigen PSI, Switzerland), Petr Novák, Erik Jämstorp Berg

Gas Evolution Reactions on Conductive Carbon Additives in Lithium-ion Batteries

s05-186

Hsin-Fu Huang (Chemical Engineering, National Taiwan University of Science and Technology, Taipei, Taiwan), Sunny Hy, Felix Felix, Yi-Hsiu Chen, Jyong-yue Liu, Bing Joe Hwang

In situ surface enhanced Raman spectroscopic studies of solid electrolyte interphase formation in lithium ion battery electrodes

s05-187

Jitti Kasemchainan (CR/ARM2, Robert Bosch GmbH, Gerlingen, Germany)

Effects on capacity retention in hybrid Li/S batteries

s05-188

Ulrike Langklotz (Institute of Material Science, Dresden University of Technology, Dresden, Germany), Christian Heubner, Michael Schneider, Alexander Michaelis

Investigations on the kinetics and thermodynamics of active materials for lithium ion batteries using a single particle electrode

s05-189

Laure Monconduit (Department of Chemistry, Institut Charles Gerhardt, Montpellier, France), Wanjie Zhang, Ali Darwiche, Hervé Martinez, Rémi Dedryvère, Fouad Ghamouss

The Role of the Electrode/Electrolyte Interphase in a promising anode material for Li-ion batteries

s05-190

Miguel Angel Oliver-Tolentino (CICATA, IPN, Mexico, Mexico), Ariel Guzmán-Vargas, Arturo Manzo-Robledo, Edilso Reguera

Electrochemical behavior of Na-ion deintercaltion/intercalation in $A_2Zn_3[Fe(CN)_6]_2$ (A= Na, K, Rb, Cs) in aqueous solution

s05-191

Hieu Quang Pham (Department of Fine Chemical Engineering & Applied Chemistry, Chungnam National University, Daejeon, Korea), Kyoung-Mo Nam, Eui-Hyeong Hwang, Young-Gil Kwon, Seung-Wan Song

Achieving High-energy Lithium-ion Batteries Based on 4.8 V Li-rich and Mn-rich Layered Cathode and High-voltage Electrolyte Additive

s05-192

Helene Ritter (Corporate Research, Robert Bosch GmbH, Gerlingen- Schillerhöhe, Germany), Sarra Moumen, Tjalf Pirk, Olivier Schecker, Emil Roduner

Investigations of intermediate layers between lithium metal anode and Lipon electrolyte

s05-193

Nataliya Roznyatovskaya (Department of Applied Electrochemistry, Fraunhofer Institute for Chemical Technology, Pfinztal, Germany), Jens Noack, Karsten Pinkwart, Jens Tübke

Electrooxidative Pre-treatment of Electrode for Bromine/bromide Half-cell of Redox-Flow Batteries

s05-194

Fridolin Röder (Institute of Energy and Process Systems Engineering, TU Braunschweig, Braunschweig, Germany), Daniel Schröder, Ulrike Krewer

Novel model approach to simulate dynamic electrochemical processes in inhomogeneous structures

s05-195

Jorge Seminario (Chemical Engineering, Texas A&M University, College Station, USA), Laura Benitez, Julibeth Martinez, Perla Balbuena

Current-voltage Characteristics of a Solid Electrolyte Interface (SEI) in Li-ion Batteries with Si Anodes

s05-196

Won-Kyung Shin (Department of Chemical Engineering, Hanyang University, Seoul, Korea), Sang-Hyung Kim, Hansu Kim, Cheolho Park, Dong-Won Kim

Study on the Interfacial Phenomena of Silicon Alloy Electrode for High Energy Density Lithium-ion Batteries

s05-197

Ann Mari Svensson (Department of, NTNU, Trondheim, Norway)

Stability of Carbon-conductive additives at high operating voltages in Li-ion cathodes

s05-198

Masahiro Toyoda (Department of Applied Chemistry, Oita University, Oita, Japan), Yasuhiko Arai, Kazuki Matsumura, Taro Kinumoto, Tomoki Tsumura

Evaluation of electrode properties of $Li-O_2$ battery using porous carbon after charge and discharge

s05-199

Fu-Ming Wang (Graduate Institute of Applied Science and Technology, National Taiwan University of Science and Technology, Taipei, Taiwan)

The effects of new anion formation between benzimidazole and pentafluoro phosphate by a Lewis acid-base reaction on lithium ion battery

s05-200

Fu-Ming Wang (Graduate Institute of Applied Science and Technology, National Taiwan University of Science and Technology, Taipei, Taiwan)

Understanding how to establish a useful SEI into lithium-ion battery

s05-201

Gunther Wittstock (Department of Chemistry, Carl v. Ossietzky University of Oldenburg, Oldenburg, Germany), Heinz Bülter, Fabian Peters, Julian Schwenzel

In Situ Investigation on Spatiotemporal Changes of SEI Properties

s05-202

Marc Zimmermann (EI, LEPMI, Grenoble, France), Frédéric Maillard, David Aymé Perrot, Marian Chatenet

Determination of the Oxygen Reduction Reaction Mechanism on Glassy Carbon Surfaces in Dimethylsulfoxide Solution Containing Alkali Metal Cations

Redox flow batteries

s05-203

Zoraida González (Chemistry of Materials, Instituo Nacional del Carbón (INCAR-CSIC), Oviedo, Spain), Ana M. Pérez, Clara Blanco, Ricardo Santamaría, Marcos Granda, Patricia Alvarez, Rosa Menéndez

Graphene modified graphite felts as effective electrodes in the positive half-cell of vanadium redox flow batteries

s05-204

Min-Young Kim (Department of Energy & Applied Optics Research Group, Korea Institute of Industrial Technology (KITECH), Gwangju, Korea), Seung-Woo Choi, Hee Sook Noh

Dispersion Effect Achievable on Electrical Resistivity of Graphite/PVB/CNT Composite Film Prepared Via a Tape-casting Process

s05-205

Petr Mazur (New Technologies - Research Centre, University of West Bohemia, Plzen, Czech Republic), Jaromír Pocedic, Jiøí Vrána, Juraj Kosek

Kinetics enhancements of carbon-based electrode materials towards electrochemical reactions of vanadium redox couples

s05-206

Mahendra Nandanwar (Department of Chemical Eengineering, Indian Institute of Science, Bangalore, India), Sanjeev Kumar

Role of convection in determining cycle life of soluble lead-acid flow battery

s05-207

Ivan Vakulko (LCPME, Université de Lorraine and CNRS, Villers-lès-Nancy, France), Ivan Vakulko, Mathieu Etienne, Alain Walcarius

Carbon Nanomaterials for Redox Flow Batteries

s05-208

Qing Wang (Department of Materials Science and Engineering, National University of Singapore, Singapore, Singapore), Qizhao Huang, Feng Pan, James R. Jennings

Redox Flow Lithium-ion Batteries

s05-209

Jung Hoon Yang (Energy Storage Department, Korea Institute of Energy Research, Daejeon, Korea), Jae-Deok Jeon, Joonmok Shim

Naphthalene as Anodic Redox Couple in All-organic Redox Flow Battery

s05-210

Vadim Lvovich (Electrochemistry, NASA Glenn Research Center, Cleveland, USA) James Wu, William Bennett, Brianne DeMattia, Patricia Loyselle, Thomas Miller, Serene Farmer, Frederick Dynys, Dionne Hernandez-Lugo

Development of Li-metal battery cell chemistries at NASA Glenn Research Center

Late Registration

Seung-Wan Song (Dept of Fine Chemical Engineering & Applied Chemistry, Chungnam National University, Daejeon, Korea) Kyoung-Mo Nam, You-Mi Lee, Eu-Hyung Hwang, Young-Gil Kwon, Dong-Hyun Kang

Interfacial Origin of Performance Improvement and Fade for 4.6 V $LiNi_{0.5}Co_{0.2}Mn_{0.3}O_2$ Cathodes for High-Energy Lithium-ion Batteries

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Symposium 6: Electrochemical Energy Conversion and Storage: Capacitors

Applications of electroactive materials

s06-001

Minoru Umeda (Department of Materials Science and Technology, Nagaoka University of Technology, Niigata, Japan), Mitsuhiko Katagiri, Motoki Kunihiro, Norio Nagayama

Charge Transfer Property in Triphenylamine-derivative Single Crystal Prepared by Solution Method

Double layer

s06-002

JunHui Jeong (Department of Material Science and Engineering, Yonsei University, Seoul, Korea), Hyun-Kyung Kim, Hee-Chang Youn, Sang-Hoon Park, Ha-Kyung Roh, Kwang-Bum Kim

Synthesis of Crumpled Graphene Ball with Assistance of Ionic Liquid for High Performance Supercapacitor

s06-003

Tamás Pajkossy (Research Centre of Natural Sciences, Hungarian Academy of Sciences, Budapest, Hungary), Soma Vesztergom, Claus Müller, Timo Jacob

Potential of zero total charge (pztc) measurements on Au single crystals in ionic liquids

s06-004

Veronika Zinovyeva (UMR 8235 Laboratoire Interfaces et Systèmes Electrochimiques, Univ. P.& M. Curie, Paris, France), Céline Cannes, Hubert Cachet, Catherine Debiemme-Chouvy, Jacques de Sanoit, Claire Le Naour, Claude Deslouis

The Double Layer at [BuMeIm][Tf2N] - Pt or C Materials

Electrochemical capacitor

s06-005

Qamar Abbas (Institute of Chemistry and Technical Electrochemistry, Poznan University of Technology, Poznan, Poland), François Béguin

Effect of Binder on the Performance of AC/AC Electrochemical Capacitors in Salt Aqueous Electrolytes

s06-006

Wafa Al-Arjan (Department of Electrochemistry, University of Southampton, Southampton, United Kingdom), Andrew Hector

Controlling the microstructure and pore structure of $BaTiO_3$ toward composite materials

s06-007

Rogério Davoglio (Department of Chemistry, Federal University of São Carlos, São Carlos, Brazil), Sonia R. Biaggio, Romeu C. Rocha-Filho, Nerilso Bocchi

Flexible and High Surface Area Composites of Carbon Fiber, Polypyrrole, and Poly(DMcT) for Supercapacitor Electrodes

s06-008

Hui Dou (College of Materials Science & Engineering, Nanjing University of Aeronautics and Astronautics, Nanjing, China), Jinpeng Han, Guiyin Xu, Bing Ding, Xiaogang Zhang

Porous N-doped Carbon Microspheres Derived from Microporous POFs and Their Applications in Supercapacitors

s06-009

Dominika Gastol (Department of Chemical Technology, Poznan University of Technology, Poznan, Poland), Elzbieta Frackowiak

Development of AC/AC supercapacitor with modified surface of current collectors

s06-010

Dominika Gastol (Department of Chemical Technology, Poznan University of Technology, Poznan, Poland), Elzbieta Frackowiak

Enhancement of AC/AC supercapacitor performance in dibromodihydroxybenzene

s06-011

Zoraida González (Department of Chemistry of Materials, Instituo Nacional del Carbón (INCAR-CSIC), Oviedo, Spain), Patricia Díaz, Ricardo Santamaría, Marcos Granda, Rosa Menéndez, Clara Blanco

Enhancement of the energy density of carbon-based supercapacitors by adding inorganic redox species to aqueous electrolytes

s06-012

Katarzyna Grzejszczyk (Department of Chemistry, Warsaw University, Warsaw, Poland), Magdalena Skunik Nuckowska, Magdalena Blicharska, Krzysztof Stolarczyk, Renata Bilewicz, Nikolaos Vlachopoulos, Anders Hagfeldt, Pawel J. Kulesza

Hybrid integrated systems based on supercapacitors coupled with solar cells and biobatteries

s06-013

Krzysztof Jurewicz (Institute of Chemistry and Technical Electrochemistry, Poznan University of Technology, Poznan, Poland), Agata Pawlicka, Katarzyna Szatkowska, Sergiusz Bielawny, Monika Bartkowiak, Beata Doczekalska

Activated Carbons Based on Plant Waste Precursors for Supercapacitor with Li_2SO_4 Electrolyte

s06-014

Jin Hee Kang (Mechanical and Mechatronics Engineering, University of Waterloo, Waterloo, Canada), Shesha Jayaram, John Wen

Electrochemical and Thermal Characterization of a Graphene-based Electrochemical Double-layer Capacitor (EDLC)

s06-015

Ann Laheäär (Institute of Chemistry and Technical Electrochemistry, Poznan University of Technology, Poznan, Poland), Esther Gomez Calvo, Ana Arenillas, José Angel Menéndez, Indrek Tallo, Alar Jänes, Enn Lust, François Béguin

Self-discharge Processes of Ionic Liquid based Supercapacitors in Relation to Carbon Properties

s06-016

Haibo Lin (Department of physical Chemistry, College of Chemistry, Jilin University, Changchun, China), Wenli Zhang, Zhe Yang, Haiyan Lu, Tingting Liu

High Performance PbO_2/AC Asymmetric Electrochemical Capacitor Based on Lead Dioxide Electrode with Three-dimensional Porous Titanium as Substrate

s06-017

Xiaoqian Meng (Key Laboratory for Soft Chemistry and Functional Materials, Nanjing University of Science and Technology, Nanjing, China), Li Chen

Synthesis of Holey $Co(OH)_2$/$Ni(OH)_2$/Graphene Ternary Composite with Enhanced Electrochemical Performance

s06-018

Naohisa Okita (Applied Chemistry, Tokyo University of Agriculture and Technology, Tokyo, Japan), Kazuaki Kisu, Wako Naoi, Katsuhiko Naoi

Ultrafast $Li_3V_2(PO_4)_3$ Embedded into Surface Graphene Layers of Carbon Nano-fibers for SuperRedox Capacitor

s06-019

Justyna Piwek (Department of Applied Electrochemistry Division, Poznan University of Technology, Poznan, Poland), Anetta Platek, Piotr Skowron, Elzbieta Frackowiak

Study of Electrode Composition on Performance of Electrochemical Capacitors

s06-020

Anetta Platek (Department of Applied Electrochemistry Division, Poznan University of Technology, Poznan, Poland), Justyna Piwek, Elzbieta Frackowiak

Galvanostatic Cycling vs Floating for Supercapacitor Testing

s06-021

Paula Ratajczak (Institute of Chemistry and Technical Electrochemistry, Poznan University of Technology, Poznan, Poland), Krzysztof Jurewicz, François Béguin

Overcoming the electrochemical stability limits of aqueous electrolyte capacitors

s06-022

Morihiro Saito (Department of Applied Chemistry, Tokyo University of Agriculture and Technology, Koganei, Japan), Satoru Kawaharasaki, Kikuko Hayamizu, Shiro Seki

Analysis of Transport Properties of Ions and Solvent in Solution Electrolytes for Capacitors

s06-023

Wasim Sarwar (Mechanical Engineering, Imperial College London, London, United Kingdom), Monica Marinescu, Nigel Taylor, Gregory Offer

Development of a coupled electrical, thermal and degradation supercapacitor model for automotive applications

s06-024

Piotr Skowron (Faculty of Chemical Technology, Poznan University of Technology, Poznan, Poland), Elzbieta Frackowiak, François Béguin

New method for the determination of electrochemical potential window in AC/AC-symmetric supercapacitors by impedance spectroscopy

s06-025

Adam Slesinski (Institute of Chemistry and Technical Electrochemistry, Poznan University of Technology, Poznan, Poland), Paula Ratajczak, Krzysztof Jurewicz, Piotr Skowron, Elzbieta Frackowiak, François Béguin

Effect of operating conditions on gas evolution and electrochemical performance of capacitors in salt aqueous electrolyte

s06-026

Fleur Thissandier (LEMOH, CEA Grenoble, Inac/ SPrAM (UMR 5819-CEA-CNRS-UJF), Grenoble, France), Annaïg Le Comte, Olivier Crosnier, Nicolas Pauc, Gérard Bidan, Thierry Brousse, Pascal Gentile, Saïd Sadki

How silicon nanowires parameters influence micro-supercapacitors performances?

s06-027

Tsukasa Ueda (Department of Applied Chemistry, Tokyo University of Agriculture and Technology, Tokyo, Japan), Kenji Oshima, Natsuki Miyashita, Hiroto Hamada, Yoko Ishihara, Etsuro Iwama, Wako Naoi, Katsuhiko Naoi

$Li_4Ti_5O_{12}$/AC Hybrid Capacitor For High Voltage Operation

s06-028

Koki Urita (Graduate School of Engineering, Nagasaki University, Nagasaki, Japan), Nozomi Ide, Kosuke Isobe, Hiroshi Furukawa, Isamu Moriguchi

Advantage to Specific Carbon Microporous Structures for Electric Double-layer Capacitance

s06-029

Hirofumi Yoshikawa (Department of Chemistry, Nagoya University, Nagoya, Japan)

Energy Storage Devices Using Polyoxometalate/Graphene Nanohybrid Materials

Electrode/electrolyte interface

s06-030

Alexander Forse (Department of Chemistry, University of Cambridge, Cambridge, United Kingdom), John M. Griffin, Hao Wang, Céline Merlet, Nicole Trease, Volker Presser, Yury Gogotsi, Patrice Simon, Clare Grey

NMR Studies of the Charge Storage Mechanism of Supercapacitors

Film deposition methods

s06-031

Chun Huang (Department of Materials, University of Oxford, Oxford, United Kingdom), Patrick Grant

One-step Spray Processing of TiO_2-Nanoparticles/Ionomer Coatings on Carbon Nanotube Scaffolds for Solid-state Supercapacitors

s06-032

Hae-Min Lee (Department of Chemical Engineering, Ajou University, Suwon, Korea)

Effects of TTAB Concentration on the Electrodeposited Manganese Oxide for Electrochemical Capacitors

s06-033

Yun Mi Nam Koung (Department of Chemical Engineering, Ajou, Suwon, Korea), Hae-Min Lee

Addition of TTAB as a Surfactant for the Electrodeposition of Cobalt Oxide Films

Functional Materials

s06-034

Hae-Min Lee (Department of Chemical Engineering, Ajou University, Suwon, Korea), Gyoung Hwa Jeong, Sang-Wook Kim

A Facile Synthesis and Electrochemical Analysis of Cobalt Hydroxide/Graphene Nanocomposites

s06-035

Teresa Moura e Silva (Department of Mechanical Engineering, Instituto Superior de Engenharia de Lisboa, Lisbon, Portugal), Sónia Eugénio, Maria João Carmezim, Maria de Fátima Montemor

Simple route for the production of metal oxide-carbon hybrid composites for application as supercapacitor electrodes

s06-036

Yun Mi Nam Koung (Department of Chemical Engineering, Ajou, Suwon, Korea), Hae-Min Lee

Electrodeposition and Electrochemical Analysis of Ternary Metal Oxides for Supercapacitors

s06-037

Houzhao Wan (School of Optical and Electronic Information, Huazhong University of Science and Technology, Wuhan, China), Jianjun Jiang, Yunjun Ruan, Ling Miao

Simple synthesis of nickel phosphite nanorods and their application to supercapacitors

s06-038

Kui Xu (School of Optical and Electronic Information, Huazhong University of Science and Technology, Wuhan, China), Houzhao Wan, Yunjun Ruan, Ling Miao, Jianjun Jiang

Rapid microwave-assisted synthesis $Ni_3(PO_4)_2 \bullet H_2O$ nanoparticles for supercapacitors

Photocatalysts

s06-039

Alicia Gomis-Berenguer (Chemical Processes for Energy and Environment, Instituto Nacional del Carbon (INCAR,CSIC), Oviedo, Spain), Jesus Iniesta, Conchi O. Ania

Photoelectrochemical behaviour of hybrid carbon/semiconductor electrodes under UV-vis light

Pseudocapacitance

s06-040

Dianxue Cao (College of Material Science and Chemical Engineering, Harbin Engineering University, Harbin, China), Kui Cheng, Ran Liu, Jinling Yin, Guiling Wang

Porous 3D transition metal oxide-metal nanocomposites for energy storage devices

s06-041

Maria João Carmezim (DEM/ESTSetubal, Instituto Politecnico de Setubal, Setubal, Portugal), Raquel Duarte, R Silva, Sónia Eugénio, TM Silva, MF Montemor

CoNi Oxide Films for Supercapacitors: Role of Thermal Conditioning

s06-042

Chaopeng Fu (Department of Materials, University of Oxford, Oxford, United Kingdom), Patrick Grant

Low-cost production of supercapacitors based on industrial mill scale

s06-043

Veniamin Kondratiev (Department of Chemistry, St.Petersburg State University, St.Petersburg, Russia)

Synthesis and Electrochemical Characterization of Nanostructured Manganese Oxide –Poly-3,4-ethylendioxithiophene Composite Electrodes

s06-044

Mikolaj Meller (Institute of Chemistry and Technical Electrochemistry, Poznan University of Technology, Poznan, Poland), Krzysztof Fic, Elzbieta Frackowiak

Influence of Di- and Trihydroxybenzene Solutions on the Surface Functionality of Activated Carbon Electrodes

s06-045

Christine Mousty (Institut de Chimie de Clermont-Ferrand (ICCF UMR 6296), Université Blaise Pascal, Clermont-Ferrand, France), Pierre Vialat, Christine Taviot-Gueho, Fabrice Leroux

Highly Performing Supercapacitor Monometallic $Co^{II}Co^{III}$-CO_3 Layered Double Hydroxide

s06-046

Roman Mysyk (Department of Electrochemical Energy Storage, CIC Energigune, Miñano, Spain), Eider Goikolea, Damien Saurel, Montserrat Casas-Cabanas, Julie Segalini

Effect of Microstructure on Enhancing the Electrochemical Performance of β-MoO_3 as a Pseudocapacitor Material

s06-047

Paula Navalpotro (Unit of Electrochemical Processes, IMDEA Energy Institure, Móstoles, Spain), Jesus Palma, Marc Anderson, Rebeca Marcilla

Electrochemical performance of parabenzoquinone- $PYR_{14}TFSI$-based electrolyte in supercapacitors

s06-048

Jaromír Pocediè (Research Centre - New Technologies, University of West Bohemia, Pilsen, Czech Republic), Petr Mazur, Romana Fojtíková, Jiøí Maršálek, Juraj Kosek

Hybrid MnO_2/carbon supercapacitors – Effect of redox couples additions

s06-049

Kumar Raju (Energy Materials, Materials Science and Manufacturing, Council for Scientific & Industrial Research (CSIR), Pretoria, South Africa), Charl J. Jafta, Kenneth I. Ozoemena

One Spot Synthesis of NH_4NiPO_4 Nanorods as High Performance Pseudo Capacitive Electrode

s06-050

Zhaohui Wang (Department of Chemistry, The Angström Laboratory, Uppsala University, Uppsala, Sweden), Petter Tammela, Maria Stromme, Leif Nyholm

Enhanced Capacitive Storage Performance of Conducting Polymer@nanocellulose by Electrode Engineering

s06-051

Yu-Ting Weng (Department of Chemical Engineering, National Taiwan University, Taipei, Taiwan), Hsiao-An Pan, Rung-Chuan Lee, Nae-Lih Wu

Fabrication of novel hierarchical hollow manganese oxide nanospheres for high-voltage stability supercapacitors in aqueous electrolyte

Solar Energy Materials

s06-052

Jurga Juodkazyte (Department of Electrochemical Material Science, Center for Physical Sciences and Technology, Vilnius, Lithuania), Benjaminas Sebeka, Irena Savickaja, Arunas Jagminas, Vitalija Jasulaitiene, Algirdas Selskis, Jelena Kovger

Study on cuprous oxide stability in photoelectrochemical cell composed of nanostructured TiO_2 and Cu_2O electrodes

Synthesis and characterization

s06-053

Cesar Alfredo Barbero (Department of Chemistry, Universidad Nacional de Rio Cuarto, Rio Cuarto, Argentina), Luciano Tamborini, N. Gustavo Cotella, Diego Fernando Acevedo

Carbon Materials for Supercapacitors Produced by Pyrolysis of Biomass Originated Synthetic Resins. Synthesis and Characterization.

s06-054

Feng Chen (College of Materials Science and Engineering, Zhejiang University of Technology, Hangzhou, China), Wenjing Zhou, Ping Fan, Jintao Yang, Mingqiang Zhong

Lignin-based Mesoporous Carbon Materials: Preparation and Electrochemical Properties

s06-055

Anna Dettlaff (Faculty of Chemistry, Gdansk University of Technology, Gdansk, Poland), Monika Wilamowska

Nanocomposites Based on Poly(3,4-ethylenedioxythiophene) and Carbon Nanotubes

s06-056

Adrien Mery (Department of Chemistry, PCM2E, University of Tours, Tours, France), Fouad Ghamouss, Douaa Farhat, Cécile Autret, Mustapha Zaghrioui, François Tran-Van

Graphene, Carbon Nanotubes, and their Composites with MnO_2 for Supercapacitor Applications: Synthesis, Optimization and Characterization

s06-057

Marina Porcher (Department of PCM2E, University of François Rabelais, Tours, France), Fouad Ghamouss, Mathieu Pinault, Martine Mayne-L'Hermite, Pierre-Henri Aubert, François Tran-Van

Three-dimensional Nanocomposite Based on Electronically Conductive Polymer and Aligned Carbon Nanotubes Carpet for Electrochemical Energy Storage

s06-058

Ramesh T. Subramaniam (Department of Physics, University of Malaya, Kuala Lumpur, Malaysia), Chiam–Wen Liew, A.K. Arof

Electrical and Structural Studies of Environmentally Friendly Ionic Liquid–based Poly(vinyl alcohol) Proton Conductors For Supercapacitor Applications

s06-059

Abdulcabbar Yavuz (Department of Chemistry, University of Leicester, Leicester, United Kingdom), Robert Hillman, Karl S. Ryder

Optimization of Polyaniline Ion Exchange Dynamics in Deep Eutectic Solvents for Energy Storage

Symposium 7: Dye Sensitized Solar Cells

Dye Sensitized Solar Cells

s07-001

Barak D.B. Aaronson (Department of Chemistry, The University of Warwick, Coventry, United Kingdom), Joshua Byers, Stanley C.S. Lai, Patrick R. Unwin

Nanoscale Electrochemical Imaging for DSSCs Using Scanning Electrochemical Cell Microscopy

s07-002

Peter Ajibade (Department of Chemistry, University of Fort Hare, Alice, South Africa)

Photo physical and Electrochemical Studies of Ruthenium complexes of NS donor ligands for application in Dye-sensitized Solar Cells

s07-003

Cameron Bentley (School of Chemistry, Monash University, Clayton, Australia), Alan Bond, Anthony Hollenkamp, Peter Mahon, Jie Zhang

Redox mechanisms and mass transport of the iodide/triiodide couple in the RTIL 1-ethyl-3-methylimidazolium bis(trifluoromethanesulfonyl)imide

s07-004

Maria Bidikoudi (IAMPPNM, National Center for Scientific Research Demokritos, Aghia Paraskevi Attikis, Greece), Thomas Stergiopoulos

Imidazolium Alkyl Chain Length Effects in DSCs Incorporating Ionic Liquid Redox Electrolytes

s07-005

María Fernanda Cerdá (Laboratorio de Biomateriales, Facultad de Ciencias, UdelaR, Montevideo, Uruguay), Paula Enciso, Franco M. Cabrerizo

Energy levels for DSSC based in phycocyanin as natural dye

s07-006

Andrea Cerdán-Pasarán (Department of Chemical Engineering, University of Guanajuato, Guanajuato, Mexico), Ana Sanchéz-Solís, Isaac Zarazúa, Tzarara López-Luke, Rosalba Fuentes-Ramírez, Alejandro Alatorre-Ordaz, Elder De la Rosa, Diego Esparza, Alejandro Torres-Castro

Colloidal CdSe Quantum Dot Sensitized Solar Cells Using Electrophoretic Deposition

s07-007

Ahmed El-Zohry (Department of Chemistry, Uppsala University, Uppsala, Sweden), Burkhard Zietz

Competitive Pathways in Dye-sensitized Solar Cells

s07-008

Claudio Gerbaldi (Department of Applied Science and Technology, DISAT, Politecnico di Torino, Torino, Italy), Federico Bella, Simone Galliano, Claudia Barolo

Design of Experiments (DoE): A multivariate approach to dye-sensitized solar cells comprehension and optimization

s07-009

Andreas Hofmann (Department of, Karlsruher Institut für Technologie, Eggenstein-Leopoldshafen, Germany), Felix Kiliani, Thomas Hanemann

Ionic Liquid-based Electrolytes for Dye-sensitized Solar Cells

s07-010

Jianli Hua (Institute of Fine Chemicals, East China University of Science and Technology, Shanghai, China), Jiabao Yang

Effect of the Donor Size in D-π-A Organic Dyes on Photovoltaic Performances of Dye-sensitized Solar Cells

s07-011

Oscar Andrés Jaramillo Quintero (Laboratorio de Óxidos Metálicos y Nanocarbono, Instituto de Energías Renovables, UNAM, Temixco, Mexico), Mauricio Solís de la Fuente, Julio Cesar Calva Yáñez, Marina Elizabeth Rincón González

Hierarchical TiO_2 1D Nanostructures Sensitized with $CH_3NH_3PbI_3$ for Solid-state Sensitized Solar Cell

s07-012

Jin Soo Kang (School of Chemical and Biological Engineering, Seoul National University, Seoul, Korea), Hyelim Choi, Jin Kim, Yoonsook Noh, Jung-Woo Choi, Myounggeun Choi, Jae-Yup Kim, Yong-Hun Cho, David Dunand, Heeman Choe, Yung-Eun Sung

Large Photocurrent Generation by Photoelectrochemical Cells Based on Anodized Metal Foam Photoelectrodes

s07-013

Ladislav Kavan (Department of Electrochemical Materials, J. Heyrovsky Institute of Physical Chemistry, Prague 8, Czech Republic), Milan Bousa, Otakar Frank, Barbora Laskova, Marketa Zukalova, Ondrej Vik, David Havlicek

Sol-Gel TiO_2 Buffer Layers for Dye-Sensitized Solar Cells: Electrochemical Characterization

s07-014

Mohammad Hassan Khanmirzaei (Department of Physics, Center for Ionics, University of Malaya, Kuala Lumpur, Malaysia)

Biopolymer Hydroxypropyl Cellulose-based Gel Polymer Electrolytes for Dye-sensitized Solar Cell Applications

s07-015

Mohammad Hassan Khanmirzaei (Department of Physics, University of Malaya, kuala Lumpur, Malaysia)

Effect of Imidazolium Iodide-based Ionic Liquids on Ionic Conductivity and Efficiency of Dye-sensitized Solar Cells Using Biodegradable Rice Starch Based Polymer Electrolytes

s07-016

Jeong Gil Kim (Department of Energy Engineering, Hanyang University, Seoul, Korea), Donghoon Song, Mi Jin Choi, Woohyung Cho

Aliphatic Chain Effect of Ruthenium Dyes on Polymer Electrolyte Dye-sensitized Solar Cells

s07-017

Athanassios Kontos (Institute of Nanoscience and Nanotechnology, NCSR Demokritos, Aghia Paraskevi, Greece), Dorothea Perganti, Thomas Stergiopoulos, Damion Milliken, Hans Desilvestro, Polycarpos Falaras

High-temperature (85° C) Ageing Tests of Dye-sensitized Solar Cells Employing High Stability Electrolytes

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François Lapicque (LRGP, CNRS, Univ. Lorraine, Nancy, France), Robin Cisneros, Marc Beley

EIS-based investigations of photo-electro-induced processes in DSSC

s07-019

Chun-Ting Li (Department of Chemical Engineering, National Taiwan University, Taipei, Taiwan), Yu-Yan Li, Chun-Ting Li, Kuan-Cheih Huang, Ping-Wei Chen, Kuo-Chuan Ho

Graphite materials with different dimensional structures as the counter electrode in dye-sensitized solar cells

s07-020

Changjian Lin (Department of Chemistry, Xiamen University, Xiamen, China), Meidan Ye, Chang Chen, Nan Zhang, Xiaoru Wen

Quantum Dot-sensitized Solar Cells Employing Hierarchical Cu_2S Microspheres Wrapped by Reduced Graphene Oxide Nanosheets as Effective Counter Electrodes

s07-021

Hui Lu (School of Metallurgical and Ecological Engineering, University of Science and Technology Beijing, Beijing, China), Feng Zheng, Xiangyang Zhai, Wenwu Liu, Mei Zhang, Min Guo

Electrodeposition of hierarchical ZnO nanorod arrays on flexible stainless steel mesh for dye-sensitized solar cell

s07-022

Tingli Ma (State Key Laboratory of Fine Chemicals, Dalian University of Technology, Dalian, China), Hong Zhang, Yantao Shi

Dual Functional Additive for Perovskite Solar Cells

s07-023

Mirko Magni (Dipartimento di Chimica, Università degli Studi di Milano, Milan, Italy), Carlo Alberto Bignozzi, Stefano Caramori, Alessia Colombo, Claudia Dragonetti, Patrizia Mussini, Dominique Roberto

Copper Complexes as Electron Mediators in DSSCs

s07-024

Juan Manríquez (Department of Research, CIDETEQ, Pedro Escobedo, Mexico), Cristian M. Díaz-Acosta, Saacnhitee Murcio-Hernández, Selene Sepúlveda, Perla F. Méndez, Luis A. Godínez

Improvement of the global conversion efficiency of dye-sensitized solar cells containing nanotubular TiO_2 photoanodes prepared by anodizing of technical grade Ti foils and chemical modification with dendritic micelles

s07-025

Takurou Murakami (Research Institute for Innovation in Sustainable Chemistry, Advanced Industrial Science and Technology (AIST), Tsukuba, Japan), Eri Yoshida, Nagatoshi Koumura

Study of Heat Stability of Dye-sensitized Solar Cells at 85 deg. C Using Carbazole Dye with Phosphonic Acid Anchoring groups

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Jijeesh R. Nair (Department of Applied Science and Technology, DISAT, Politecnico di Torino, Torino, Italy), Annalisa Chiappone, Federico Bella, Giuseppina Meligrana, Roberta Bongiovanni, Claudio Gerbaldi

Nanocellulose-based polymer electrolytes for highly efficient quasi-solid dye-sensitized solar cells

s07-027

Yuta Ogawa (Research Center for Organic Electronics (ROEL), Yamagata University, Yonezawa, Japan), Matthew White, Lina Sun, Markus Scharber, Niyazi Serdar Sariciftci, Tsukasa Yoshida

Substrate oriented nanorod scaffolds in polymer-fullerene bulk-heterojunction solar cells

s07-028

Dorothea Perganti (IAMPPNM, National Center for Scientific Research Demokritos, Aghia Paraskevi Attikis, Greece), Athanassios Kontos

Molecular Antenna - Redox Couple Interaction in Dye-sensitized Solar Cells

s07-029

Delphine Schaming (ITODYS, Université Paris Diderot, Paris, France), Sana Koussi Daoud, Jean-Christophe Lacroix

Enhanced efficiency of dye-sensitized solar cells using gold nanoparticles–PEDOT hybrid material as counter-electrodes and new EDOT-based cobalt complexes as redox shuttle

s07-030

Hyunwoong Seo (Information Science and Electrical Engineering, Kyushu University, Fukuoka, Japan), Shinji Hashimoto, Daiki Ichida, Giichiro Uchida, Naho Itagaki, Kazunori Koga, Masaharu Shiratani

Fabrication of tandem dye-sensitized solar cell based on mesh-type of counter electrode

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Lina Sun (Research Center for Organic Electronics (ROEL), Yamagata University, Yonezawa, Japan), Tatsuhiro Chiba, Hayato Kurotaki, Kaito Fujii, Shogo Mori, Tsukasa Yoshida

High voltage ZnO solar cell sensitized with D35 and employing Co redox couple

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He Sun (Research Center for Organic Electronics (ROEL), Yamagata University, Yonezawa, Japan), Takashi Sugiura, Tsukasa Yoshida

Microwave Synthesis of ZnO Nano Crystals for Dye-sensitized Solar Cells

s07-033

Yoshitaka Tateyama (International Center for Materials Nanoarchitectonics, National Institute for Materials Science, Tsukuba, Japan), Yusuke Ootani, Koharu Aikawa, Liyuan Han, Keitaro Sodeyama

Adsorption, Excitation and Charge Transfer of Black Dye at TiO_2 Anatase/Acetonitrile Interface in DSC

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Lucia Viglianti (Department of Chemistry, Università degli Studi di Milano, Milano, Italy), Patrizia Romana Mussini, Elena Longhi, Alessandro Bolzoni, Clara Baldoli, Emanuela Licandro, Stefano Maiorana

Electrochemistry of New Thiophene ContainingOrganic Sensitizers for Dye-Sensitized Solar Cells

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Jongok Won (Department of Chemistry, Sejong University, Seoul, Korea), H. Choi, H.-k. Song

Dye-sensitized Solar Cells containing Cellulose Iongels

s07-036

Jih-Jen Wu (Department of Chemical Engineering, National Cheng Kung University, Tainan, Taiwan), Shou-Yen Lin

Room-temperature Fabrication of ZnO Nanostructured Anodes on Templated Plastic Substrates for Flexible Dye-sensitized Solar Cells

s07-037

Tsukasa Yoshida (Research Center for Organic Electronics (ROEL), Yamagata University, Yonezawa, Japan), Kazuhiro Manseki, Yousuke Kondo, Toshinori Ikeya, Atsushi Tamura, Hiroki Ishihama, Takayuki Ban, Takashi Sugiura

Structure-controlled rapid crystallization of TiO_2 nanoparticles for mesoscopic solar cells

s07-038

Kamila Zarebska (Faculty of Chemistry, University of Warsaw, Warsaw, Poland), Magdalena Skompska

Synthesis and photoelectrochemical characterization of semiconductor-sensitized solar cells based on ZnO nanorods and CdS/CdSe quantum dots

s07-039

Qinghong Zhang (College of Materials Science and Engineering, Donghua University, Shanghai, China)

Wet Chemical Routes to Current-contributed Scattering Layers for Dye-sensitized Solar Cells

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Jinbao Zhang (Department of Chemistry, Uppsala University, Uppsala, Sweden), Nick Vlachopoulos, Adel Jarboui, Mohamed Jouini, Anders Hagfeldt

Organic and Aqueous Photo-electrochemical Polymerization of PEDOT hole conductor for Solid-sate Dye-sensitized Solar Cells

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Fan Zhang (State Key Laboratory for Surface Physics, Institute of Physics, Chinese Academy of Sciences, Beijing, China), Wei Ma, Yang Jiao, Sheng Meng

Identification and Manipulation of Adsorption Geometry of Organic Dye on Nanocrystalline TiO_2 Films for Improved Photovoltaic Performances

s07-042

Weihong Zhu (Institute of Fine Chemicals, East China University of Science and Technology, Shanghai, China), Kai Pei

Photovoltaic Performances Dye-sensitized Solar Cells Based on Quinoxaline Dyes: Effect of π-Linker on Absorption, Energy Levels and Photovoltaic Performances

Symposium 8: Modern Electroactive Polymeric, Organic, Inorganic and Nanocomposite Materials

Alloys

s08-001

Xiaomei Chen (Department of Material Chemistry, Kyoto University, Kyoto, Japan), Munetaka Oyama

Surfactant-free AuPd Nanoparticles on Graphene Nanosheets with Enhanced Electrocatalytic Performance

Applications of electroactive materials

s08-002

Sumeyye Bahceci (Department of Chemistry, Fatih University, Istanbul, Turkey), Burak Esat

Microwave (MW) Assisted Electro-active Tempo Functionalized Single Walled Carbon Nanotube (SWNT) Electrodes for Li-ion Batteries

s08-003

Sumeyye Bahceci (Department of Chemistry, Fatih University, Istanbul, Turkey), Burak Esat

Development of Quinizarine Attached an Organic Polymer as Electrode Active Material for Rechargeable Batteries

s08-004

Erika Bustos (Department of Research, CIDETEQ, S. C., México, Mexico), J.A. García, L. M. Sánchez, D. Monzón, Monica Cerro-Lopez, M. A. Quiróz, Juan Manríquez

Electrochemical Detection of Hg (Ii) Using Modified in(SnO_2) with Polyacrilate and Prussian Blue

s08-005

Justyna Czupryniak (Department of Analytical Chemistry, University of Gdansk, Gdansk, Poland)

Modification and application of ion-sensitive field effect transistors

s08-006

Luiz Henrique Dall'Antonia (Departamento de Quimica, Universidade Estadual de Londrina, Londrina, Brazil), Renata Afonso, Ana P.P. Eisele, Jessica A. Serafim, Adriana C. Lucilha, Elen R. Sartori, Cesar R. T. Tarley

Solution Combustion Synthesis of $BiVO_4$: Application as Electrodes in Voltammetric Determination of Atenolol

s08-007

Abhijit Dutta (Department of Chemistry and Biochemistry, University of Bern, Bern, Switzerland), Motiar Rahaman, Alexander V. Rudnev, Thomas Wandlowski, Peter Broekmann

Turning Hematite-based Iron Oxide nano Cubes on Graphene into a Superior Electro-catalyst for CO_2 reduction

s08-008

Lorena A. Goulart (Department of Chemistry, Federal University São Carlos, São, Brazil), Fernando C. Moraes, Lucia H. Mascaro

Effect of Functionalization and Size of the Carbon Nanotubes Used as Sensor at Electrochemical Determination of Bisphenol A

s08-009

Zofia Iskierko (Department of Physical Chemistry of Supramolecular Complexes, Instytut Chemii Fizycznej PAN, Warszawa, Poland), Marcin Dabrowski, Piyush Sindhu Sharma, Krzysztof Noworyta, Krzysztof Fronc, Danek Elbaum, Wlodzimierz Kutner

Selective Determination of D-arabitol using Molecularly Imprinted Polymer based Extended Gate Field Effect Transistor (EG-FET) Chemosensor

s08-010

Minkyung Kang (Department of Chemistry, University of Warwick, Coventry, United Kingdom), Yang-Rae Kim, Robert Lazenby

H_2O_2 Oxidation Kinetics at Ruthenium Oxide Revealed by Nanoparticle Landing Experiments

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Amir Homayoun Keihan (Institute of Biochemistry & Biophysics, University of Tehran, Tehran, Iran), Sharareh Sajjadi, Ali Akbar Moosavi-Movahedi, Khadijeh Eskandari

Comparing the Effect of Three Different Ionic Liquids on the Electrocatalytic Performance of Prussian Blue/Carbon Nanotubes Composites

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Bagdaulet Kenzhaliyev (Innovations, Kazakh-British Technical University, Almaty, Kazakhstan), Essen Suleimenov, Ainur Berkinbayeva

Using Sulfur Graphite Electrode for Extracting Metals from Refractory Materials

s08-013

Joo Yeon Kim (OLED Research Section, Electronics and Telecommunications Research Institute (ETRI), Daejeon, Korea), Jaehyun Moon, Seung Koo Park, Ji-Young Oh, Hyunkoo Lee, Jonghee Lee, Doo-Hee Cho, Jin Wook Shin, Jong Tae Lim, Seong M. Cho, Hojun Ryu, Hye Yong Chu, Jeong-Ik Lee

Surface Roughness Effects on Optical Contrast and Response Time of Electrochromic Devices

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Patrick Kinlen (Boeing Research and Technology, The Boeing Company, St. Louis, USA), Ofer Alves, Ekaterina Badaeva

Aerospace Applications of Conductive and Electroactive Polymers

s08-015

Atif Koca (Department of Chemical Engineering, Marmara University, Istanbul, Turkey), Hakan Sariçayir

Electrochromism of Electropolymerized Metallophthalocyanines

s08-016

Youssef Lattach (Department of Molecular Chemistry, Université Joseph Fourier, Grenoble, France), Juan Francisco Rivera, Tahya Bamine, Alain Deronzier, Jean-Claude Moutet

Electrosynthesis of Nanostructured Composites Film Modified Electrode for the Water Splitting Reaction

s08-017

Kamila Lepicka (Department of Physical Chemistry of Supramolecular Complexes, Institute of Physical Chemistry Polish Academy of Sciences, Warsaw, Poland), Piotr Pieta, Wlodzimierz Kutner

Electropolymerization of Ni(II) salen-based complexes to form redox conducting polymers for electrochemical capacitors

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Mirko Magni (Dipartimento di Chimica, Università degli Studi di Milano, Milan, Italy), Sergio Dell'Angelo, Clara Baldoli, Emanuela Licandro, Stefano Maiorana, Luigi Falciola, Patrizia Mussini

Phthalimide-based Metal-free Labelling of Peptido Nucleic Acids for Biosensor Applications

s08-019

Inês Miranda (Departamento de Química e Bioquimica, Faculdade de Ciências, Universidade do Porto, Porto, Portugal), Carlos Pereira, Fernando Silva

Carbon composite electrodes for glucose sensing

s08-020

Rodrigo Munoz (Department of Chemistry, Federal University of Uberlandia, Uberlandia, Brazil), Poliana Freire, Rodrigo Montes, Eduardo Richter, Juliane Marinho, Fernanda Romeiro, Renata Lima

Morphology of ZnO nanoparticles bound to carbon nanotubes affects electrocatalytic oxidation of phenolic compounds

s08-021

Tsuyoshi Ochiai (Photocatalyst Group, Kanagawa Academy of Science and Technology, Kawasaki, Japan), Shoko Tago, Kazuo Hirota, Takeshi Kondo, Kazuhito Satomura, Akira Fujishima

Flexible Pinpoint Electrolysis Unit Coated with Boron-doped Diamond-based Polymer Composites for Dental Treatments

s08-022

Joanna Pawlowska (Faculty of Chemistry, University of Warsaw, Warsaw, Poland), Mateusz Wozny, Bohdan Korybut-Daszkiewicz, Renata Bilewicz

Electrochemically switchable foldamer - Feature of rotaxane with non-equivalent stations

s08-023

Valentina Pifferi (Chimica, Università degli Studi di Milano, Milan, Italy), Luigi Falciola, Stefano Checchia, Hermes Farina, Marco Ortenzi

Sulphonated Poly (Aryl Ether Sulphone) as electrode modifier in electroanalytical applications

s08-024

Katarzyna Piwowar (Department of Physical Chemistry and Technology of Polymers, Faculty of Chemistry, Silesian University of Technology, Gliwice, Poland), Jerzy Zak

Electrocopolymerized phenothiazines as functional materials for singlet oxygen generation

s08-025

Piyush Sindhu Sharma (Department of Physical Chemistry of Supramolecular Complexes, Institute of Physical Chemistry, Warsaw, Poland), Marcin Dabrowski, Krzysztof Noworyta, Alexander Kuhn, Francis D'Souza, Wlodzimierz Kutner

Molecularly Imprinted Polymer-based Chemosensors for Sensing of Sugar Isomers

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Marek Sobkowiak (Department of Chemical Technology, Poznan University of Technology, Poznan, Poland), Tomasz Rebis, Grzegorz Milczarek

Activity of PEDOT-s Based Nanocomposites for Electrochemical Sensors and Energy Storage Systems

s08-027

Patrick Steegstra (Research Group Electrochemical and Surface Engineering, Vrije Universiteit Brussel, Brussels, Belgium), Jon Ustarroz, Xia Sheng, Paolo P. Pescarmona, Nick Daems, Ivo F.J. Vankelecom, Annick Hubin

Nitric Oxide Reduction on Modified Carbon Electrodes

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Stephen Thompson (Department of Chemsitry, University of Southampton, Southampton, United Kingdom), Stephen Price, Xiaohong Li, Richard Wills, Scott Gorman, Andrea Russell, Derek Pletcher, Frank Walsh

Bifunctional oxygen electrocatalysts for zinc-air flow batteries

s08-029

Eleonora Ussano (Department of Chemistry, Università di Bologna, Bologna, Italy), Giovanni Valenti, Matteo Iurlo, Francesco Paolucci, Massimo Marcaccio

An Electrochemical Pathway to Generate Self-Assembled Nanographenes and Graphene-like Films

s08-030

Mikhail Vorotyntsev (Department of Novel Materials Chemistry, Institute for Problems of Chemical Physics, Russian Academy, Chernogolovka, Russia), Dmitry Konev, Charles Devillers, Kseniya Lizgina, Olga Istakova, Vladimir Baulin, Irina Kalashnikova

Influence of Proton-acceptor Additives on Electropolymerization Process of Magnesium Porphine

s08-031

Agnieszka Wojnarowicz (Department of Physical Chemistry of Supramolecular Complexes, Institute of Physical Chemistry Polish Academy of Sciences, Warszawa, Poland)

Electrochemically Synthesized Imprinted Polymer for Chemosensing of the Carnosine Dipeptide Biomarker

s08-032

Jun Yano (Department of Engineering Science, Niihama National College of Technology, Niihama, Japan)

Time Indicator Using Polyaniline and Conventional Transparent Polymer Films

Electrodeposition

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Suresh Kumar Aggarwal (Fuel Chemistry Division, Homi Bhabha National Institute/ Bhabha Atomic Research Cent, Mumbai, India), Ruma Gupta, Kavitha Jayachandran, B. Rajeshwari

Novel Electrochemical Synthesis and Characterization of Ag/Polypyrrole Nanocomposite and its Electrocatalytic Performance towards Hydrogen Peroxide Reduction

s08-034

Erika Bustos (Department of Research, CIDETEQ, S. C., México, Mexico), Rosa Alhelí Herrada, Alejandro Medel, Selene Sepulveda, Federico Manríquez, José de Jesús Pérez, Juan Manríquez

Comparison of hydrocarbon removal after electrokinetic remediation process using modified electrodes by painting, immersion and electrophoretic deposition

s08-035

Abdeslam Et Taouil (Institut UTINAM UMR CNRS 6213, Université de Franche-Comté, Besançon, France), Fabrice Lallemand, Jean-Yves Hihn, Loïc Hallez, Jean-Marie Melot

Effects of High Frequency Ultrasound Irradiation on Electrochemically Synthesized Conducting Polymers: Influence on Morphology and Chemical Structure

s08-036

Ahmed Fakhry (Laboratoire Interfaces et Systèmes Electrochimiques (LISE), Université Pierre et Marie Curie - LISE, Paris, France), Hubert Cachet, Catherine Debiemme-Chouvy

Electrochemical Characterizations of Ultra Thin Overoxidized Polypyrrole Films

s08-037

Oxana Gribkova (Russian Academy of Sciences, Institute of Physical Chemistry and Electrochemistry, Moscow, Russia), Olga Omelchenko, Alexander Nekrasov, Victor Ivanov, Anatoly Vannikov

Influence of Polyelectrolyte Conformation on the Electrodeposition of Polyaniline and Properties of the Obtained Films

s08-038

Andrew Hector (Department of Chemistry, University of Southampton, Southampton, United Kingdom), Calum Robertson, Richard Beanland, Reza Kashtiban, Jeremy Sloan

Production of Oriented Mesoporous Templates for Supercritical Fluid Electrodeposition

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Zhaohui Huo (Laboratoire d'Electrochimie et de Chimie Physique du Corps, Université de Strasbourg, Strasbourg, France), Iban Azcarate, Eric Saint-Amane, Bernold Hasenknopf, Christophe Bucher, Laurent Ruhlmann

Electrosynthesis of porphyrin copolymers

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Massimo Innocenti (Dipartimento di Chimica, Università di Firenze, Florence, Italy), Ilaria Bencistà, Francesco Borgatti, Massimiliano Cavallini, Andrea Comparini

Electrochemical synthesis of bismuth-based materials: Morphological and compositional characterization

s08-041

Elaine C. S. Coelho (Department of Química Fundamental, Universidade Federal de Pernambuco, Recife, Brazil), Valberes B. Nascimento, Adriana S. Ribeiro, Marcelo Navarro

New nitro/dinitrobenzoyl thiophene derivatives: Electrosynthesis, voltammetric characterization and optical properties

s08-042

Cibely Silva Martin (Departamento de Química, Faculdade de Ciências e Tecnologia, Universidade de Coimbra, Coimbra, Portugal), Carla Gouveia-Caridade, Frank N. Crespilho, Carlos J.L. Constantino, Christopher M.A. Brett

Electrochemical Impedance Characterisation of Ni-Salpn Complex on Glassy Carbon Electrodes

Electron transfer

s08-043

Miku Akahori (Department of Chemistry, Keio University, Yokohama, Japan), Keisuke Natsui, Takashi Yamamoto, Yasuaki Einaga

Functionalization of Superconducting Diamond via Electro-Click Chemistry

Electron-ion conductivity

s08-044

Evgeniya Sivokhina (Department of Chemistry, Al-Farabi Kazakh National University, Almaty, Kazakhstan), Andrey Kurbatov, Kamila Ablayeva, Alina Galeyeva, Gaukhar Askarova, Asel Dzhubanshkaliyeva

Li-conductive Composite Membrane Based on PVdF

Etching

s08-045

Kang Shi (Department of Chemistry, Xiamen University, Xiamen, China), Wang Chen, Hong-Wan Zhang, Jin-Fu Zhang, Zhong-Qun Tian, Zhao-Wu Tian

Confined etchant layer technique for electrochemical micropatterning of functional polymer film in sulfuric acid solution

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Yuta Suzuki (Applied Chemistry and Chemical of Engineering, Kogakuin University, Hachioji, Japan), Hidetaka Asoh, Sachiko Ono

Photoetching of InP with noble metal catalyst

Films

s08-047

Serena Arnaboldi (Dipartimento di Chimica, Università degli Studi di Milano, Milan, Italy), Francesco Sannicolò, Patrizia Romana Mussini, Simona Rizzo, Voichita Mihali, Armando Gennaro, Abdirisak Ahmed Isse

Electrochemistry of Inherently Chiral Thiophene-based Materials in Achiral and Chiral Ionic Liquids

s08-048

Serena Arnaboldi (Dipartimento di Chimica, Università degli Studi di Milano, Milan, Italy), Francesco Sannicolò, Patrizia Romana Mussini, Sephira Riva, Elisa Lo Bello, Monica Panigati, Gian Luca Chiarello, Rocco Martinazzo, Elena Selli, Tiziana Benincori, Andrea Penoni, Giovanna Longhi, Roberto Cirilli, Wlodzimierz Kutner, Krzysztof Noworyta

The Thiophene-based Inherently Chiral Monomer Family Grows: Molecular Design and Electrochemical Properties

s08-049

Agustín Bolzán (Electrochemistry, Inst. Investigaciones Fisicoquímicas Teóricas y Aplicadas, La Plata, Argentina), Eduart Gutiérrez-Pineda, María José Rodríguez Presa, Claudio A. Gervasi

Electrochemical Preparation and Characterisation of Stainless Steel/Polypyrrole Composite Electrodes Decorated with Gold Nanoparticles

s08-050

Agata Fedorczyk (Faculty of Chemistry, University of Warsaw, Warsaw, Poland), Magdalena Skompska

Selective Deposition of Gold Nanoparticles on the Top or Inside a Thin Conducting Polymer Film

s08-051

Joanna Jalkh (Institut des Sciences Chimiques de Rennes, Université de Rennes 1, Rennes, France), Yann Leroux, Antoine Vacher, Dominique Lorcy, Philippe Hapiot

Charge Transfer Phenomena Between TCNQF4 and TTF-based Monolayers on a Carbon Surface

s08-052

Carita Kvarnstrom (Department of Chemistry, University of Turku, Turku, Finland)

Electrochemical Synthesis of Composite Materials of Conducting Polymers and Different Allotropes of Carbon

s08-053

Krzysztof Noworyta (Department of Physical Chemistry of Supramolecular Complexes, Institute of Physical Chemistry Polish Academy of Sciences, Warsaw, Poland), Karolina Gawecka, Raghu Chitta, Francis D'Souza

Formation and redox properties of Langmuir and Langmuir-Blodgett films of the (crown ether)-appended bis(2,2’-bithienyl)methane derivatives

s08-054

Alex Palma (Departament of Macromolecular Chemistry, University of Wuppertal, Wuppertal, Germany), Ullrich Scherf

Electrochemical Polymerization of Carbazole Derivatives

s08-055

Rasa Pauliukaite (Department of Nanoengineering, Center for Physical Sciences and Technology, Vilnius, Lithuania), Raimonda Celiesiuté, Tautvydas Venckus, Aneta Radzevië, Darûnas Vaitekonis, Tomas Rakickas, Zivile Ruzele

Electrochemical Polymerization and Application of Some Vitamin-B-Group Compounds

s08-056

Tomasz Rebis (Department of Chemical Technology, Poznan University of Technology, Poznan, Poland), Marek Sobkowiak, Grzegorz Milczarek

Redox - Active Biopolymer/Conducting Polymer composites. Characterization and Electrochemical Properties

s08-057

Laura Valero (Department of Electronic Engineer Researching, Universidad Autónoma del Estado de México, Toluca, Mexico), Toribio Fernández Otero, Jose G. Martínez, Masaki Fuchiwaki

Self-supported conducting polymer electrodes: Structural Electrochemistry and Full Water Cathodic Discharge Inhibition

Nanostructures

s08-058

Hyeongcheol Cha (School of Energy, Materials, and Chemical Engineering, KOREATECH, Cheonana, Korea)

Transparent electrochromic devices composed of viologen modified TiO_2 nanotubes by anodization

s08-059

Nicola Dalle Carbonare (Department of Chemical and Pharmaceutical Sciences, University of Ferrara, Ferrara, Italy), Roberto Argazzi, Stefano Caramori, Carlo Alberto Bignozzi

Hematite Photoanodes Modified with an Iron(III) Water Oxidation Catalyst

s08-060

Ramendra S. Dey (Department of Chemistry, Technical University of Denmark, Kongens Lyngby, Denmark), Nan Zhu, Shuang Han, Jens Ulstrup, Qijin Chi

Graphene Nanofilms Functionalized with Electroactive Nanoparticles and Enzyme for Electrocatalytic Sensing

s08-061

Dong Hyeop Han (Department of Chemistry, Seoul National Univeristy, Seoul, Korea), Sung-Soo Kim, Byeong-Hyeok Sohn, Taek Dong Chung

Electrochemical Oxidation of Well Defined Size and Inter-particle Spacing Gold Nanoparticles Fabricated by Diblock-copolymer

s08-062

Joanna Kapusta-Kolodziej (Department of Physical Chemistry & Electrochemistry, Jagiellonian University, Krakow, Poland), Mateusz Rosolek, Marian Jaskula, Grzegorz D. Sulka

3D Nanoporous Anodic Titania as a Promising Photoelectrode Material

s08-063

Joanna Kapusta-Kolodziej (Department of Physical Chemistry & Electrochemistry, Jagiellonian University, Krakow, Poland), Karolina Syrek, Magdalena Jarosz, Grzegorz D. Sulka

Photodegradation of Pharmaceuticals on Nanoporous Anodic Titanium Dioxide

s08-064

Takumi Nagashima (Department of Applied Chemistry, Chuo University, Tokyo, Japan), Takashi Suzuki, Hiroaki Ozawa, Takao Ishida, Masa-aki Haga

Molecular Junction Diode of Hetero-layer Films Based on Ru Dinuclear Complexes with Potential Gradient

s08-065

Hiroaki Ozawa (Department of Applied Chemistry, Chuo University, Tokyo, Japan), Tomomi Kita, Kazuma Kosaka, Masa-aki Haga

Electrochemical properties of mixed-valence ruthenium complex/single walled carbon nanotube composites

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Jorge Pavez (Department of Materials Chemistry, Universidad de Santiago de Chile, Santiago, Chile), Mireya Santander-Nelli, José H. Zagal, Carlos P. Silva, Maritza Páez, Juan F. Silva, Ismael Diez-Perez

Nanostructured Self-assembled Electrode Systems

s08-067

Marina Porcher (Department of PCM2E, Université François Rabelais, Tours, France), Fouad Ghamouss, Mathieu Pinault, Martine Mayne-L'Hermite, Pierre-Henri Aubert, François Tran-Van

Three-dimensional Nanocomposite Based on Electronically Conductive Polymer and Aligned Carbon Nanotubes Carpet for Electrochemical Energy Storage

s08-068

Paulo A. Raymundo-Pereira (Department of Physical Chemistry, Institute of Chemistry of São Carlos, São Carlos, Brazil), Flávio M. Shimizu, Sergio A.S. Machado

Design and Fabrication of Hybrid Surface Based On Pt/Au Interdigitated Microelectrodes Array

s08-069

Irina Sapurina (Department of Conducting Polymers, Institute of Macromolecular Chemistry ASCR, Prague 6, Czech Republic), Jaroslav Stejskal

Polypyrrole Nanotubes Decorated with Noble-metal Nanoparticles and their Carbonization

s08-070

Renato Seeber (Department of Chemical and Geological Sciences, University of Modena and Reggio Emilia, Modena, Italy), Chiara Zanardi, Fabiana Arduini, Stefano Cinti, Giulio Maccaferri, Danila Moscone, Giuseppe Palleschi, Laura Pigani, Fabio Terzi

Carbon Black – Au Nanoparticles Composite for the Development of Efficient Amperometric Sensors

s08-071

Jaroslav Stejskal (Department of Conducting Polymers, Institute of Macromolecular Chemistry ASCR, Prague 6, Czech Republic), Przemek Magdziarz, Patrycja Bober, Miroslava Trchova

Conducting Composites of Poly(p-phenylenediamine) with Silver

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Agnieszka Swietlikowska (Department of Chemistry, Warsaw University, Warsaw, Poland), Barbara Palys

Graphene Oxide Surface Groups as Electrocatalysts

s08-073

Konrad Trzcinski (Faculty of Chemistry, Gdansk University of Technology, Gdansk, Poland), Monika Wilamowska, Anna Lisowska-Oleksiak

Electrochemical behaviour of hybrid thin films containing $BiMEVO_x$ and conducting polymer

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Maria Vela (Nanoscopies and Physical Chemistry Laboratory, INIFTA, La Plata, Argentina), Julie Maya Girón, Eugenia Zelaya, Aldo Rubert, Guillermo Benitez, Pilar Carro, Roberto Salvarezza

Adsorption of 4-mercaptobenzoic acid on Ag upd-Au(111) surfaces and Ag nanoparticles

s08-075

Maria Vela (Nanoscopies and Physical Chemistry Laboratory INIFTA, La Plata, Argentina), Pia Quiroga Argañaraz, Susana Ribotta, Guillermo Benitez, Aldo Rubert, Liliana Gassa, Roberto Salvarezza, Jose Ramallo Lopez

Functionalization of nanostructured Ni-W coatings obtained by electrodeposition

s08-076

Ekaterina Zolotukhina (Department of Functional Inorganic Materials, Institute for the Problem of Chemical Physics RAS, Chernogolovka, Russia), Ekaterina Sakardina, Ekaterina Gerasimova, Ivan Ermakov

Catalytic activity of silver-ion exchanger nanocomposites in methanal (in water) and ethanal (in ethanol) low-temperature oxidation with molecular oxygen

Redox response

s08-077

Juan Carlos Flores-Segura (Área Académica de Ciencias de La Tierra Y Materialesdepartment of, Universidad Autonoma del Estado De Hidalgo, Pachuca de Soto, Mexico), Juan Antonio Azpeitia-Vera

Electrochemical characterization of chelates of Co and Ag, its possible application as catalysts.

s08-078

Sara Gatto (Department of Chemistry, University of Milano, Milano, Italy), Claudia Bianchi, Carlo Pirola, Marta Stucchi, Giuseppina Cerrato, Sara Morandi, Roberto Gomez, Pedro Bonete

Photoelectrochemical and photocatalytic characterization: Comparison between nanometric and micrometric TiO_2 powders

s08-079

Hao Huang (Engineering Sciences, Uppsala University, Uppsala, Sweden), Christoffer Karlsson, Maria Strømme, Adolf Gogoll, Martin Sjödin

Monomers and Polymers of Quinone Functionalized Pyrrole for Organic Energy Storage

s08-080

Joanna Jalkh (Institut des Sciences Chimiques de Rennes, Université de Rennes 1, Rennes, France), Yann Leroux, Antoine Vacher, Dominique Lorcy, Philippe Hapiot

Electrochemical Behavior of Ferrocene and Tetrathiafulvalene Monolayers in RTILs and Organic Media

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Dimitrios Louloudakis (Department of Electrical Engineering, Technological Educational Institute of Crete, Heraklion, Greece), Dimitra Vernardou, Kostas Psifis, Emmanouel Spanakis, Nikolaos Katsarakis, Giorgos Papadimitropoulos, Dimitrios Davazoglou, Emmanouel Koudoumas

Effect of the Growth Parameters on the Electrochromic Properties of Low-pressure CVD WO_3 Films

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Ligia Maria Moretto (Department of Molecular Sciences and Nanosystems, University ca' Foscari of Venice, Venice, Italy), Andrea Mardegan, Morena Silvestrini, Mattia Cettolin, Paolo Scopece, Paolo Ugo

Pyrolized Photoresist Carbon Electrodes – Analytical Applications

s08-083

Ligia Maria Moretto (Department of Molecular Sciences and Nanosystems, University Ca' Foscari of Venice, Venice, Italy), Andrea Mardegan, Valentina Pifferi, Enrico Pontoglio, Luigi Falciola, Paolo Scopece

Preparation and Analytical Application of Pyrolized Photoresist Carbon Electrodes Modified with Carbon Nanotubes

s08-084

Kuniaki Murase (Department of Materials Science and Engineering, Kyoto University, Kyoto, Japan), Takahiro Asai, Atsushi Kitada, Kazuhiro Fukami

Anion Effect on Redox Behavior of Ferrocenylthiol SAMs — Parallel between Aqueous and Ionic Liquid Media

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Patrizia Romana Mussini (Dipartimento di Chimica, Università degli Studi di Milano, Milano, Italy), Francesco Sannicolò, Simona Rizzo, Serena Arnaboldi, Voichita Mihali, Armando Gennaro, Abdirisak Ahmed Isse

Towards Inherently Chiral Ionic Liquids: Molecular Design Strategies and Electrochemical Properties

s08-086

Andrzej P. Nowak (Faculty of Chemistry, Gdansk University of Technology, Gdansk, Poland), Monika Wilamowska, Anna Lisowska-Oleksiak

Electrochemical Activity of Conducting Polymer Films Modified by Graphene and Prussian Blue Analogues

s08-087

Tadaharu Ueda (Applied Science, Kochi University, Kochi, Japan), Keisuke Kodani, Si-Xuan Guo, John Boas, Alan Bond

An Electrochemical study of the alpha- and beta-forms of Keggin-type 12-Tungstophosphates

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Tadaharu Ueda (Applied Science, Kochi University, Kochi, Japan), Toru Konishi, Keisuke Kodani, Si-Xuan Guo, John Boas, Alan Bond

Voltammmetric behavior of Keggin-type vanadium-substituted Polyoxometalates coupled with Li^+ in CH_3CN

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Lucia Viglianti (Department of Chemistry, Università degli Studi di Milano, Milano, Italy), Alessandro Bolzoni, Andrea Figini, Patrizia Romana Mussini, Clara Baldoli, Emanuela Licandro, Stefano Maiorana

Electrochemical Investigations of Heteroarylethylene Class and of Related Conducting Films

s08-090

Li Yang (Engineering Sciences, Uppsala University, Uppsala, Sweden), Xiao Huang, Martin Sjödin, Adolf Gogoll, Maria Strömme

Novel Thiophene-based Terephthalate Redox Polymer for Energy Storage

Spectroelectrochemical properties

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Efe Baturhan Orman (Department of Chemistry, Marmara University, Istanbul, Turkey)

Electrochemical Properties of Lanthanide Series Bis-Phthalocyanines

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Anodic films

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Song-Zhu Kure-Chu (Department of Chemistry and Bio-Engineering, Iwate University, Morioka, Japan), Saharu Saito, Hitoshi Yashiro, Hiroyo Segawa, Kenji Wada, Satoru Inoue

Fabrication and Characteristics of Nanoporous Anodic TiO_2-TiN Composite Films toward Multi-functional Nanomaterials

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Alicja Lukaszczyk (Department of Chemistry, AGH Univeristy of Science and Technology, Cracow, Poland)

Effect of Chromium Content in Low Alloyed constructional Steels on their Electrochemical Proprties and Corrosion Resistnace in Geothermal Water

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Yunny Meas-Vong (Department of Electrochemistry, CIDETEQ, Pedro Escobedo, Mexico), Ildefonso Zamudio Torres, Jose de Jesus Perez Bueno

TiO_2 nanotubes obtained by anodization in organic media and surface study

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Sungmo Moon (Surface Engineering Division, Korea Institute of Materials Science, Changwon, Korea)

PEO Coatings on AZ31 Mg Alloy

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Anna Palacios-Padrós (Department of Physical Chemistry, University of Barcelona, Barcelona, Spain), Marco Altomare, Alexei Tighineanu, Robin Kirchgeorg, Nabeen Kumar Shrestha, Ismael Diez-Perez, Felipe Caballero-Briones, Fausto Sanz, Patrik Schmuki

Growth of Ordered Anodic SnO_2 Nanochannel Layers and Their Application for H_2 Gas Sensing

s09-006

Masatoshi Sakairi (Faculty of Engineering, Hokkaido University, Sapporo, Japan), Tomoya Yamaguchi, Koji Fushimi

Area Selective Porous-type Aluminum Anodic Oxide Film Formation by Solution flow-type Micro-droplet Cell

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Wojciech Simka (Faculty of Chemistry, Silesian University of Technology, Gliwice, Poland), Danila Korotin, Ivan Zhidkov, Joanna Michalska, Katarzyna Szymañska, Katarzyna Suchanek, Lilianna Szyk-Warszyñska, Elzbieta Pamula, Ernst Kurmaev, Seif Cholakh

Electrolytic Polishing and Anodic Passivation of Ti-15Mo Alloy in Phosphoric Acid Solution

s09-008

Wojciech Simka (Faculty of Chemistry, Silesian University of Technology, Gliwice, Poland), Alicja Kazek-Kesik, Malgorzata Krok-Borkowicz, Izabela Kalemba, Katarzyna Suchanek, Joanna Michalska, Jerzy Piotrowski, Elzbieta Pamula

Electrochemical Surface Modification of Ti-13Nb-13Zr Alloy For Biomedical Application

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Nilson T. C. Oliveira (Department of Materials Engineering – DEMa, Federal University of São Carlos – UFSCar, São Carlos, Brazil), Julia F. Verdério, Claudemiro Bolfarini, Ricardo P. Nogueira, Virginie Roche, Pedro Córdoba-Torres

New Insights on the Electrochemical Behavior of Self-organized Nanotubes Ti for Biomedical Applications

s09-010

Francisco Trivinh-Strixino (Departamento de Física, Química e Matemática, Universidade Federal de São Carlos, Sorocaba, Brazil), Fernando H. Cristovan, Patricia F. Monteiro

Investigation of Experimental Parameters on Porous Alumina (PA) Formation

s09-011

Hiroaki Tsuchiya (Div. Mater. Manuf. Sci., Graduate School of Engineering, Osaka University, 2-1 Yamada-oka, Suita, Osaka, Japan), Shota Yamamoto, Shinji Fujimoto

Effects of Heat-treatment and Cold-work on Growth of Anodic TiO_2 Nanotube Layers

s09-012

Hiroaki Tsuchiya (Div. Mater. Manuf. Sci., Graduate School of Engineering, Osaka University, 2-1 Yamada-oka, Suita, Osaka, Japan), Toshiaki Erami, Shinji Fujimoto

Growth of Oxide Layers on Intermetallic Compounds

s09-013

Delphine Veys-Renaux (Institut Jean Lamour, Université de Lorraine, Vandoeuvre les Nancy, France), Nicolas Stein, Emmanuel Rocca

In-situ characterization of anodic film growth on Mg in alkaline media

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Xuetao Yuan (Reasearch Institute of Rare Metal and Materials, General Research Institute for Nonferrous Metals, Beijing, China), Lei Yao, Zhiqiang Hua, Lei Wang, Xiaokui Che

Influence of Ag concentration on the electrochemical properties of Pb-Ag alloy anode for zinc electrowinning

s09-015

Leszek Zaraska (Department of Physical Chemistry & Electrochemistry, Jagiellonian University in Krakow, Faculty of Chemistry, Krakow, Poland), Michal Bobruk, Grzegorz D Sulka, Marian Jaskula

The effect of anodizing parameters on nanoporous tin oxides formation

s09-016

Leszek Zaraska (Department of Physical Chemistry & Electrochemistry, Jagiellonian University in Krakow, Faculty of Chemistry, Krakow, Poland), Anna Brudzisz, Ewa Wierzbicka, Grzegorz D. Sulka

The effect of electrolyte change before the second anodizing step on morphology and degree of nanopore order of porous alumina formed by two-step anodization

s09-017

Xuemei Zhou (Department of Materials Science, University of Erlangen-Nuremberg, Erlangen, Germany), JeongEun Yoo, Marco Altomare

TiO_2 Nanotube Arrays by Pulsed Anodization

Corrosion protection

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Imanbaeva Alima (Electrochemistry, D.V.Sokolsky Institute of Organic Catalysis and Electrochemi, Almaty, Kazakhstan), Statsjuk Vadim

Influence of Brass Deformation Degree on Electrochemical and Corrosion Properties

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Pawel Bacal (Faculty of Chemistry, University of Warsaw, Warsaw, Poland), Mikolaj Donten

Structure, corrosion and electrochemical properties of electrodeposited tungsten-copper alloys

s09-020

Vera Rosa Capelossi (Department of Chemical Engineering, Polytechnic School of the University of São Paulo, São Paulo, Brazil), Rocio P. B. Hernandez, Isaline Recloux, Hercilio G. de Melo, Marie-Georges Olivier

Corrosion Protection of clad AA2024 Anodized in Tartaric-sulfuric Acid Sealed with Sol-gel Hybrid Coatings.

s09-021

Najat Chahboun (Institut Jean Lamour, Université de Lorraine, Vandoeuvre lès Nancy, France), Delphine Veys-Renaux, Emmanuel Rocca

Chemistry of Zr/Cr based solutions: Application to sealing of anodized aluminium alloys

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Stefania Costovici (Center of Surface Science and Nanotechnology, POLITEHNICA University of Bucharest, Bucharest, Romania), Liana Anicai, Paula Prioteasa, Teodor Visan

Electrodeposition of Co and NiCo Alloys Coatings using Choline Chloride Based Ionic Liquids – Evaluation of Corrosion Behavior

s09-023

Miguel Antonio Domínguez (Department of Materials, Instituto Politecnico Nacional Cicata Altamira, Altamira, Mexico), Beatriz Brachetti-Sibaja, Sandra Rodil, Aidé Minerva Torres, Edgar Onofre

Effect of the synthesis parameter in the optical and electric properties of La_2O_3 thin films

s09-024

Miguel Antonio Domínguez (Department of Materials, Instituto Politecnico Nacional Cicata Altamira, Altamira, Mexico), Zoila Sánchez-Hernández, Aidé Minerva Torres-Huerta, Edgar Onofre

Improvement of adhesion and barrier properties of biomedical stainless steel by deposition of YSZ coatings using RF magnetron sputtering

s09-025

Mikolaj Donten (Faculty of Chemistry, University of Warsaw, Warsaw, Poland), Pawel Bacal, Zbigniew Stojek, Andrzej Krolikowski

Ternary alloys of tungsten, iron-group metal and copper. Corrosion resistance and electrocatalytic properties toward hydrogen evolution in acidic solutions

s09-026

Rong-Gui Du (Department of Chemistry, Xiamen University, Xiamen, China), Xiao-Ping Wang, Ying-Bo Gao, Yan-Feng Zhu, Qing Liu, Shi-Gang Dong, Changjian Lin

Effect of $NaNO_2$ and Na_2SiO_3 admixture as corrosion inhibitor on reinforcing steel: A scanning micrio-reference electrode study

s09-027

Rong-Gui Du (Department of Chemistry, Xiamen University, Xiamen, China), Ying-Bo Gao, Xiao-Ping Wang, Yan-Feng Zhu, Qing Liu, Shi-Gang Dong, Changjian Lin

Synergistic Inhibition Effect of Sodium Tungstate and Hexamethylene Tetramine on the Corrosion of Reinforcing steel

s09-028

Ali Ehsani (Department of Chemistry, University of Qom, Qom, Iran)

Electrochemical and DFT study on the adsorption and inhibitory of newly synthesized tetrazol nanoparticles in acidic media

s09-029

Zude Feng (College of Materials, Xiamen University, Xiamen, China), Chao Xu

Preparation of anatase-TiO_2 thin films by micro-mixing process for visible light-induced photo-generated cathodic protection

s09-030

Christian Fernández-Solis (Department of Interface Chemistry and Surface Engineering, Max-Planck-Institut für Eisenforschung GmbH, Düsseldorf, Germany), Michael Rohwerder, Andreas Erbe

Properties of Water-containing Polysaccharide Coatings for Corrosion Protection

s09-031

Asta Griguceviciené (Department of Electrochemical Materials Science, Center for Physical Sciences and Technology, Vilnius, Lithuania), Laurynas Staišiunas, Konstantinas Leinartas, Povilas Miecinskas, Jürate Vaiciüniene, Rokas Kondrotas, Eimutis Juzeliünas

Electrochemical Properties of Mg-Nb Alloy Films in Hanks' Balanced Salt Solution

s09-032

Fakiha Heakal (Department of Chemistry, Faculty of Science, Cairo University, Giza, Egypt)

Improving the Corrosion Resistance of AM60 Magnesium Alloyin Chloride Solution by Rare Earth Salt

s09-033

Masashi Hojo (Department of Chemistry, Kochi University, Kochi, Japan)

Why can pure gold be dissolved in seawater mixed with aqueous nitric acid?

s09-034

Manuel Krott (Institute for Energy and Climate Research (IEK-1), Forschungszentrum Jülich GmbH, Jülich, Germany), Sven Uhlenbruck, Hans Peter Buchkremer, Paul Meister, Martin Winter

Deposition of Corrosion Preventing Coatings for Dual-ion Batteries

s09-035

Vitaly Kuznetsov (Department of Electrochemistry, D. Mendeleyev University of Chemical Technology of Russia, Moscow, Russia)

Composition and Structure of Iron-molybdenum Deposits Obtained by Electrolysis

s09-036

Vitaly Kuznetsov (Department of Elecktrochemistry, D. Mendeleyev University of Chemical Technology of Russia, Moscow, Russia)

Electrodeposition of Corrosion-resistant Alloy Cr-W

s09-037

Maria Marcu (Department of Electrochemistry, Institute of Physical Chemistry, Bucharest, Romania), Alexandra Banu, Elena Maria Anghel, Elvira Alexandrescu

Investigation on the oxidation behavior and electrochemical corrosion performance of γ-TiAl with ceramic coating

s09-038

Artur Motheo (Department of Physical Chemistry, Sao Carlos Institute of Chemistry, University of Sao Paulo, Sao Carlos, Brazil), Leandro Bisanha, Sandra Moraes

Cathodic Electrodeposition of Cerium Oxide/Hydroxide on AA7075-T6 and AA8006-F for Corrosion Protection

s09-039

Abbas Ali Rostami (Department of Physical Chemistry, University of Mazandaran, Babolsar, Iran)

Effect of Nanoparticles on the Anticorrosion Properties of Epoxy Coating

s09-040

Georg Teucher (Institute for Energy and Climate Research (IEK-1), Forschungszentrum Jülich GmbH, Jülich, Germany), Tim Van Gestel, Sven Uhlenbruck, Rüdiger-A. Eichel, Olivier Guillon, Paul Meister, Martin Winter

Development of Corrosion Protection Layers for Current Collectors in Dual-ion Batteries

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Célia Regina Tomachuk (Environment and Basic Sciences Department, Engineering School of Lorena of the University of São Paulo, Lorena, Brazil), Jose Daniel Culcasi, Cecilia Ines Elsner, Isolda Costa, Alejandro Ramón Di Sarli

The Protection of Electrogalvanised Steel by Passivation Treatment with Trivalent Chromium and Cobalt Ions

s09-042

Aide Minerva Torres-Huerta (CICATA-Altamira, Instituto Politecnico Nacional, Altamira, Mexico), Miguel Antonio Domínguez, Ana Ortega, Edgar Onofre

Electrochemical and analytical characterization of TiO_2/HA atomic layer depositions on AISI 316L stainless steel

Electrochemical engineering

s09-043

Sandrine Costenoble (Department of Nuclear Energy, CEA Marcoule, Bagnols sur Cèze, France), Isabelle Solinhac

Corrosion Behavior of ODS and 15-15Ti Steels Cladding in the Condition of the Nuclear Spent Fuel Dissolution Process

s09-044

Joanna Michalska (Institute of Materials Science, Silesian University of Technology, Gliwice, Poland), Wojciech Simka, Marzena Jaworska-Kik

Microbiologically-influenced Hydrogen Damage in Duplex Stainless Steel - Electrochemical Studies

s09-045

Joanna Michalska (Institute of Materials Science, Silesian Univeristy of Technology, Gliwice, Poland), Wojciech Simka, Marzena Jaworska-Kik

The effect of sulphate reducing bacteria on the passivity and pitting corrosion resistance of 2205 duplex stainless steel

s09-046

Raheleh Partovi-Nia (Department of Chemistry, Western University, London, Canada), Rebecca Jacklin, Jian Chen, Dimitrij Zagidulin, Sridhar Ramamurthy, Peter G. Keech, David W. Shoesmith

Electrochemical and Surface Characteristics of Cold Sprayed and Electroplated Copper Coatings on Steel Substrates

Electrochemical methods

s09-047

Talal Aljohani (National Centre for Advanced Materials, King Abdulaziz City for Science and Technology, Riyadh, Saudi Arabia), Brian Hayden

Corrosion Resistance Mapping of Library Al-Mg-Zr Alloys Synthesized by High-throughput Method

s09-048

Franky Bedoya (CIDEMAT, Universidad de Antioquia, Medellin, Colombia), Jorge A. Calderon, Angela Bermudez, Juan Castaño, Felix Echeverria, Juan Maya

Effectiveness of the Non-Fickian Diffusion Model on the Water Uptake Determination of Different Anticorrosive Organic Coatings

s09-049

Lamia Hamadou (Department of Physics, Laboratoire de Physique et Chimie des Matériaux, Tizi Ouzou, Algeria)

Electrochemical impedance spectroscopy study of thermally grown oxides exhibiting Constant Phase Element behaviour (CPE)

s09-050

Takashi Kawano (Steel Research Laboratory, JFE Steel Corporation, Kawasaki, Japan), Hiroshi Kajiyama, Kei Yanagisawa, Koji Fushimi

Investigation of Inhomogeneous Corrosion Behavior of Dual-phase Carbon Steel with SECM

s09-051

Volodymyr Kuznetsov (Analytical Chemistry, Ruhr-University Bochum, Bochum, Germany), Artjom Maljusch, Balázs B. Berkes, Aliaksandr Bandarenka, Ricardo M. Souto, Wolfgang Schuhmann

Study of Effects of Aeration-induced Corrosion on Brass Using AC-SECM

s09-052

Noémie Ott (Laboratory for Joining Technologies and Corrosion, Empa, Dübendorf, Switzerland), Alessandra Beni, Christian Ludwig, Patrik Schmutz

Flow microcapillary plasma mass spectrometry investigations of Al-Cr-Fe alloy passive film stability

s09-053

Raheleh Partovi-Nia (Department of Chemistry, Western University, London, Canada), Taylor Martino, Jian Chen, Zack Qin, David W. Shoesmith

Sulphide Film Formation Mechanisms on Copper in Aqueous Solutions Containing Sulphide and Chloride under Voltammetric Conditions

s09-054

Monica Santamaria (Electrochemical Materials Science Laboratory, DICAM, Università di Palermo, Palermo, Italy), Francesca Muratore, Bartolomeo Megna, Giorgio Conigliaro, Francesco Di Quarto

Synthesis and characterization of zinc hydroxystannate films

s09-055

Kei Yanagisawa (Graduate School of Chemical Sciences and Engineering, Hokkaido University, Sapporo, Japan), Koji Fushimi, Takayuki Nakanishi, Yasuchika Hasegawa, Takashi Kawano, Mitsuo Kimura

Corrosion of Dual-phase Carbon Steel in 0.1 mol dm^{-3} Sulphuric Acid Aqueous Solution

Electrochemical processes and development

s09-056

Adriano Gomes (Department of Chemistry and Molecular Biology, University of Gothenburg, Gothenburg, Sweden), Mats Wildlock, Nina Simic, Elisabet Ahlberg

Effects of Electrodeposited $Cr(OH)_3$ and Cr_2O_3 on Hydrogen Evolution Reaction

s09-057

Andrei Nazarov (Atmospheric Corrosion, French Corrosion Institute, Brest, France), Dominique Thierry

Hydrogen Entry into Steels at the Atmospheric Corrosion. SKP and Permeation Technique Studies

s09-058

Davide Rosestolato (Department of Chemical and Pharmaceutical Sciences, University of Ferrara, Ferrara, Italy), Stefano Neodo, Sergio Ferro, Giancarlo Battaglin, Achille De Battisti

The activation energy of the oxidation of chlorides at oxide-based electrocatalysts: An experimental approach

s09-059

Eiji Tada (Chemistry and Materials Science, Tokyo Institute of Technology, Tokyo, Japan), Atsushi Nishikata

Evaluation of Hydrogen Absorption into Steel Using Electrochemical Hydrogen Permeation Technique

s09-060

Jorge O. Zerbino (Department of Electrochemistry, Instituto de Fisicoquimica. INIFTA., La Plata, Argentina), Liliana Gassa, Alberto Maltz, Maria G. Sustersic

Butilacetate adsorbed on gold electrodes in the confined aqueous layer form in contact with the solvent

Green processing

s09-061

Ippei Shimoji (Department of Applied Material and Life Sicence, Kanto Gakuin University, Yokohama-shi, Japan), Naoya Tasugi, Katsuhito Sano, Nobuaki Watanabe, Ichiro Koiwa

Effect of Metallic Additives on Surface Morphology of Plated Aluminum Films

s09-062

Yuya Yamamoto (Department of Applied Material and Life Science, Kanto Gakuin University, Yokohama-shi, Japan), Akihiro Yamamoto, Misa Ueno, Nobuaki Watanabe, Ichiro Koiwa

Effect of Bath Parameter on Aluminum Content of Zn-Al_2O_3 Composite Films Platedfrom Non-suspended Solution

Innovative electrochemical routes

s09-063

Liana Anicai (Center of Surface Science and Nanotechnology, Politehnica University of Bucharest, Bucharest, Romania), Stefania Costovici, Aurora Petica, Claudia-Sorina Dumitru, Adrian Manea

Synthesis of oxide nanopowders involving anodic dissolution of metals in choline chloride based ionic liquids

s09-064

Valentine Grimaudo (Department of Chemistry and Biochemistry, University of Bern, Bern, Switzerland), Carolin Edinger, Jan Eggimann, Siegfried R. Waldvogel, Peter Broekmann

Suppression of the Hydrogen Evolution Reaction in Additive-supported Electrochemical Synthesis Methods of Amines

s09-065

Changjian Lin (Department of Chemistry, Xiamen University, Xiamen, China), Wenxi Guo, Xiaoyi Li, Xia Cao, Wei Tang, Mengxiao Chen, Lu Xu, Caofeng Pan, Zhonglin Wang

Corrosion Protection of Metals Powered by Triboelectric Nanogenerator

Modelling

s09-066

George Engelhardt (Department of Corrosion, OLI Systems, Inc., Cedar Knolls, USA), Digby Macdonald

Determinism in the Prediction of Localized Corrosion Damage

s09-067

Olga Guseva (Laboratory for Joining Technologies and Corrosion, Empa-Swiss Federal Laboratories for Materials Science and Te, Dübendorf, Switzerland), Patrik Schmutz

Modelling of localized anodic dissolution processes in aluminium alloys

s09-068

Francisco Gómez (Department of Solar Materials, UNAM, Temixco, Mexico), Margarita Miranda

The study of the impedance spectra: A fractional calculus approach

Passivity

s09-069

Francesco Di Franco (Electrochemical Materials Science Laboratory, DICAM, Università di Palermo, Palermo, Italy), Monica Santamaria, Francesco Di Quarto, Philippe Marcus

Photoelectrochemical Characterization of Oxide Layers on 316L Stainless Steel Grown in High-temperature Water

s09-070

Anna Palacios-Padrós (Department of Physical Chemistry, University of Barcelona, Barcelona, Spain), Felipe Caballero-Briones, Ismael Diez-Perez, Fausto Sanz

Tin Passivation in Alkaline Media: Formation of SnO Microcrystals as a Result of Hydroxyl Etching

Syposium 10: Electrodeposition for Energy Applications

Electrodeposition

s10-001

Claudine Buess-Herman (Service de Chimie Analytique et Chimie des Interfaces, Université Libre de Bruxelles, Bruxelles, Belgium), Moussa Bougouma, El Amine Mernissi Cherigui, Thomas Doneux

Electrodeposition of CZTSe Precursors from a Deep Eutectic Electrolyte

s10-002

Francesco Carla (Experiment Division, ID03 Beamline, ESRF, The European Synchrotron, Grenoble, France), Maria Luisa Foresti, Massimo Innocenti, Roberto Felici

Electrochemical Atomic Layer Deposition of CdS on Ag Single Crystals: Effects of Substrate Orientation on Film Structure

s10-003

Luis F. Chazaro-Ruiz (Division de Ciencias Ambientales, Instituto Potosino de Investigacion Cientifica y Teconlogic, San Luis Potosi, Mexico), Rossy Feria-Reyes, Javier A. Quezada-Rentería, José R. Rangel-Méndez

Influence of the degree of ionic strength on the electroplating of metal surfaces with reduced graphene oxide

s10-004

Umit Demir (Department of Chemistry, Atatürk University, Erzurum, Turkey), Tuba Oznülüer, Yesim Hanedar

A New Electrochemical Approach for the Deposition of Nanostructured α-Fe_2O_3 Photoanodes

s10-005

Margarita Dergacheva (Department of Electrochemistry, Institute of Organic Catalysis and Electrochemistry, Almaty, Kazakhstan)

Pulsed electrodeposition of ZnS thin films

s10-006

Raquel Duarte (Chemical and Biological Engineering, Polytechnic Institute of Setúbal, Barreiro, Portugal), Maria João Carmezim, Rui Pedro Silva, Sónia Eugénio, Maria Teresa Moura e Silva, Maria de Fátima Montemor

Co-Electrodeposition of Graphene and Transition Metal Oxides Electrodes for Supercapacitors Electrodes

s10-007

Hany El-Sayed (Technical Electrochemistry, Department of Chemistry, Technische Universität München, Garching, Germany), Timon Geppert, Hubert A. Gasteiger

Direct Electrodeposition of Thin Pt Films on Sn Surfaces

s10-008

Nadezda Ermakova (Physics-Chemistry Institute, Tyumen State University, Tyumen, Russia)

Features of Electrodeposition of Copper and Copper Binary Galvanic Plates from Complex Solutions with Organic Ligands

s10-009

Larisa Fishgoit (General Chemistry, Moscow State University, Faculty of Chemistry, Moscow, Russia), Natalia Zvereva, Maxim Dolov, Tatiana Kukushkina, Olga Safonova, Pieter Glatzel, Victor Safonov

New Data on the Chemical State of Metalloids in Amorphous Electrochemical Coatings Based on Iron-triad Metals

s10-010

Yasuhiro Fukunaka (Nanotechnology Research Center, Waseda University, Shinjuku, Japan), Takao Wakatsuki, Takayuki Homma

Coupling Phenomena between Micromorphological Evolution and Ionic Mass Transfer Rate during Ag Electrodeposition in $AgNO_3$ Aqueous Solution

s10-011

Serena Gallanti (Institute of R&D on Photovoltaic Energy, IRDEP-UMR 7174 EDF-CNRS-Chimie Paritech, Chatou, France)

Investigation of photoelectrochemical deposition of Zn(S,O) via nitrate ions reduction in presence of thiourea

s10-012

José Garcia-Anton (Department of Ingeniería Química y Nuclear, Universidad Politecnica de Valencia, Valencia, Spain), Rita Sánchez-Tovar, Ramon Manuel Fernandez-Domene, Dionisio García-García, Patrik Schmuki

Influence of Reynolds Number on TiO_2 nanosponges for Photoelectrochemical Applications

s10-013

Vinicius Graciano (Química Fundamental, Instituto de Química da Universidade de São Paulo, São Paulo, Brazil), Paulo Sumodjo, Teng An

Study of the Effect of Additives in the Electrodeposition of Co-based Alloys

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Ruma Gupta (Fuel Chemistry Division, Homi Bhabha National Institute, Bhabha Atomic Research Cent, Mumbai, India), Suresh Kumar Aggarwal

Electrosynthesis of Palladium Nanoparticles on Template Free Electrode: Application for Electro-oxidation of Formic Acid and Methanol

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Humberto Gómez (Instituto de Química, Pontificia Universidad Católica de Valparaíso, Valparaíso, Chile), Hernán Altamirano, Ricardo Schrebler, Francisco Cataño, Ana Burgos

One-step Electrodeposition of $CuGaSe_2$ from Dimethyl Sulfoxide Solutions

s10-016

Mahboba Hasan (Department of Chemistry, University of Southampton, Southampton, United Kingdom)

Microstructure of Electrodeposited Ni and Ni-B Thin Films

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Thi Mien Trung Huynh (Department of Chemistry and Biochemistry, University of Bern, Bern, Switzerland), Peter Broekmann

Intercalation of hydrogen into Cu(111) under reactive conditions studied by *in-situ* STM

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Massimo Innocenti (Department of Chemistry, University of Florence, Sesto Fiorentino, Italy), Serena Cinotti, Francesco Carla, Roberto Felici, Maria Luisa Foresti, Annalisa Guerri, Francesco Di Benedetto, Alessandro Lavacchi, Giordano Montegrossi

Growth and Structural Characterization of Cu-Zn Sulfides Semiconductors for Photovoltaic Application

s10-019

Katsumi Katakura (Department of Chemical Engineering, Nara National College of Technology, Yamatokoriyama, Japan), Chihiro Obayashi, Hirohisa Yamada

Electrochemical Synthesis of Mn-Al LDHs and Their Electrochemical Behaviors in Aqueous Solution

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Ludwig Kibler (Institut für Elektrochemie, Universität Ulm, Ulm, Germany), Khaled Soliman

Electrocatalytic Behaviour of Ag(111) Overlayers

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Man Kim (Electrochemistry Lab, Korea Institute of Materials Science, Changwon, Korea), Joo-Yul Lee, Sungmo Moon, G.H. Choi, Yong Choi

Abnormal Grooving Phenomena of Electrodeposited Copper-nickel Layers with Nano-thickness

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Sunjung Kim (School of Materials Science and Engineering, University of Ulsan, Ulsan, Korea), Bora Ye

Effect of Complexing Agents on the Electrochemical Formation of Porous Cu Alloy Current Collector for Li-ion Batteries

s10-023

Yangrae Kim (Department of Chemistry, University of Warwick, Coventry, United Kingdom), Patrick R. Unwin

New Insights into the Nucleation and Growth of Metal Nanoparticles on Carbon Electrodes Using Microscale and Nanoscale Meniscus Systems

s10-024

Song-Zhu Kure-Chu (Department of Chemistry and Bio-Engineering, Iwate University, Morioka, Japan), Tohru Ogasawara, Hitoshi Yashiro, Michimasa Uchidate, Rongbin Ye, Eichi Suzuki, Takuya Hosokai

Fabrication and Characteristics of Multilayered Sn/Ag_3Sn Films on Cu Alloys toward Highly Durable LED Reflective Materials

s10-025

Sophie Legeai (Institut Jean Lamour, UMR CNRS 7198, Equipe 208, Université de Lorraine, Metz Cedex 3, France), Jonathan Szymczak, Laura Thiebaud, Nicolas Stein, Clotilde Boulanger

Electrochemical synthesis of Bi_2Te_3 in a piperidinium-based room-temperature ionic liquid

s10-026

Markus Licklederer (Department of Chemistry and Pharmacy, University of Erlangen, Erlangen, Germany), Julien Bachmann

Galvanic deposition of noble metal nanotubes

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Yasuhisa Maeda (Graduate School of Engineering, Shizuoka University, Hamamatsu, Japan), Hiroyuki Yoshida, Hiroki Hamada, Yoshiumi Kohno

Preparation of Iron Oxide Film and Its Photoelectrochemical Behavior in Aqueous Solution

s10-028

Luca Magagnin (Department of Chemistry, Materials and Chemical Eng. G. Natta, Politecnico di Milano, Milan, Italy), Md Ibrahim Khalil

CZTS thin film solar cells by an electrodeposition–annealing route

s10-029

Manuel César Martí Calatayud (Chemical and Nuclear Engineering, Universitat Politècnica de València, València, Spain), Cristina González Buch, Isaac Herraiz Cardona, Emma Ortega, José García Antón, Valentín Pérez Herranz

Electrochemical Characterization of Ni-based Electrodes for Alkaline Water Electrolysis

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Lucia Mascaro (Department of Chemistry, Sao Carlos Federal University - UFSCar, Sao Carlos, Brazil), Fransciso Lucas

Morphological and structural characterization of the electrochemically obtained Ga-doped $CuInSe_2$

s10-031

Petr Matuska (Department of Chemical Engineering, Institute of Chemical Technology Prague, Prague, Czech Republic), Jan Sima, Pavel Hasal, Juraj Kosek

Morphological and Photocatalytic Activity Study of Layers of Transition Metal Oxide Nanoparticles Prepared by Electrospraying

s10-032

Margarita Miranda (Department of Solar Materials, IER-UNAM, Temixco, Mexico), Paola G. Castillo Gama

Description of silver electrodeposition on different carbon matrices

s10-033

Pavel Moreno-García (Physics Institute, Space Research and Planetary Sciences, University of Bern, Bern, Switzerland), Valentine Grimaudo, Andreas Riedo, Peter Wurz, Peter Broekmann

Contamination Profiles in Electrodeposited Copper Interconnects

s10-034

Edgard Ngaboyamahina (Laboratoire Interfaces et Systèmes Electrochimiques, Université Pierre et Marie Curie, Paris, France), Alain Pailleret, Hubert Cachet, Eliane M.M. Sutter

Photo-assisted Control of the Electrodeposition Rate of Polypyrrole in Titania Nanotube Arrays

s10-035

Tran Ngoc Huan (Laboratoire de Chimie et Biologie des Métaux, Université Grenoble Alpes, CNRS UMR 5249, CEA, Grenoble, France), Philippe Simon, Jonathan Heidkamp, Holger Dau, Marc Fontecave, Vincent Artero

Electrodeposition of a new copper based material for efficient electrocatalyst of CO_2 reduction

s10-036

Hai Nguyen (Department of Chemistry and Biochemistry, University of Bern, Bern, Switzerland), Julien Furrer, Florian Gjuroski, Florian Stricker, Thi Mien Trung Huynh, Nicola Luedi, Tobias Brunner, Florian Weiss, Iris Chang, Dieter Meier, Peter Broekmann

Polyvinylpyrrolidones (PVPs): Switchable Leveler Additives for Damascene Applications

s10-037

Anthony O'Mullane (School of Chemistry, Physics and Mechanical Engineering, Queensland University of Technology, Brisbane, Australia), Blake Plowman

Investigating surface active sites via electrochemical and chemical approaches

s10-038

David Rehnlund (Department of Chemistry, Ångström Laboratory, Uppsala University, Uppsala, Sweden), Mario Valvo, Jonas Angström, Ugo Lafont, Kristina Edström, Leif Nyholm

Multilayered Cu/Cu_2O nanostructured electrodes by one-step electrodeposition fabrication

s10-039

Gonzalo Riveros (Instituto de Química y Bioquímica, Facultad de Ciencias, Universidad de Valparaíso, Valparaíso, Chile), Daniel Ramírez, Enrique A. Dalchiele, Ricardo A. Marotti, Paula Grez, Humberto Gómez, Francisco Martín, José Ramón Ramos-Barrado

Electrodeposition and characterization of $CuFeO_2$ thin films from a DMSO based solution

s10-040

Eric Sibert (LEPMI, Université de Grenoble, CNRS, Saint Martin d'Hères, France), Liang Wang, Maurizio De Santis, Yvonne Soldo-Olivier

Mechanisms of the initial steps of Pd electro-deposition onto Au(111)

s10-041

Tarik Sidali (Institute of R&D on Photovoltaic Energy (IRDEP), EDF CNRS-ChimieParisTech, Chatou, France)

Mechanistic study of one-step electrodeposition of mixed CuInGa oxides/hydroxides for the elaboration of efficient CIGS solar cells

s10-042

Tanta Spataru (Department of Electrochemistry and Corrosion, Institute of Physical Chemistry of the Romanian Academy, Bucharest, Romania), Loredana Preda, Alexandru Ioan Caciuleanu, Nicolae Spataru

Effect of Hydrophobic Interaction between Boron-doped Diamond and Anionic Surfactants on the Charge Transfer Efficiency

s10-043

Sergio A. Spinola Machado (Department of Physical Chemistry, Institute of Chemistry of São Carlos, São Carlos, Brazil), Dyovani Coelho

Enhanced photocurrent and crystallinity of modified selenium films with underpotential deposited bismuth or lead

s10-044

Dimitrios Tsoukleris (School of Chemical Engineering, National Technical University of Athens, Athens, Greece), Evangelia Pavlatou, Nikoletta Chronopoulou, Stella Spanou, Antonis Karantonis, Chariklia Sarafoglou, Dimitris Pantelis

Codeposition of Hydride Multi-Walled Carbon Nanotubes – Al_2O_3 with Nickel by pulse plating

s10-045

Kazhmukan Urazov (Department of Electrochemical Technology, Institute of Organic Catalysis and Electrochemistry, Almaty, Kazakhstan), Margarita Dergacheva, Murat Zhurinov

Combined method of $CuIn_{1-x}Ga_xSe_2$ electrodeposition for solar cells

s10-046

Jon Ustarroz (Department of Electrochemical and Surface Engineering (SURF), Vrije Universiteit Brussel (VUB), Brussels, Belgium), Laurens Stevaert, Bart Geboes, Kadir Sentosun, Patrick Steegstra, Tom Breugelmans, Annick Hubin, Sara Bals, Herman Terryn

Highly porous Pt nanostructures electrodeposited on carbon substrates: Towards larger surface areas for electrocatalysis

s10-047

Sachio Yoshihara (Graduate School of Engineering, Utsunomiya University, Utsunomiya, Japan), Daisuke Suzuki, Kazuyoshi Suzuki, Kenta Asanuma

Electrode Performance of Newly Developed Ni-W-P Deposited Alloy for Alkaline Water Electrolysis

Electrometallurgy

s10-048

Xuetao Luo (Department of Materials Science and Engineering, Xiamen University, Xiamen, China), Chenghao Lu, Jing Cai, Ming Fang, Liuqing Huang, Huixian Lai, Juan Chen, Xiaobing Yang, Jintang Li

Electrorefining of metallurgical grade silicon in molten $CaCl_2$ based salts

Energy conversion

s10-049

Mirko Battaglia (Dipartimento di Ingegneria Chimica, Gestionale Informatica, Università di Palermo, Palermo, Italy), Rosalinda Inguanta, Salvatore Piazza, Carmelo Sunseri

Template electrosynthesis of CuGaInSe and CuZnSnSe nanowires for solar cells

s10-050

Balázs Endrõdi (Department of Physical Chemistry and Materials Science, University of Szeged, Szeged, Hungary), Gergely Ferenc Samu, Csaba Janáky, Dóra Fejes, Endre Horváth, Zoltán Németh, Klára Hernádi, László Forró, Csaba Visy

Energy Applications in Macroscopic Dimensions: Electrosynthesis of Aligned Carbon Nanotube Array / Conducting Polymer Hybrids

s10-051

Daiyu Kodama (Department of Applied Chemistry and Biochemical Engineering, Shizuoka University, Hamamatsu City, Japan), My Duc, Yoshiumi Kohno, Yasuhisa Maeda, Masatoshi Sakurai, Hiroyuki Hanyu

Oxidation Process of Organic Acid on Titanium Dioxide Photoelectrode and Boron-doped Diamond Electrode

s10-052

Katarzyna Siuzdak (Centre for Plasma and Laser Engineering, The Szewalski Institute of Fluid-Flow Machinery, Gdansk, Poland), Miroslaw Sawczak, Anna Lisowska-Oleksiak

Nitrogen doped titania nanotube array electrodes with enhanced visible light performance

s10-053

Nicolae Spataru (Department of Electrochemistry and Corrosion, Institute of Physical Chemistry of the Romanian Academy, Bucharest, Romania)

Effect of Oxygenated Platinum and Carbon Species on the Electrocatalytic Activity of Pt Particles

s10-054

Dimitrios Tsoukleris (School of Chemical Engineering, National Technical University of Athens, Athens, Greece), Evangelia Pavlatou, Stella Spanou, Caterina Zanella, Peter Leisner

Novel Self-cleaning, anti-bacterial Sn-Ni electrocoatings of high aesthetics and durability

s10-055

Jin-Yu Ye (Department of Chemistry, Xiamen University, Xiamen, China), Jin-Yu Ye, Chang-Deng Xu, Ling Chen, Chun-Hua Zhen, Shi-Gang Sun

Study of Interaction Between Functional Agents and Single Crystal Electrodes towards Understanding the Shape-controlled Synthesis of Nanoparticle Catalysts

Renewable energy

s10-056

Shen-Ming Chen (Department of Chemical Engineering and Biotechnology, National Taipei University of Technology, Taipei, Taiwan), Rajesh Madhu, Vediyappan Veeramani

Carbon based materials for the electrochemical sensor, biosensors and energy storage applications

s10-057

Monserrat Gutierrez (Department of Electrochemestry, CIDETEQ, Queretaro, Mexico), Yunny Meas-Vong, Jose de Jesus Perez Bueno, Guy Stremsdoerfer

Evaluation of durability properties of silver deposits by Dynamic Chemical Plating technique for solar concentrators

Sustainability

s10-058

Bart Geboes (Faculty of Applied Engineering Sciences, University of Antwerp, Antwerpen, Belgium), Jon Ustarroz, Danny Pauwels, Sotiris Sotiropoulos, Annick Hubin, Tom Breugelmans

Influence of the Morphology of Electrodeposited Nanoparticles on the Electrocatalytic Activity towards Organic Halide Reduction

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CO_2 reduction

s11-001

Soojin Jeong (Department of Chemistry, Sogang University, Seoul, Korea)

Dental amalgam as an electrode material for the electrochemical reduction of carbon dioxide

s11-002

Ioanna Kalaitzidou (Department of Chemical Engineering, University of Patras, Patras, Greece), Alexandros Katsaounis, Constantinos Vayenas

Electrochemical Promotion of CO_2 Hydrogenation on Ru Catalyst-electrodes Deposited on a BZY Proton Conductor

s11-003

Marialena Makri (Chemical Engineering, University of Patras, Patras, Greece), Dimitrios Theleritis, Angel Caravaca, Alexandros Katsaounis, Constantinos Vayenas

Electrochemical Promotion of CO_2 Hydrogenation on Ru/β"-Al_2O_3 (Na^+) and Ru/YSZ Catalyst-electrodes

s11-004

Shungo Natsui (Faculty of Engineering, Hokkaido University, Sapporo, Japan), Mika Kitamura, Takafumi Wakamatsu, Tatsuya Kikuchi, Ryosuke O. Suzuki

Direct Observation of CO_2 Decomposition Behavior by Electro-reduction in LiCl-KCl Eutectic Melt

s11-005

Marcel Schreier (Institut des Sciences et Ingénierie Chimiques, Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland), S. David Tilley, Michael Grätzel

Reduction of carbon dioxide using Cu_2O photocathodes

s11-006

Dalila Touhami (Department of Engineering, University of Hull, Hull, United Kingdom), Jay Wadhawan, Stephanie Haywood, Sergey Rybchenko

Reduction of CO_2 on Pt Using Pyridine as Electrocatalyst at High Pressure

s11-007

Patrick Voyame (ISIC - LEPA, EPFL, Lausanne, Switzerland), Kathryn E. Toghill, Manuel A. Méndez, Hubert Girault

Electrocatalytic Reduction of Carbon Dioxide by $[Ru(bpy)_2(CO)L]^n$+ Catalyst in Pressurized Systems

s11-008

Anna Wadas (Department of Chemistry, University of Warsaw, Warsaw, Poland), Martyna Wisniewska, Iwona Rutkowska, Pawel J. Kulesza, Adam Gorczynski, Maciej Kubicki, Violetta Patroniak

Application of N-ligand Supported Palladium Nanostructures to Electrocatalytic Reduction of Carbon Dioxide

Electrochemistry of biologically active molecules and pharmaceuticals

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Yuya Ishii (Department of Chemistry, Keio University, Yokohama, Japan), Tribidasari Ivandini, Kazutaka Murata, Yasuaki Einaga

Development of Electrolyte-free Ozone Sensors Using Boron-doped Diamond Electrodes

s11-010

Cecilia Lete (Department of Electrochemistry, Institute of Physical Chemistry, Ilie Murgulescu, Bucharest, Romania), Stelian Lupu, Francisco Javier del Campo, Boris Lakard, Jean-Yves Hihn

Simultaneous detection of dopamine and catechol at conducting polymer-tyrosinase based electrochemical biosensor

s11-011

Stelian Lupu (Analytical Chemistry and Environmental Engineering, University Politehnica of Bucharest, Bucharest, Romania), Cecilia Lete, Paul Catalin Balaure, Dan Ion Caval, Rabah Boukherroub

Phenol detection at tyrosinase based electrochemical biosensor

Electrolyser

s11-012

Isaac Herraiz-Cardona (Photovoltaics and Optoelectronic Devices Group, Universitat Jaume I, Castelló, Spain), Luca Bertoluzzi, Sixto Giménez, Juan Bisquert

Carrier Dynamics of Photoanode Materials for Solar Water Splitting by Electrochemical Techniques

Electron transfer

s11-013

Maurício Baldan (LAS, National Institute for Space Research, São José dos Campos, Brazil), Diego H. L. Souza, Jorge Tadao Matsushima, Neidenei Ferreira, Maurício Baldan

Comparative analysis of micro- and nanocristalline boron-doped diamond films: Influence of cathodic and anodic treatments on the charge transfer

s11-014

Tom Breugelmans (Faculty of Applied Engineering Sciences, University of Antwerp, Hoboken, Belgium), Danny Pauwels, Paul Vanderauwera, Karolien De Wael, Annick Hubin

Investigation of the electrosynthetic pathway of the aldol condensation of aceton to mesityl oxide in an electrochemical microreactor

s11-015

Jesus Iniesta (Physical Chemistry and Inst. of Electrochemistry, Alicante University, Alicante, Spain), Leticia García-Cruz, Alicia Gomis-Berenguer, Conchi O. Ania, Vicente Montiel

Cu-doped nanoporous carbons for the electro-oxidation of alcohols

s11-016

Yu Mukuda (Department of Chemistry, Keio University, Yokohama, Japan), Takeshi Watanabe, Akihiko Ueda, Yoshiki Nishibayashi, Yasuaki Einaga

Electrochemical properties of phosphorus-doped diamond

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Erika Méndez-Albores (Dpto. de Fisicoquímica. Laboratorio de Inv. Electroquímica, Universidad Autónoma de Puebla, Puebla, Mexico), Martin Davila

Electrochemical Oxidation Study of Dibenzothiophene in Acetonitrile on Glassy Carbon Electrodes

Energy conversion and storage

s11-018

Francisco Alcaide (Energy, IK4-CIDETEC, San Sebastián, Spain), Hans-Jürgen Grande, Oscar Miguel, Amaia Querejeta

Nanostructured electrodes for energy generation in redox flow batteries

s11-019

Luis Arenas-Martínez (Faculty of Engineering and the Environment, University of Southampton, Southampton, United Kingdom), Carlos Ponce de León, Frank C. Walsh

Zinc-Cerium Flow Battery for Energy Storage: A Fast-assembly Laboratory Cell

s11-020

Karel Bouzek (Department of Inorganic Technology, Institute of Chemical Technology Prague, Prague, Czech Republic), Martin Prokop, Tomáš Bystron

Electrochemistry of selected phosphorus acids in context of phosphoric acid HT PEM fuel cell operation

s11-021

Christine Cachet-Vivier (Institut de Chimie et des Matériaux Paris-Est, CNRS-University Paris-East, Thiais, France), Stéphane Bastide, Michel Laurent, Claudia Zlotea, Michel Latroche

Rhodium@carbon composites for nitrates electroreduction to ammonia

s11-022

Alberto Ganassin (Department of Chemistry, Ruhr University Bochum, Bochum, Germany), Jakub Tymoczko, Viktor Colic, Aliaksandr Bandarenka, Wolfgang Schuhmann

Influence of the Alkali Metal Cations on the Activity of Pt(111) Towards Model Electrocatalytic Reactions in Acidic Sulfuric Media

s11-023

Botao Huang (DSM/IRAMIS/SPEC, CEA Saclay, Gif-sur-Yvette, France), Marco Bonetti, Michel Roger, Sawako Nakamae

Thermoelectric power conversion towards DMSO based ferrofluids – Electrochemical aspects

s11-024

Aleksandar Karajic (ISM - NSYSA Group, University of Bordeaux, Pessac, France), Mathias Heim, Marine Cadet, Stéphane Reculusa, Serge Ravaine, Nicolas Mano, Alexander Kuhn

Development of electrode architectures for bioelectrochemical applications

s11-025

Jaehan Lee (Department of Chemical and Biological Engineering, Seoul National University, Seoul, Korea), Seoni Kim, Choonsoo Kim, SeongHwan Kim

Hybrid Capacitive Deionization System: A Novel Desalination Technology Combined Carbon and Battery Materials

s11-026

Haibo Lin (Department of physical Chemistry, College of Chemistry, Jilin University, Changchun, China), Dechen Liu, Yang Li, Haiyan Lu, Yan Wang, Shi He

A Green Process of Simultaneous Preparation of Nano-silica and High Capacitance Activated Carbon from Rice Husk

s11-027

Miguel Montiel (Institute of Electrochemistry, University of Alicante, Alicante, Spain), Carlos Manuel Sánchez-Sánchez, Jose Solla-Gullón

Electrochemical characterization of different metal nanoparticles (Pt, Pd, Rh and Ir) in imidazolium-based Ionic Liquids

s11-028

Selda Oezkan (Department of Materials Science University of Erlangen-Nuremberg, 91058 Erlangen, Germany)

Optimizing the Geometrical Parameters of TiO_2 Nanotube Arrays for Maximum Performancein Photo-electrochemical Applications

s11-029

Lionel Santinacci (Center for Interdisciplinary Nanoscience of Marseille, Aix-Marseille University — CNRS, Marseille, France), Nicolas Brazeau, Loïc Assaud, Maïssa Barr, Margrit Hanbücken, Elena Baranova

Pd catalysts grown by Atomic Layer Deposition onto TiO_2/SnO_2 nanostructures: Effect of the substrate on the electrooxidation of ethanol

s11-030

Kwak Su Hong (Department of Chemistry, Seoul National University, Seoul, Korea)

Ion-selective Membranes Based on Anodized Aluminum Oxide Framework and Its Application to Reverse Electrodialysis

s11-031

Marius Treideris (Laboratory of Microstructure Technology, Center for Physical Sciences and Technology, Vilnius, Lithuania), Arūnas Setkus, Irena Simkiene, Rasa Suzanoviciene, Virginijus Bukauskas, Alfonsas Reza, Audružis Mironas, Viktorija Strazdiene, Renata Butkute

3D c-Si Solar Cell with Electrochemically Etched Frame Matrix Layer

s11-032

Benny Wouters (Research Group Electrochemical and Surface Engineering, Vrije Universiteit Brussel, Brussels, Belgium), Jonas Hereijgers, Bram Van Oevelen, Wim De Malsche, Tom Breugelmans, Annick Hubin

Membraneless Microfluidic Fuel Cell for Cogeneration of Chemicals and Electricity

s11-033

Jingjing Xiao (Department of Chemistry, Fudan University, Shanghai, China), Lei Liao, Xiaojun Bian, Jilie Kong, Baohong Liu, Micheal D. Scanlon, Hubert Girault

Functional Mesoporous Graphene as Synergistic Electrocatalyst Matrix for High-performance Hydrogen Evolution and Oxygen Reduction Reactions

Fuel Cell

s11-034

Cristina Locatelli (Department of Chemistry, University of Study of Milan, Milan, Italy), Sara Morandi, Alessandro Minguzzi, Alberto Naldoni, Ottavio Lugaresi, Marcello Marelli, Vladimiro Dal Santo, Alberto Vertova, Rinaldo Psaro, Sandra Rondinini

Electrochemical characterization of electrocatalysts for PEC water splitting

H2 production

s11-035

Mario Bärtsch (Department of Materials, ETH Zurich, Zurich, Switzerland), Sandra Hilaire, Markus Niederberger

Fe_2O_3-TiO_2 Nanostructured Composite Photoanode for Water Splitting

s11-036

Sandra Hilaire (Department of Materials, ETH Zurich, Zurich, Switzerland), Markus Niederberger

Microwave-assisted Synthesis of Crystallographically Oriented WO_3 Photoanodes for Water Splitting

s11-037

Maciej Kwiatkowski (Faculty of Chemistry, University of Warsaw, Warsaw, Poland), Igor Bezverkhyy, Magdalena Skompska

Preparation and characterization of thin TiO_2 layers deposited on ZnO nanostructures via sol-gel method

s11-038

Meixian Li (College of Chemistry and Molecular Engineering, Peking University, Beijing, China)

Hydrogen Evolution Performance Based-on MoS_2 Nanoparticles

s11-039

Lifeng Liu (Department of Nanoelectronics, International Iberian Nanotechnology Laboratory, Braga, Portugal), Xiao-Qing Bao, Ricardo Ferreira, Elvira Paz, Diana C. Leitao, Ana Silva, Susana Cardoso, Paulo P. Freitas

Well-ordered Arrays of Silicon Nanobelts with Improved Hydrogen Evolution Performance

s11-040

Benoit Piro (Department of Chemistry, University Paris Diderot, Paris, France), Amine Brayek, Samiha Chaguetmi, Sophie Nowak, Hélène Lecoq, Fayna Mammeri, Radhouane Chtourou, Souad Ammar

Photoelectrochemical Properties of ZnO@ZnS/ITO Heterostructures Prepared by Tandem Electrodeposition and Surface Sulfurization

s11-041

Kenji Sakamaki (Department of Chemistry, Fukushima National College of Technology, Iwaki, Japan), Haruka Endo, Masataka Sato, Yoichi Kamo

Photoelectrochemical Zero Bias Hydrogen Generation by Self-assembled Nanoarchitecture Electrode Associated with Chemical Bial for Reducing the Theroretical Water Electrolysis Voltage (7)

s11-042

Jeong Eun Yoo (Department of Material Science, University of Erlangen-Nüremberg, Erlangen, Germany) Patrik Schmuki

Noble Metal Decorated Arrays of TiO_2 Nanotubes for Photocatalysis

s11-043

Xiaoling Zhang (Department of R&D, Teer Coatings Limited, Miba Coating Group, Droitwich, United Kingdom), Kevin Cooke, D. Hazafy, D.N. Jose

Magnetron sputtering deposition of TiO_2 based photodiodes for direct water splitting

s11-044

Antonio de Lucas-Consuegra (Department of Chemical Engineering, University of Castilla La Mancha, Ciudad Real, Spain)

Electrochemical regeneration of Pt catalyst for hydrogen production in a solid electrolyte membrane reactor

Hydrogen-bonding proton-electron transfer reactions

s11-045

Omotayo Arotiba (Department of Applied Chemistry, University of Johannesburg, Johannesburg, South Africa), B. Ntsendwana, S. Sampath, B.B. Mamba

Photoelectrochemical degradation of Eosin Yellowish dye on EG-Si-ZnO Composite Electrode

s11-046

Guillaume de Robillard (Université de Bourgogne, Institut de Chimie Moléculaire de l'Université de Bourgogne, Dijon, France), Charles Devillers, Jacques Andrieu

Electrosynthesis of Imidazolium 2-carboxylates

Theoretical aspects

s11-047

Jouke Dykstra (Sub-department of Environmental Technology, Wageningen University, Wetsus, Leeuwarden, Netherlands), Maarten Biesheuvel, Harry Bruning, Annemiek Ter Heijne

Theory of ion transport with fast acid-base equilibrations in bioelectrochemical systems

s11-048

Carlos Alberto Martinez-Huitle (Institute of Chemistry, Federal University of Rio Grande do Norte, Natal, Brazil), Djalma Ribeiro da Silva, Karla Caroline de Freitas Araújo, Hamilton Varela

The impact of water concentration in concentrated sulfuric acid on BDD anode

s11-049

Kafia Oulmi (Department of Chemistry, University of Batna, Batna, Algeria)

Evaluation of Water Splitting Contribution Through Cation Exchange Membrane Cmx by the Electrochemical Techniques: Linear Sweep Voltammetry and Chronopotentiommetry

s11-050

Martin Wiesing (Department of Chemistry, University of Paderborn, Paderborn, Germany), Christoph Ebbert, Hans Christian Schmidt, Dmytro Rodman, Olexander Grydin, Werner Homberg, Hans-Jürgen Maier, Guido Grundmeier

Enhancement of Cu-Cu Cold Pressure Welding by Means of Electrochemical Surface Activation

Wastewater treatment

s11-051

José M. Aquino (Department of Chemistry, São Carlos Federal University, São Carlos, Brazil), Douglas A.C. Coledam, Romeu C. Rocha-Filho, Nerilso Bocchi, Sonia R. Biaggio

On the Performance of Boron-doped Diamond and β-PbO_2 Anodes in the Electrooxidation of Norfloxacin

s11-052

Symeon Bebelis (Department of Chemical Engineering, University of Patras, Patras, Greece), Asimina Tremouli, Michalis Martinos, Gerasimos Lyberatos

A Four Air Cathodes Single Chamber Microbial Fuel Cell (4ACMFC) for Municipal Wastewater Treatment

s11-053

M.E. Henry Bergmann (Department of Process and Electroengineering, Anhalt University, Köthen/Anh., Germany), Tatiana Iourtchouk, Jens Hartmann, Wido Schmidt, Michaela Fischer

Comparison of different technical electrode materials for drinking water electrolysis with respect to THM and AOX formation

s11-054

Maarten Biesheuvel (Sub-department of Environmental Technology, Wageningen University, Wetsus, Wageningen, Leeuwarden, Netherlands), Taeyoung Kim, Jouke Dykstra, Slawomir Porada, Bert van der Wal, Jeyong Yoon

Reducing energy consumption in Ccapacitive deionization by increasing the discharge voltage

s11-055

Nerilso Bocchi (Department of Chemistry, Federal University of São Carlos, São Carlos, Brazil), Gabriel F. Pereira, Romeu C. Rocha-Filho, Sonia R. Biaggio

Electrochemical Degradation of the Herbicide Picloram using BDD and β-PbO_2 Anodes in a Flow Reactor

s11-056

Ricardo Brocenschi (Department of Chemistry, São Carlos Federal University, São Carlos, Brazil), Romeu C. Rocha-Filho, Bianca Ferreira, Sonia R. Biaggio, Nerilso Bocchi

Electrodegradation of estrone in a flow reactor using a boron-doped diamond anode

s11-057

Simone Congiu (Department of Civil, Chemical and Environmental Engineering, University of Genoa, Genoa, Italy), Marco Panizza, Antonio Barbucci, Maria Paola Carpanese, Marina Delucchi, Alice Giuliano, Giacomo Cerisola

Electro-Fenton Degradation of Anionic Surfactants

s11-058

Martin Davila (Faculty of Chemistry, Universidad Autónoma de Puebla, Puebla, Mexico), María Alejandra Romero Morán, Esmeralda García Díaz, María Elizalde González

Oxidation and mineralization of urea on a β-$Ni(OH)_2$/Ni-PVC Electrode

s11-059

Didier Devilliers (PHENIX Laboratory, Université Pierre et Marie Curie, Paris, France), Eric Mahe, Dmytri Girenko, Alexander Velichenko

Electrodeposition of thin electrocatalytic PbO_2 layer on FTO substrates

s11-060

Antonio Fonseca (Department of Chemistry, University of Minho, Braga, Portugal)

Electrochemical reduction of nitrate ions in aqueous medium using carbon nanotubes supported metal catalysts

s11-061

Sergi Garcia-Segura (Química Física, Universitat de Barcelona, Barcelona, Spain), Francesc Centellas, Rosa M. Rodríguez, José Antonio Garrido, Pere L. Cabot, Enric Brillas

Treatment of Dyes by Solar Photoelectro-Fenton in an Autonomous Flow Plant. An Eco-friendly, Efficient and Affordable Electrochemical Technology

s11-062

Sergi Garcia-Segura (Química Física, Universitat de Barcelona, Barcelona, Spain), Xavier Florenza, Aline Maria Sales Solano, Francesc Centellas, Carlos Alberto Martinez-Huitle, Enric Brillas

Electrochemical Advanced Oxidation Processes Applied to the Decoloration and Mineralization of Industrial Azo Dye Acid Red 1

s11-063

Ping Geng (Department of Chemical and Biomolecular Engineering, The Hong Kong University of Science and Technology, Hong Kong, China), Caroline Miles, Christos Comninellis, Guohua Chen

Magnéli Ti_4O_7 Nanotube Arrays as Novel Anodes for Wastewater Treatment

s11-064

Laura Gonzalez-Macia (Department of Biological, Biomedical and Analytical Sciences, University of the West of England, Bristol, United Kingdom), Jonathan Winfield, Ioannis Ieropoulos, Anthony J. Killard

Application of Printing Techniques for the Miniaturization of Microbial Fuel Cells

s11-065

Stefanie Hild (Department of Electrochemistry, DECHEMA-Forschungsinstitut, Frankfurt / M, Germany), Jürgen Schuster, Claudia Weidlich, Klaus-Michael Mangold

Electrochemistry in water treatment –Water softening and Micropollutants

s11-066

Kallyni Irikura (Department of Chemistry, Federal University of São Carlos, São Carlos, Brazil), Romeu Cardoso Rocha-Filho, Nerilso Bocchi, Sonia R. Biaggio

Preparation of β-PbO_2 Microfilms on Carbon Fiber for the Electrochemical Degradation of the Dye Acid Green 28 using a Filter-press Reactor

s11-067

Kazuhide Kamiya (Department of Applied Chemistry, The University of Tokyo, Tokyo, Japan), Kazuhito Hashimoto, Shuji Nakanishi

Graphene Defects Serve as Active Catalytic Sites Superior to Platinum for the Electrochemical Nitrate Reduction

s11-068

Seoni Kim (Department of Chemical and Biological Engineering, Seoul National University, Seoul, Korea), Minhyuk Im, Jaehan Lee

Lithium recovery from wastewater using a hybrid supercapacitor

s11-069

Jan Kruid (Biotechnology Innovation Centre, Rhodes University, Grahamstown, South Africa), Ronen Fogel, Janice Limson

Catalyst Assisted Electro-Fenton Reaction for Remediation of Endocrine Disrupting Compounds

s11-070

Javier Llanos (Department of Chemical Engineering, University of Castilla-la Mancha, Ciudad Real, Spain), Salvador Cotillas, Manuel Andrés Rodrigo, Cristina Sáez, Pablo Cañizares

An Environmental Application of Electrochemistry: Combined Electrochemical Technologies for the Regeneration of Treated Wastewaters

s11-071

Javier Llanos (Department of Chemical Engineering, University of Castilla La Mancha, Ciudad Real, Spain), Salvador Cotillas, Katherin Castro, Pablo Cañizares, María José Martín de Vidales, Cristina Sáez, Manuel A. Rodrigo

Sono-electrodisinfection of Urban Wastewaters Using DSA Anodes

s11-072

Laura Mais (Department of Mechanical, Chemical and Materials Engineering, University of Cagliari, Cagliari, Italy), Sara Monasterio, Federica Dessì, Michele Mascia, Annalisa Vacca, Simonetta Palmas

Electrochemical Treatment for the Removal of Chlorella Vulgaris and Microcystis Aeruginosa by Using a Fixed Bed Single Cell

s11-073

Takayuki Mano (Department of Material and Energy Science, Okayama University, Okayama, Japan), Shunsuke Nishimoto, Yoshikazu Kameshima, Michihiro Miyake

Wastewater Treatment by Electrochemically Assisted Photocatalytic Ozonation Using TiO_2 Photoelectrode

s11-074

Manuel César Martí Calatayud (Chemical and Nuclear Engineering, Universitat Politècnica de València, València, Spain), Montserrat García Gabaldón, Emma Ortega, Valentín Pérez Herranz

Role of Electrolyte on the Overlimiting Ion Conductance of Cation-exchange Membranes

s11-075

Jorge Matsushima (Laboratorio Associado de Sensores e Materiais (LAS), Instituto Nacional de Pesquisas Espaciais (INPE), São Jose dos Campos, Brazil), Neidenei Ferreira, Maurício Baldan

Oxide cobalt electrodeposited on boron-doped diamond electrodes for application in electroanalysis of nitrite

s11-076

Luca Mattarozzi (Institute for Energetics and Interphases, National Research Council of Italy, Padua, Italy), Sandro Cattarin, Nicola Comisso, Paolo Guerriero, Marco Musiani, Lourdes Vázquez-Gómez, Enrico Verlato

Electrodeposition of Compact and Porous Cu-Zn Alloys and their Test in the Cathodic Reduction of Nitrate

s11-077

Elena Mejia Likosova (Advanced Water Management Centre, The University of Queensland, Brisbane, Australia), Jurg Keller, Yvan Poussade, Stefano Freguia

A Novel 2-Stage Process for the Recovery and Recycling of Ferric from Ferric Sludges Generated in Water and Wastewater Treatment

s11-078

Francisca Moreira (Department of Chemical Engineering, LSRE - University of Porto, Porto, Portugal), Rui Boaventura, Enric Brillas, Vítor Vilar

Combination of Biological Oxidation and Electrochemical Advanced Oxidation Processes to the Remediation of a Winery Wastewater

s11-079

Francisca Moreira (Department of Chemical Engineering, LSRE - University of Porto, Porto, Portugal), Juan Escoda, Rui Boaventura, Enric Brillas, Vítor Vilar

Electrochemical Advanced Oxidation Processes Applied to the Treatment of a Leachate from Sanitary Landfill

s11-080

Francisca Moreira (Department of Chemical Engineering, Faculty of Engineering University of Porto, Porto, Portugal), Sergi Garcia-Segura, Rui Boaventura, Enric Brillas

Degradation of Trimethoprim Antibiotic by Anodic Oxidation, Electro-Fenton, UVA PhotoElectro-Fenton and Solar PhotoElectro-Fenton Processes

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Antonio Moya (Department of Física, Universidad de Jaén, Jaén, Spain), Philippe Sistat

Chronoamperometric Characterization of Ion-exchange Membrane Systems

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Shunsuke Nishimoto (Department of Material and Energy Science, Okayama, Japan), Yusuke Sawai, Yoshikazu Kameshima, Michihiro Miyake

Underwater superoleophobicity of anodized TiO_2 nanotube

s11-083

Emma M. Ortega (ISIRYM, Universitat Politècnica de València, Valencia, Spain), Jordi Carrillo-Abad, Montserrat García-Gabaldón, Valentín Perez-Herranz

Effect of the cathodic initial zinc concentration on the behaviour of an electrochemical CEM reactor

s11-084

Javier Paramo Vargas (Environmental Research, CIATEC, Leon, Mexico), Juan Manuel Peralta Hernandez

Electrochemical treatment of the effluent of an anaerobic digester from a slaughtherhouse

s11-085

Pier Parpot (Department of Chemical Chemistry, University of Minho, Braga, Portugal)

Electrochemical oxidation of emerging pollutants with carbon nanotubes supported metal catalysts

s11-086

Manuel Andres Rodrigo (Department of Chemical Engineering, Universidad de Castilla la Mancha, Ciudad Real, Spain), Esperanza Mena, Clara Ruiz, Carolina Risco, José Villaseñor, Cristina Sáez, Pablo Cañizares

Coupling Electrokinetic Soil Flushing with Permeable Reactive Barriers: The Key to Use Effectively Electrochemical Technology in Soil Remediation

s11-087

Claudie Roy (Centre Énergie, Matériaux, Télécommunications, Institut National de la Recherche Scientifique, Varennes, Canada), Manuel Martin, Erwan Bertin, David Reyter, Sebastien Garbarino, Daniel Guay

Cu_{upd} / Pt Nano-structured Thin Films: Crystallographic(100) Surface Orientation and Synergetic Effect for NO_3- Reduction

s11-088

Claudie Roy (Centre Énergie, Matériaux, Télécommunications, Institut National de la Recherche Scientifique, Varennes, Canada), Jules Galipaud, Manuel Martin, Sebastien Garbarino, Lionel Roué, Daniel Guay

Ammonia Oxidation at (100) Oriented Pt and PtNi Alloy Synthesized by Pulsed Laser Deposition

s11-089

Luis Ruotolo (Department of Chemical Engineering, Federal University of Sao Carlos, Sao Carlos, Brazil), Rosimeire Farinos

Organic Degradation Using Three-dimensional PbO_2 Anodes

s11-090

Maria Maésia S. G. Eiband (Department of Institute of Chemistry, Federal University of Rio Grande do Norte, Natal, Brazil), Kelvin Gama Guimarães, Kamelia C. de Araújo Trindade, Carlos Alberto Martinez-Huitle

Electrocoagulation Process to Remove Lead and Cadmium Metals from a Binary Mixture

s11-091

Maria Maésia S. G. Eiband (Department of Institute of Chemistry, Federal University of Rio Grande do Norte, Natal, Brazil), Kelvin Gama Guimarães, Kamelia C. de Araújo Trindade, Carlos Alberto Martinez-Huitle

Use of Combined Electrochemical Approaches for Elimination and Detection of Cadmium from Synthetic Effluent

s11-092

Elisama Santos (Institute of Chemistry, Federal University of Rio Grande do Norte, Natal, Brazil), Danyelle M. Araújo, Salvador C. Soriano, Carlos Alberto Martinez-Huitle, Manuel A. Rodrigo

Evaluation of the Electrochemical Degradation of Rhodamine B using BDD at Different Electrolytes

s11-093

William Tarpeh (Department of Civil and Environmental Engineering, University of California at Berkeley, Berkeley, USA), Kara Nelson

Optimizing Electrochemical Nitrogen Recovery as Ammonium from Source-separated Urine

s11-094

Abdoulaye Thiam (Laboratori Electroquímica dels Materials i del Medi Ambient, Universitat de Barcelona, Barcelona, Spain), Enric Brillas, Rosa M. Rodríguez, José Antonio Garrido, Francesc Centellas, Pere L. Cabot, Ignasi Sirés

Treatment of a Mixture of Food Azo-colours in Different Water Matrices by UV and Solar Photoelectro-Fenton

s11-095

Abdoulaye Thiam (Laboratori Electroquímica dels Materials i del Medi Ambient, Universitat de Barcelona, Barcelona, Spain), Fábio Gozzi, Silvio C. De Oliveira, Amilcar Machulek Jr., Enric Brillas, Ignasi Sirés

On the Need of BDD Anode for the Mineralization of a Commercial Pesticide Formulation

s11-096

Asuman Unal (Department of Chemistry, University of Leicester, Leicester, United Kingdom), Robert Hillman, Karl S. Ryder, Abdulcabbar Yavuz

Defluoridation of Water by Polyaniline Films: EQCM Characterization of Ion Uptake and Film Regeneration

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Jiade Wang (Environmental Engineering Center, Zhejiang University of Technology, Hangzhou, China), Bijuan Shao, Tingting Li, Xiaolong Chen, Xiangpeng Li

Degradation of Phenol in a Novel Plug Flow Electrochemical Reactor with Mesh Plate Electrodes

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Symposium 12: Electrochemistry Combined with Spectroscopic and Microscopic Techniques for Molecular Descriptions of ET Processes

Coupled techniques

s12-001

Chun-hsien Chen (Department of Chemistry, National Taiwan University, Taipei, Taiwan), Ta-Se Ding, Min-Jie Huang, Hao-Cheng Lu, Chan-Hsiang Hsu, Erh-Chien Hung, Ching-Hong Jiang

Tuning the Electric Conductance of Metal String Complexes via Electrochemical Control

s12-002

Zhao-Bin Chen (Chemistry Department, Xiamen University, Xiamen, China), Wen-Yun Hu, Xiao-Shun Zhou, De-Yin Wu, Bing-Wei Mao, Christian Amatore

Electron Conduction through Atomic Size Metal Contacts under Electrochemical Charge Transfer

s12-003

Thomas Doneux (Chimie Analytique et Chimie des Interfaces, Université Libre de Bruxelles, Bruxelles, Belgium), Eléonore Triffaux, Anne Meunier, Claudine Buess-Herman

Combining Electrochemistry and Fluorescence Microscopy for the Study of Electrified Biointerfaces

s12-004

Angelika Holzinger (Institute of Analytical and Bioanalytical Chemistry, University Ulm, Ulm, Germany), Maria Komkova, Arkady Karyakin, Christine Kranz

AFM Tip-integrated Prussian Blue/Nickel-Hexacyanoferrate Electrodes for H_2O_2 Detection

s12-005

Wenjing Hong (Department of Chemistry and Biochemistry, University of Bern, Bern, Switzerland), Masoud Baghernejad, Cancan Huang, Pavel Moreno García, Thomas Wandlowski

Towards *in-situ* Raman Spectroscopy on Electrochemical Gated Single-molecule Junctions

s12-006

Susumu Kuwabata (Department of Applied Chemistry, Graduate School of Eng., Osaka University, Suita, Japan)

In Situ Electron Microscope Observation of Electrochemical and Chemical Reactions in Ionic Liquid

s12-007

Akiyoshi Kuzume (Chemistry and Biochemistry, University of Bern, Bern, Switzerland), Alexander Rudnev, Yongchun Fu, Thomas Wandlowski

CO oxidation on Pt(100): New insights from combined voltammetric, microscopic and spectroscopic studies

s12-008

Milica Sentic (Faculty of Chemistry, University of Belgrade, Belgrade, Serbia), Gabriel Loget, Stéphane Arbault, Laurent Bouffier, Dragan Manojlovic, Alexander Kuhn, Neso Sojic

Autonomous Light-emitting Systems at Different Scales Triggered by Bipolar Electrochemistry

s12-009

Cigdem Toparli (Department of Interface Chemistry and Surface Engineering, Max-Planck-Institut für Eisenforschung, Düsseldorf, Germany), Ying Cheng, Andreas Erbe

Electronic Structure of Copper Oxide Films under Electrochemical Polarization

s12-010

Fritz Weisser (Institut für Anorganische Chemie, Freie Universität Berlin, Berlin, Germany), Johannes Klein, Bernd Plietker, Biprajit Sarkar

Identification of a Reversible EC Mechanism in $[Fe(CO)_3(NO)]^-$

Electroanalysis

s12-011

Milka Avramov Ivic (Department of Eelectrochemistry, Institute of Electrochemistry, University of Belgrade, Belgrade, Serbia), Dusan Mijin, Slobodan Petrovic

Electrochemical Oxidation of Donepezil and Its Voltammetric Determination at Gold Electrode

s12-012

Milka Avramov Ivic (Department of Electrochemistry, Institute of Electrochemistry, University of Belgrade, Belgrade, Serbia), Branimir Brgur, Dusan Mijin, Slobodan Petrovic

Electrochemical Activity and Degradation of Dimethenamide-P

s12-013

Ilche Gjuroski (Department of Chemistry and Biochemistry, University Berne, Berne, Switzerland)

On the Acceleration of Cu Electrodeposition by TBPS: A Combined Electrochemical, STM, NMR and ESI-MS Study

s12-014

Karol Lušpai (Department of Physical Chemistry, Slovak University of Technology, Bratislava, Slovakia)

Cyclic voltammetry in thin layer of controlled thickness on Pt disc microelectrode – Theory and application

s12-015

Philani Mashazi (Department of Chemistry, Rhodes University, Grahamstown, South Africa)

Thin films of electron conducting carbon nanotubes and electro-active metallo-phthalocyanines: Surface analysis and enhanced electrocatalysis

s12-016

Klaus Mathwig (MESA+ Institute for Nanotechnology, University of Twente, Enschede, Netherlands), Dileep Mampallil, Ab F. Nieuwenhuis, Serge Lemay

Nanofluidic Electrochemical Transient Spectroscopy

s12-017

Giovanni Valenti (Department of Chemistry, University of Bologna, Bologna, Italy), Enrico Rampazzo, Elena Villani, Elisa Biavardi, Massimo Marcaccio, Enrico Dalcanale, Luca Prodi, Francesco Paolucci

Electrochemiluminescent μbeads-based sensor for prostate cancer early detection

Molecular and supramolecular electrode mechanisms

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Binghong Han (Materials Science and Engineering, MIT, Cambridge, USA), Kelsey Stoerzinger, Vaso Tileli, Eric A. Stach, Yang Shao-Horn

In-situ TEM Study of Perovskites for Oxygen Electrocatalysis

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Isis Ledezma-Yanez (LIC-Catalysis and Surface Science, Leiden University, Leiden, Netherlands), Marc T.M. Koper

Electrochemical Impedance Spectroscopy of Hydrogen/Deuterium UPD on Pt(111) in Acidic and Alkaline Media: Kinetics of Proton Transfer

Molecular electrochemistry

s12-020

Fernando Henrique Cincotto (Department of Chemistry, Instituto de Química de São Carlos, Universidade de São Paulo, São Carlos, Brazil), Thaigo Canevari, Anderson Campos, Sergio A.S. Machado

Simultaneous Determination of Epinephrine and Dopamine by Electrochemical Reduction on the Hybrid Material SiO_2/graphene Content Ag Nanoparticles

s12-021

Oscar Diaz-Morales (Catalysis and Surface Chemistry, Leiden University, Leiden, Netherlands), Thom J.P. Hersbach, Dennis G.H. Hetterscheid, Joost N.H Reek, Marc T.M. Koper

Oxygen evolution on an iridium-based molecular catalyst: Turnover frequencies, stability and electrolyte effects

s12-022

Yongchun Fu (Department of Chemistry and Biochemistry, University of Bern, Bern, Switzerland), Akiyoshi Kuzume, Alexander V. Rudnev, Thomas Wandlowski

The Interface between Au Single Crystal Surfaces and 1-Hexyl-3-Methylimidazolium Cation-based Ionic Liquids: Electrochemistry and EC-STM Study

s12-023

Felipe J. González (Departamento de Química, Centro de Investigación y de Estudios Avanzados, Mexico, Mexico), Drochss P. Valencia

Estimation of Diffusion Coefficients by Using a Linear Correlation Depending on the Molecular Weight

s12-024

Cancan Huang (Department of Chemistry and Biochemistry, University of Berne, Bern, Switzerland), Wenjing Hong, Thomas Wandlowski

Single-molecule Charge Transport Study Using Electrochemical and Mechanical Controllable Break Junction (EC-MCBJ)

s12-025

Abdirisak Ahmed Isse (Department of Chemical Sciences, University of Padova, Padova, Italy), Ludovico Scarpa, Christian Durante, Armando Gennaro

Electrocatalytic Reduction of Organic Halides in 1-Butyl-3-methylimmidazolium Tetrafluoroborate

s12-026

Kristyna Kantnerova (Department of Molecular Electrochemistry, J. Heyrovsky Institute of Physical Chemistry of the ASCR, Prague 8, Czech Republic), Jirí Ludvík

Spectroelectrochemical Study of Reactivity of Orthophthalaldehyde with Amino Acids

s12-027

Alan Liska (Department of Molecular Electrochemistry, J. Heyrovský Institute of Physical Chemistry AS CR , Prague 8, Czech Republic), Jirí Ludvík

Electrochemistry of nitro-substituted thiacalix[4]arenes

s12-028

Radka Metelková (Department of Inorganic Chemistry, Institute of Chemical Technology Prague, Prague, Czech Republic), Irena Hoskovcová, Tomáš Tobrman, Jirí Ludvík

Fischer carbene complexes with two chromium centers as potential molecular wires

s12-029

Miklós Mohos (Department of Chemistry and Biochemistry, University of Bern, Bern, Switzerland)

Electrochemical current-sensing atomic force microscopy in conductive solutions

s12-030

Shino Sato (Department of Chemistry, Hokkaido University, Sapporo, Japan), Kei Murakoshi

Enhancement of electron transfer at metal-molecule interfaces using Palladium atomic layer deposition

s12-031

Yuma Takeuchi (Department of Chemistry, Hokkaido University, Sapporo, Japan), Kei Murakoshi

Electrochemical formation and conductive AFM observation of molecular nanodots

s12-032

Veronika Zinovyeva (Chemistry Department, IPN Orsay, University of Paris 11, Orsay, France), Servando López-León, Céline Cannes, Claire Le Naour, Marie-Olga Sornein, Jean-Claude Berthet, Jacques de Sanoit

Electrochemical and Spectral Properties of Neodymium, Lanthanum, Europium and Uranium Compounds in Room-temperature Ionic Liquids

Organic and inorganic electrosynthesis and electrocatalysis

s12-033

Ali Rýza Ozkaya (Department of Chemistry, Marmara University, Istanbul, Turkey)

Electrochemical Properties of 2,3-dihydro-1h-inden-5 yloxy Beta-substituted Phthalocyanine Compounds

Spectroelectrochemistry surface-driven electron transfer pathways

s12-034

Andreas Erbe (Department of Interface Chemistry and Surface Engineering, Max-Planck-Institut für Eisenforschung GmbH, Düsseldorf, Germany), Simantini Nayak, P. Ulrich Biedermann

Peroxide and Superoxide as Intermediates in the Oxygen Reduction Reaction on Ge(100) – Alkaline vs. Acidic Conditions: A Combined Electrochemical ATR-IR Spectroscopic and DFT Study

s12-035

Minbale Admas Teshager (Chemical Engineering, National Taiwan University of Science and Technology, Taipei, Taiwan), Shawn D. Lin, Bing Joe Hwang

In-Situ DRIFTS Analysis of Surface Layer Formation on ($Li_{1.2}Ni_{0.2}Mn_{0.6}O_2$) and $LiCoO_2$ Cathode and the Oxidation-induced Decomposition of Electrolyte

s12-036

Luciana Vieira (Institute for Chemistry and Technology of Materials, Graz University of Technology, Graz, Austria), Robert Schennach, Bernhard Gollas

Surface Chemistry of Glassy Carbon in a Deep Eutectic Solvent: A Spectroelectrochemical PM-IRRAS Study

s12-037

Ulmas Zhumaev (Chemistry and Biochemistry, The University of Bern, Bern, Switzerland), Akiyoshi Kuzume, Ilya V. Pobelov, Alexander V. Rudnev, Thomas Wandlowski

Adsorption of Perchlorate Ions on Au(111) Electrodes

Spectroscopies

s12-038

Heike Arnolds (Department of Chemistry, University of Liverpool, Liverpool, United Kingdom), Nungnit Wattanavichean, Richard Nichols

Metallization of Mercaptopyridine Self-assembled Monolayers Observed by Surface-enhanced Raman Spectroscopy

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Ilche Gjuroski (Department of Chemistry and Biochemistry, Univeristy of Berne, Berne, Switzerland), Peter Broekmann Julien Furrer

Interaction of MPS with Cu(I) intermediates: An NMR Study

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Rudolf Holze (Institute of Chemistry, Technical University Chemnitz, Chemnitz, Germany)

The Adsorption of Thiophenol on Gold - A Spectroelectrochemical Study

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Sheng-Juan Huo (Department of Chemistry, Shanghai Universit, Shanghai, China), Zhi-Yuan Chang

In situ ATR-FTIR spectroscopy on Cu-Ni alloy electrodes

s12-042

Katsuyoshi Ikeda (Department of Chemistry, Faculty of Science, Hokkaido University, Sapporo, Japan), Jian Hu, Kohei Uosaki

Electrochemical gap-mode SERS study of molecular adsorbates on atomically defined catalytic metal surfaces

s12-043

Akiyoshi Kuzume (Department of Chemistry and Biochemistry, University of Bern, Bern, Switzerland), Ulmas Zhumaev, Thomas Wandlowski

In-situ spectro-electrochemical studies on OH adsorption on Pt(hkl) towards oxygen reduction reaction

s12-044

Jian-Feng Li (Department of Chemistry, Xiamen University, Xiamen, China), Thomas Wandlowski, Zhong-Qun Tian

Shell-isolated Nanoparticle-enhanced Raman Spectroscopy (SHINERS) and Its Applications on Atomically Flat Single Crystal Electrode Surfaces

s12-045

Takuya Masuda (JST, PRESTO, Tsukuba, Japan), Hideki Yoshikawa, Hidenori Noguchi, Tadahiro Kawasaki, Masaaki Kobata, Keisuke Kobayashi, Kohei Uosaki

In situ Observation of Electrochemical Growth of Si Oxide by Hard X-ray Photoelectron Spectroscopy

s12-046

Fang Niu (Interface Chemistry and Surface Engineering, Max-Planck-Institut für Eisenforschung GmbH, Düsseldorf, Germany), Simantini Nayak, Andreas Erbe

Structural Dynamics Study of Hydration Shells in Aqueous Solution with Electrochemical Control

s12-047

Hidenori Noguchi (International Center for Materials Nanoarchitectonics, National Institute For Materials Science, Tsukuba, Japan), Shuo Yang, Mikio Ito, Kohei Uosaki

Utilization of double resonance sum frequency generation (DR-SFG) spectroscopy to investigate the interfacial vibrational and electronic structure at solid/liquid interface

s12-048

Danai E. Panagoulia (Department of Chemistry, University of Southampton, Southampton, United Kingdom), Robert P. Johnson, Andrea E. Russell

Studying the Double Layer at the Metal-ionic Liquid Interface using Electrochemical Surface-enhanced Raman Spectroscopy on Nanostructured Substrates

s12-049

Stefanie Pengel (Department of Interface Chemistry and Surface Engineering, Max-Planck-Institut für Eisenforschung GmbH, Düsseldorf, Germany), Bernd Schönberger, Andreas Erbe

Attenuated total reflection mid-IR-spectroscopy for electrochemical applications using a quantum cascade laser

s12-050

Milica Sentic (Faculty of Chemistry, University of Belgrade, Belgrade, Serbia), Milena Milutinovic, Frédéric Kanoufi, Dragan Manojlovic, Stéphane Arbault, Neso Sojic

Mapping the Electrogenerated Chemiluminescence Reactivity in Space: Mechanistic Insight into Model Systems Used in Immunoassays

s12-051

Ludmila Simková (Department of Molecular Electrochemistry, J. Heyrovský Institute of Physical Chemistry of the ASCR, Prague, Czech Republic), Karol Lušpai, Jirí Ludvík

Simulation of temperature dependent ESR spectra with AL effect formed upon electrochemical reduction of FOX-7

Symposium 13: Synergizing Theory and Experiment in Electrochemistry: State-of-the-Art Developments

Adsorption

s13-001

Julia Alvarez-Malmagro (Department of Physical Chemistry, University of Seville, Seville, Spain), Francisco Prieto, Antonio Rodes, Manuela Rueda

Adenine adsorption and co-adsorption with thymine on gold electrodes from basic media: A spectroelectrochemical FT-IR study

s13-002

Yi-Fan Huang (Department of Chemistry, Leiden University, Leiden, Netherlands), Manuel Kolb, Marc T.M. Koper

In-situ Identification of Intermediates of Hydrogen Evolution on Platinum Single Crystal Electrodes by Shell-Isolated Nanoparticles-enhanced Raman Spectroscopy

s13-003

Katherine Hunter (Department of Chemistry, Cardiff Catalysis Institute, Cardiff, United Kingdom), Ashley Brew, Jonathan Sharman, Edward Wright

Studies of the Specific Adsorption of the Perchlorate Anion on Pthkl

s13-004

Guohui Zhang (Department of Chemistry, University of Warwick, Coventry, United Kingdom), Paul M. Kirkman, Kim McKelvey, Patrick R. Unwin

Quinone Adsorption and Electrochemistry at Graphite Electrodes: Testing and Revising the Literature Model

Computational Electrochemistry

s13-005

Serhiy Cherevko (Department of Interface Chemistry and Surface Engineering, Max-Planck Institut for Eisenforschung GmbH, Dusseldorf, Germany), Nadiia Kulyk, Karl Mayrhofer

Application of Koutecky-Levich Equation for Scanning Flow Cell: Numerical Calculations

s13-006

Jeanet Conradie (Department of Chemistry, University of the Free State, Bloemfontein, South Africa)

Cr and W Fisher Carbenes: A DFT Understanding of the Electrochemical Behaviour

s13-007

Jeanet Conradie (Department of Chemistry, University of the Free State, Bloemfontein, South Africa), Roxanne Freitag, Renyuan Liu, Marrigje Marianne Conradie

Redox potentials of M(β-diketonato)$_3$ Complexes: Prediction by Frontier Orbital Energies

s13-008

Jürgen Fuhrmann (Department of Numerical Analysis and Scientific Computing, Weierstrass Institute for Applied Analysis and Stochastics, Berlin, Germany), Christian Merdon

Activity-based Finite Volume Methods for Generalized Nernst-Planck-Poisson Systems

s13-009

Zdenek Futera (Department of Chemistry, Keio University, Yokohama, Japan), Keitaro Sodeyama, Jaroslav Burda, Yoshitaka Tateyama

Double QM/MM Method for Donor-acceptor Electron Transfer Reactions in Aqueous Solution

s13-010

Olga Gichan (Department of Theory of Nanostructured Systems, Chuiko Institute of Surface Chemistry, Ukrainian National Ac, Kyiv, Ukraine)

Mass Transfer and Loss of Stability in a Model Electrocatalytic Process

s13-011

Hana Kvapilová (J. Heyrovský Institute of Physical Chemistry, Academy of Sciences of the Czech Republic, Prague, Czech Republic), Irena Hoskovcová, Jirí Ludvík, Stanislav Záliš

Theoretical Predictions of Redox Properties of Mononuclear and Binuclear Fischer Aminocarbene Complexes – Effect of Counterion

s13-012

Ezequiel Leiva (Department of Mathematics and Physics, Universidad Nacional de Córdoba, Córdoba, Argentina), M. Ezequiel Castillo, Martin Zoloff-Michoff, Patricio Vélez

First Principles Studies of Molecular Junctions on the Basis of Tolane Derivatives

s13-013

Christian Merdon (Numerical Analysis and Scientific Computing, Weierstrass Institute for Applied Analysis and Stochastics, Berlin, Germany), Alexander Linke, Jürgen Fuhrmann, Mehdi Khodayari, Helmut Baltruschat

Detection of Solubility, Transport and Reaction Coefficients from Experimental Data by Inverse Modeling of Thin Layer Flow Cells

s13-014

Lehel Sabo (Institute of Electrochemistry, Ulm University, Ulm, Germany), Donato Fantauzzi, Timo Jacob

ReaxFF Simulations on the Dynamics of the Oxygen Reduction Reaction on Pt Electrodes

s13-015

Dodzi Zigah (ISM, University of Bordeaux, Pessac, France), Jérôme Roche, Gabriel Loget, Zahra Fattah, Stéphane Arbault, Alexander Kuhn, Laurent Bouffier

Simulation of Competing Charge Transfer and Migration Processes Involved in the Electrochemical Formation of Ringed Microparticles

Double-layer capacitance

s13-016

Renata Costa (Department of Chemistry, Faculdade de Ciências da Universidade do Porto, Porto, Portugal), Carlos M. Pereira, A. Fernando Silva

The Role of the Cation and the Anion on the Interfacial Properties of Ionic Liquids Mixtures at Charged Surfaces

Electrocatalysis

s13-017

Carlos Busó-Rogero (Department of Physical Chemistry, Institute of Electrochemistry, Alicante, Spain), Sylvain Brimaud, Enrique Herrero, Jose Solla-Gullon, Francisco J. Vidal-Iglesias, R. Jürgen Behm, Juan M. Feliu

Surface structure effects on different Pt electrodes for ethanol oxidation: Influence of pH exchange

s13-018

Wen-Bin Cai (Department of Chemistry, Fudan University, Shanghai, China), Han Wang

Pt Monolayer on Au Formed by Chemical Process with Enhanced Electrocatalysis towards Ethanol Oxidation in Alkaline Media

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Shengli Chen (Department of Chemistry, Wuhan University, Wuhan, China), Junxiang Chen

DFT Insights into the Oxygen Reduction Reaction on Pt(111): Surface Spectators and Tafel Kinetics

s13-020

Xi Cheng (LEC, Paul Scherrer Insititut, Villigen, Switzerland), Emiliana Fabbri, Thomas Justus Schmidt

Study of the oxygen evolution/reduction reaction mechanism and activity of Perovskite $La_{1-x}Sr_xCoO_3$-based electrodes in alkaline media by thin film rotating ring disk electrode measurements

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Oscar Diaz-Morales (Department of Catalysis and Surface Chemistry, Leiden University, Leiden, Netherlands), Marc T.M. Koper

Electrochemical water oxidation catalyzed by nickel-based double hydroxides

s13-022

Christian Durante (Department of Chemical Sciences, Università di Padova, Padova, Italy), Valentina Perazzolo, Abdirisak Ahmed Isse, Marco Favaro, Gaetano Granozzi, Armando Gennaro

Electrochemical Activation of Carbon-halogen Bonds: Electrocatalysis at Palladium/Copper Nanoparticles

s13-023

Kai S. Exner (Physical Chemistry Department, Justus-Liebig-University Giessen, Giessen, Germany), Josef Anton, Timo Jacob, Herbert Over

Microscopic Insights into the Chlorine Evolution Reaction on RuO_2(110) Catalyst: *ab initio* Thermodynamics DFT Study Investigating the Influence of Catalyst Doping

s13-024

David Fenning (Department of Mechanical Engineering, Massachusetts Institute of Technology, Cambridge, USA), Kevin May, Kelsey Stoerzinger, Wesley Hong, Dongkyu Lee, Michael Biegalski, Alexie Kolpak, Yang Shao-Horn

Single-Nanometer Scale Thickness Dependence of Photoelectrochemical Water Splitting on Ultrathin Lanthanum Ferrite Films

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Elumalai Ganesan (GREEN, National Institute for Materials Science (NIMS), Tsukuba, Japan), Hidenori Noguchi, Takuya Masuda, Andrey Lyalin, Akira Nakayama, Tetsuya Taketsugu, Kohei Uosaki

Electrocatalytic Activity of Various Types of Boron Nitride for Oxygen Reduction Reaction - Theoretical and Experimental Investigations

s13-026

Anja Habereder (Electrochemistry Laboratory, Paul Scherrer Institut, Villigen PSI, Switzerland), Emiliana Fabbri, Thomas Justus Schmidt

Systematic Investigations on Lanthanum-based Perovskites ($LaBO_3$) for Oxygen Evolution and Reduction in Alkaline Media

s13-027

Johannes Hermann (Institut für Elektrochemie, Universität Ulm, Ulm, Germany), Ludwig Kibler

pH Dependence of the Oxidation of adsorbed Formate on Au(111)

s13-028

Hana Hoffmannova (Department of Electrpocatalysis, J. Heyrovsky Institute of Physical Chemistry, Prague, Czech Republic), Olga Boytsova, Valery Petrykin, Petr Krtil

Selectivity Control of the Oxygen Reduction on the Nanocrystalline MnO_2 via Synthesis induced Disorder

s13-029

Wesley Hong (Department of Materials Science & Engineering, Massachusetts Institute of Technology, Cambridge, USA), Kelsey Stoerzinger, Yueh-Lin Lee, Alexis Grimaud, Wanli Yang, Yang Shao-Horn

The influence of oxygen electronic states on perovskite oxygen evolution reaction catalysts

s13-030

Rasmus K.B. Karlsson (Chemical Engineering and Technology, KTH Royal Institute of Technology, Stockholm, Sweden), Heine A. Hansen, Thomas Bligaard, Ann Cornell, Lars G. M. Pettersson

Ti in DSA Electrodes is an Active and Selective Site for Electrochemical Production of Chlorine

s13-031

Maria Komkova (Chemistry Faculty, M.V.Lomonosov Moscow State University, Moscow, Russia), Natalya Sitnikova, Elena Karyakina, Arkady Karyakin

Transition Metal Hexacyanoferrates in Electrocatalysis of H_2O_2 Reduction: An Exclusive Property of Prussian Blue

s13-032

Barbara Mielcarek (Department of Chemistry, University of Warsaw, Warsaw, Poland), Adam Lewera

Synthesis and electrochemical properties of pure Pt nanoparticles containing (100) facets

s13-033

Pierre-Yves Olu (EI, LEPMI, Saint Martin d'Hères, France), Marlène Rouhet, Vincent Martin, Antoine Bonnefont, Nathalie Job, Marian Chatenet, Elena Savinova

Potential dependence of the sodium borohydride electrooxidation reaction mechanism on Platinum surfaces

s13-034

Annett Rabis (Electrochemistry Laboratory, Paul Scherrer Institut, Villigen, Switzerland), Emiliana Fabbri, Denis Kramer, Matt Worsdale, Rüdiger Kötz, Thomas Justus Schmidt

Oxygen reduction on Pt/SnO_2 catalysts: Influence of the oxide surface and Pt loading

s13-035

Paramaconi Rodriguez (School of Chemistry, University of Birmingham, Birmingham, United Kingdom), Yvonne Malewsky, Francisco Javier Monzó, Francisco J Vidal Iglesias, Jose Solla-Gullón

Electrochemical oxidation of small organic molecules on Au nanoparticles with preferential surface orientation

s13-036

Alexander Rudnev (Department of Chemistry and Biochemistry, University of Bern, Bern, Switzerland), Maria Ehrenburg, Ulmas Zhumaev, Elena Molodkina, Inna Botriakova, Motiar Rahaman, Aleksei Danilov, Thomas Wandlowski

A Kinetic Study of CO_2 Electroreduction on Metallic Electrodes in Aprotic Media

s13-037

Katarzyna Siuzdak (Centre for Plasma and Laser Engineering, The Szewalski Institute of Fluid-Flow Machinery, Gdansk, Poland), Miroslaw Sawczak, Adam Cenian

Titania nanotubes decorated with platinum nanoparticles generated by laser ablation in liquid

s13-038

Nyccolas Souza (Instituto de Química de São Carlos, Universidade de São Paulo, São Carlos, Brazil), Têko Napporn, Boniface Kokoh, Germano Tremiliosi

Glycerol Oxidation By-products over Gold in Alkaline Environment

s13-039

Momo Yaguchi (Catalysis Reserach Center, Hokkaido University, Sapporo, Japan), Masatoshi Osawa

Effect of pH on the electrocatalytic oxidation of formic acid/formate on Pd electrode studied by cyclic voltammetry and surface-enhanced infrared spectroscopy

Electrochemical double layer phenomena

s13-040

Renata Costa (Department of Chemistry, Faculdade de Ciências da Universidade do Porto, Porto, Portugal), Carlos M. Pereira, A. Fernando Silva

Monocationic vs. Dicationic Ionic Liquids: Electric Double-layer Insight

s13-041

Vladislav Ivanistsev (Department of Physics, University of Strathclyde, Glasgow, United Kingdom), Ruth M. Lynden-Bell, Maxim Fedorov

Effects of ionic liquid interfacial structure on solute–electrode interaction

s13-042

Manuel Landstorfer (LG3, Weierstrass Institute for Applied Analysis and Stochastics, Berlin, Germany), Clemens Guhlke, Wolfgang Dreyer

What are the Helmholtz planes? New answers from continuum thermodynamics

s13-043

Habeen Park (Department of Chemistry, Pukyong National University, Pusan, Korea), Byoung-Yong Chang

Development of Galvanostatic Fourier Transform Electrochemical Impedance Spectroscopy

Kinetic of adsorption

s13-044

Christian Engelbrekt (Department of Chemistry, Technical University of Denmark, Lyngby, Denmark), Renat R. Nazmutdinov, Jiawei Yan, T. T. Zinkicheva, Bing-Wei Mao, Jens Ulstrup, Jingdong Zhang

Adsorption Dynamics and Self-assembled L-cysteine on Au(100)

Kinetics and mechanisms of electrode reactions

s13-045

Alberto Battistel (Center for Electrochemical Sciences, Ruhr-Universität Bochum, Bochum, Germany)

Intermodulated Differential Immittance Spectroscopy on the Study of Oxygen Evolution Reaction Macrokinetics

s13-046

Alberto Battistel (Center for Electrochemical Sciences, Ruhr-Universität Bochum, Bochum, Germany)

Intermodulated Differential Immittance Spectroscopy: Instrumental Setup and Applications

s13-047

Byoung-Yong Chang (Department of Chemistry, Pukyong National University, Busan, Korea)

Real-time Snapshot Impedance Spectroscopy for Studying Mechanisms of Complex Reactions

s13-048

Alexis Fallet (DEN/DANS/DPC/SCCME/LECNA, CEA, Gif sur Yvette, France), Nathalie Larabi-Gruet, Jakab-Costenoble Sandrine, Philippe Moisy

Electrochemical kinetic of plutonium in nitric acid media

s13-049

Elena E. Ferapontova (iNANO, Aarhus University, Aarhus C, Denmark), Rui Campos, Andrey Kartashov

Effect of the Electric Double-layer Structure on Electron Transfer in Surface-tethered DNA

s13-050

Bernhard Gollas (Institute for Chemistry and Technology of Materials, Graz University of Technology, Graz, Austria), Luciana Vieira, Adam H. Whitehead

The Mechanism of Zinc Electrodeposition from Deep Eutectic Electrolytes onto Glassy Carbon, Gold, Platinum, Copper and Steel Electrodes

s13-051

Manuela Lopez-Tenes (Department of Physical Chemistry, University of Murcia, Murcia, Spain), Joaquin Gonzalez, Angela Molina

Reversible Two-electron Transfer Reactions in Electrochemistry for Solution Soluble and Surface-confined Molecules

s13-052

Manuela Lopez-Tenes (Department of Physical Chemistry, University of Murcia, Murcia, Spain), Angela Molina, Carmen Serna, Joaquin Gonzalez

Catalytic Routes Coupled to Reversible Surface Two-Electron Transfer Reactions

s13-053

Alessandro Minguzzi (Department of Chemistry, University of Milan, Milano, Italy), Ottavio Lugaresi, Elisabetta Achilli, Francesco D'Acapito, Giovanni Agostini, Cristina Locatelli, Alberto Vertova, Paolo Ghigna, Sandra Rondinini

Fixed Energy X-Ray Absorption Voltammetry (FEXRAV) and *in-operando* energy dispersive XANES on IrO_2 as catalyst for water oxidation: First evidences of the heterogeneous catalytic cycle

s13-054

Sze-yin Tan (Department of Chemistry, University of Warwick, Coventry, United Kingdom), Robert Lazenby, Jie Zhang, Alan Bond, Patrick R. Unwin

Impact of Electrode Density of States on Electron Transfer Kinetics: Tetrathiafulvalene Electrochemistry in Acetonitrile at Platinum and Highly Oriented Pyrolytic Graphite

s13-055

Encarnación Torralba (Department of Physical Chemistry, University of Murcia, Murcia, Spain), Angela Molina, Carmen Serna, Eduardo Laborda

Voltammetrical Study of the ECC Mechanism at ITIES by Means of Reverse Pulse Voltammetry

s13-056

Soma Vesztergom (Department of Physical Chemistry, Eötvös Loránd University, Budapest, Hungary), Norbert Barankai, G.G. Láng

Electrical Cross-talk in RRDE and Other 4-Electrode Electrochemical Systems – A Digital Simulation Approach

s13-057

Yingjing Zheng (Corporate Research, Robert Bosch GmbH, Gerlingen-Schillerhoehe, Germany), Ulrich Sauter, Oehler Gudrun, Streeb Martin, Moos Ralf

Identification of Oxygen Exchange Mechanisms on Geometrically Defined Pt|YSZ Electrodes

Modern electrode materials

s13-058

Jin-Young Lee (Department of Chemistry, Seoul National University, Seoul, Korea), Taek Dong Chung, Jae Gyeong Lee

Electron Transfer Through 6-nm-thick Thermal Silicon Dioxide

s13-059

Kevin May (Department of Mechanical Engineering, Massachusetts Institute of Technology, Cambridge, USA), David Fenning, Yang Shao-Horn, Alexie Kolpak

Band Alignment of $LaFeO_3$/Nb:$SrTiO_3$ Heterojunctions via Spectroscopic Ellipsometry, X-Ray Photoelectron Spectroscopy and First-principles Calculations

s13-060

Heiko Müller (Institut für Elektrochemie, Universität Ulm, Ulm, Germany), Johannes Hermann, Martin Metzler, Ludwig Kibler, Timo Jacob

Electrochemical Reactivity of Metallized SAMs on Au(111)

s13-061

Cristina Oliveira (Department of Chemistry, Universidade de Trás-os-Montes e Alto Douro, Vila Real, Portugal), Pedro Tavares, Ana Viana, Romeu Videira, Marta Ferro, Ana Rego, Ana Ferraria, André Veloso, José Fernandes

Mechanistic insight on the electrochemicalformation of carbon quantum dots

s13-062

Jochen Rohrer (Fachbereich Material- und Geowissenschaften, Technische Universität Darmstadt, Darmstadt, Germany), Karsten Albe

Thermodynamics and Kinetics of Amorphous Li-Si Systems from First-principle Calculations

Surface Processes

s13-063

Joseph Elias (Department of Chemistry, Massachusetts Institute of Technology, Cambridge, USA), Livia Giordano, Azzam Mansour, Yang Shao-Horn

Structure-activity Relationships in CO Oxidation Catalysis Over Transition-metal Substituted CeO_2

s13-064

Toshihiro Kondo (Department of Chemistry, Ochanomizu University, Bunkyo-ku, Japan), Takuya Masuda, Nana Aoki, Kohei Uosaki

Potential Dependent Structures at Pt(111) Single Crystal Electrode/Electrolyte Interfaces Studied by *in situ* Surface X-ray Scattering

s13-065

Frederico Lima (Computer and Electrical Engineering, Hochschule Furtwangen University, Furtwangen, Germany), Ulrich Mescheder, Holger Reinecke

Maskless Selective Electrodeposition on Silicon

s13-066

Stefania Marzorati (Dipartimento di Chimica, Universita' degli Studi di Milano, Milano, Italy), Ronan J. Cullen, Richard L. Doyle, Mariangela Longhi, Michael E.G. Lyons, Paula E. Colavita

The Electronic Valence Structure of Amorphous Carbon Thin Films and Its Effects on the Kinetics of Interfacial Charge Transfer

s13-067

Nhat Truong Nguyen (Department of Materials Science and Engineering, WW4-LKO, University of Erlangen-Nuremberg, Erlangen, Germany), Jeong Eun Yoo, Patrik Schmuki

Enhanced Photocatalytic H_2 Production of Pt-decorated Anodic TiO_2 Nanotubes

s13-068

Samuel Perry (Department of Chemistry, University of Southampton, Southampton, United Kingdom), Guy Denuault

Investigation of the Extra Current Seen during Transient Analysis of the Oxygen Reduction Reaction on Microdisc Electrodes

s13-069

Kelsey Stoerzinger (Materials Science and Engineering, Massachusetts Institute of Technology, Cambridge, USA), Wesley Hong, Ethan Crumlin, Michael Biegalski, Gisele Azimi, Kripa Varanasi, Hendrik Bluhm, Yang Shao-Horn

Molecular Insight into the Reactivity of Perovskite Oxide Surfaces with Water

Symposium 14: Brain Electrochemistry

s14-001

John Cirrito (Department of Neurology, Washington University, St Louis, USA), Carla Yuede, Chen-Zhong Li

Temporal Relationship Between Synaptic Activity and Aβ Generation *In Vivo*

s14-002

Nuno Ferreira (Center for Neuroscience and Cell Biology, University of Coimbra, Coimbra, Portugal), Cátia Lourenço, Ana Ledo, Sergio Costa, Joao Laranjinha, Rui Barbosa

Simultaneous Measurements of Ascorbate and Glutamate *In Vivo* in the Rat Brain

s14-003

Alexander Oleinick (Departement de Chimie, Ecole Normale Superieure, CNRS, Paris, France), Frédéric Lemaître, Manon Guille Collignon, Irina Svir, Christian Amatore

Theoretical Extraction of Fusion Nanopores Topology and Energetics from Amperometric Measurements of Vesicular Exocytosis at Ultramicroelectrodes

s14-004

Carla Yuede (Department of Neurology, Washington University School of Medicine, Saint Louis, USA), Chen-Zhong Li, John Cirrito

Using Microimmunoelectrodes to Study Rapid Mechanisms of Aβ Clearance from the Brain Interstitial Fluid of Mice

General Session

General Session

s15-001

Chia-Chern Chen (Department of Family Medicine, St. Martin de Porres Hospital, Chiayi, Taiwan), Cheng-Hui Chen

Thermodynamic Analysis on Electrodeposition Using Averaged Moving Approximate Entropy

s15-002

Heiki Erikson (Institute of Chemistry, University of Tartu, Tartu, Estonia), Ave Sarapuu, Jekaterina Kozlova, Väino Sammelselg, Kaido Tammeveski

Oxygen Reduction on Electrodeposited Pd-Au Alloys

s15-003

Leonel Marques Antunes Ferreira (TE, CERN, Geneva, Switzerland), Jamie Andrew Shirra, Hannah Rana

Electropolishing Simulation on Full Scale Radio Frequency Elliptical Structures

s15-004

Takeshi Gojuki (Division of Science, College of Science and Engineering, Tokyo Denki University, Hatoyama, Saitama, Japan), Noriko Okano, Terumasa Kuge, Mizuka Morita, Yoshiharu Mukouyama, Hiroshi Okamoto

Potential oscillations during oxidation of formic acid and methanol with scarce water

s15-005

Paola Jara-Ulloa (Department of Chemistry, Universidad Andres Bello, Santiago, Chile), Maria Luisa Valenzuela

Polyphenol/ Carbon Nanotubes Modified Glassy Carbon Electrode for Metals Detection

s15-006

Kristel Jukk (Institute of Chemistry, University of Tartu, Tartu, Estonia), Nadezda Kongi, Aivar Tarre, Arnold Rosental, Alexey B. Treshchalov, Jekaterina Kozlova, Peeter Ritslaid, Leonard Matisen, Väino Sammelselg, Kaido Tammeveski

Oxygen Reduction on Platinum Nanoparticles Supported on Carbon Nanotube/Titanium Dioxide Composites

s15-007

Elo Kibena (Institute of Chemistry, University of Tartu, Tartu, Estonia), Margus Marandi, Väino Sammelselg, Kaido Tammeveski, Anders B. Mortensen, Bjarke B.E. Jensen, Mie Lillethorup, Steen U. Pedersen, Kim Daasbjerg

A Comparative Study of CVD-grown Graphene and HOPG Electrografted with Thick Anthraquinone Films

s15-008

Nadezda Kongi (Institute of Chemistry, University of Tartu, Tartu, Estonia), Kristel Jukk, Jekaterina Kozlova, Peeter Ritslaid, Väino Sammelselg, Kaido Tammeveski

Oxygen Reduction on Sputter-deposited Platinum Nanoparticle/Multi-Walled Carbon Nanotube Composites

s15-009

Terumasa Kuge (Division of Science, College of Science and Engineering, Tokyo Denki University, Hatoyama, Saitama, Japan), Yoshiharu Mukouyama, Tetsuaki Shiono, Shuji Nakanishi, Hiroshi Okamoto

Three Types of Electrochemical Oscillations during Reduction of Nitrate Ions on Cu

s15-010

Laura Mais (Department of Mechanical, Chemical and Materials Engineering, University of Cagliari, Cagliari, Italy), Michele Mascia, Annalisa Vacca, Simonetta Palmas, Francesco Delogu

Electrodeposition of Nb-Cu and Ta-Cu Composites from 1-butyl-1-methylpyrrolidinium bis(trifluoromethylsulfonyl) imide

s15-011

Charline Meudre (Department of Sonochemistry and Surface reactivity, Institute UTINAM, University of Franche-Comté, Besançon, France), Laurence Ricq, Jean-Yves Hihn

Adsorption of gelatin during copper and copper-tin electrodeposition in acidic sulfate electrolyte

s15-012

Yoshiharu Mukouyama (Division of Science, College of Science and Engineering, Tokyo Denki University, Hatoyama, Saitama, Japan), Mitsuhisa Hasegawa, Shuji Nakanishi, Hiroshi Okamoto

Appearance of Potential Oscillation Induced by Na_2SO_4 and K_2SO_4 in H_2O_2-H_2SO_4-Pt System

s15-013

Stephan Vogt (Department of Chemistry/Biology, University of Siegen, Siegen, Germany), Tanja Nöll, Holger Schönherr, Daniel Wesner, Michael Schopferer, Thomas Paululat

Construction of three-dimensional DNA hydrogels from linear building blocks

s15-014

David Weinberger (Inorganic and Physical Chemistry, Ghent University, Ghent, Belgium), Dennis H. van Dorp, Katrien Strubbe

The etching of InGaAs in acidic solutions of H_2O_2

Analytical Electrochemistry (d1)

s15-015

Egor Andreev (Chemistry Faculty, M.V.Lomonosov Moscow State University, Moscow, Russia), Maria Komkova, Oleg Voronin, Ivan Kotchetkov, Arkady Karyakin, Anatoly Yatsimirski

Increase of Conductivity of Boronic Acid Substitued Polyaniline-based Sensor upon Complexation with Polyols

s15-016

William Araujo (Department of Chemistry, University of São Paulo, São Paulo, Brazil), Thiago Paixão

Fabrication of Disposable Electrochemical Devices Using Silver Ink and Office Paper: Application for Aqueous and Airborne Explosive Detection

s15-017

Mojtaba Bagherzadeh (Material Research School, NSTRI, Isfahan, Iran), Mahdi Jabouri-Abassi, Anahita Farahbakhsh

Magnetic Graphene Nanocomposite as a New Material for Electrochemical Sensing of Pb^{2+}

s15-018

Maísa Beluomini (Department of Analytical Chemistry, Universidade Estadual Paulista - UNESP, Araraquara, Brazil), José Luiz da Silva, Nelson Stradiotto

Determination of Uronic Acids in Sugarcane Bagasse by Anion-exchange Chromatography using Electrode Modified with Copper Nanoparticles

s15-019

Priscila Cervini (Department of Chemistry and Molecular Physics, University of São Paulo, Institute of Chemistry, São Carlos, Brazil), Eder Cavalheiro

Development of a Polyurethane Graphite Composite Electrode Modified with Epinephrine Molecularly Imprinted Polymer

s15-020

Priscila Cervini (Department of Chemistry and Molecular Physics, University of São Paulo, Institute of Chemistry, São Carlos, Brazil), Abigail Vasconcelos Pereira, Eder Tadeu Gomes Cavalheiro

Evaluation of Folic Acid Molecularly Imprinted Polymer as Electrode Modifier

s15-021

Victor Costa Bassetto (Analytical Chemistry, Institute of Chemistry, Unicamp, Campinas, Brazil), José Tiago Claudino Barragan, Lauro Tatsuo Kubota

Evaluation of brass TM 620 as working electrode as amperometric detector cell for ion chromatography: Valine determination in food supplement

s15-022

Orlando Fatibello-Filho (Department of Chemistry, Federal University of São Carlos, São Carlos, Brazil), Bruna Lourencao, Tiago Silva, Greg Swain

Simultaneous voltammetric determination of propranolol and hydrochlorothiazide using a nitrogen-containing tetrahedral amorphous carbon electrode

s15-023

Orlando Fatibello-Filho (Department of Chemistry, Federal University of São Carlos, São Carlos, Brazil), Tiago Silva, Hudson Zanin, Fernando Vicentini

Voltammetric determination of nanomolar levels of atorvastatin calcium in pharmaceutical and biological samples using a vertically aligned carbon nanotube/graphene oxide electrode

s15-024

Vellaichamy Ganesan (Department of Chemistry, Banaras Hindu University, Varanasi, India), Pankaj Kumar Rastogi

Silver Nanoparticles Based Efficient Electrochemical Sensing Platform for Isoniazid Determination

s15-025

Arturo García-Mendoza (Analytical Chemistry, National Autonomous University of Mexico, UNAM, Mexico City, Mexico), Julio-César Aguilar-Cordero

Determination of water in imidazolium-based ionic liquids by cathodic stripping square wave voltammetry

s15-026

Arturo García-Mendoza (Department of Analytical Chemistry, National Autonomous University of Mexico, UNAM, Mexico City, Mexico), Alejandro Baeza, Adrián de Santiago, Alejandro Marín

Microscale electroanalytical chemistry experimental teaching with locally produced low-cost instrumentation

s15-027

Camila Gutiérrez (Organic and Physical Chemistry Departament, University of Chile, Santiago, Chile), Juan Arturo Squella, Pablo Richter, Paola Salgado

Flow Injection Analysis of Nifedipine Based on Carbon Nanofiber Screen Printed Electrodes.

s15-028

Kensuke Honda (Division of Environmental Science and Engineering, Graduate School of Science and Engineering, Yamaguchi University, 1677-1, Yoshida, Yamaguchi-shi, Japan), Ryohei Kawajiri, Yohsuke Shimai

Fabrication of B-doped DLC based interdigitated array microelectrodes and high sensitive detection of redox analytes with higher standard potential than H_2O/O_2

s15-029

Aneta Januszewska (Biological and Chemical Research Centre, University of Warsaw, Warsaw, Poland), Rafal Jurczakowski

Electrochemical Behavior of Pd/Au(111) Overlayers in Neutral Solutions and its Application to CO_2 Electroreduction

s15-030

Martyna Jañczyk (Department of Microbioanalytics, Warsaw University of Technology, Warsaw, Poland), Wojciech Wróblewski

Organoboron compounds as neurotransmitter receptors in ion-selective electrodes

s15-031

Anna Kutyla-Olesiuk (Department of Microbioanalytics, Warsaw University of Technology, Warsaw, Poland), Malgorzata Wesoly, Wojciech Wróblewski

Monitoring of wine fermentation and ageing process using the hybrid electronic tongue

s15-032

Hye Jin Lee (Department of Chemistry, Kyungpook National University, Daegu, Korea), Hye Youn Han, Md. Kamrul Hasan, Md. Nurul Karim

Nanoparticle-amplified Amperometric Biosensors for Allergic Disease Protein Biomarkers

s15-033

Yong-Gu Lee (Department of Water Resource, Sungkyunkwan University, Suwon, Korea), Hye Jin Lee, Am Jang

Layer by Layer self-assembled multilayer films composed of iron(III)-porphyrin and polyelectolyte for ,bromate analysis

s15-034

Yong-Gu Lee (Department of Water Resource, Sungkyunkwan University, Suwon, Korea), Jungyoup Han, Soondong Kwon, Seoktae Kang, Am Jang

Development of a rotatory lab chip sensor system for determination of heavy metals in water

s15-035

Eduardo Mendez (Laboratorio de Biomateriales, Facultad de Ciencias, Universidad de la República, Montevideo, Uruguay), Rodrigo Bozzo, Aldana Grimaldi, Gonzalo Heijo

Decentralized Analysis of Lead(II) and Cadmium(II) in Air Particulate Matter by Square-wave Anodic Stripping Voltammetry

s15-036

Krishnan Murugappan (Department of Chemistry, Curtin University, Perth, Australia), Colin Kang, Callum Bonnar, Debbie Silvester

Electrochemical Behaviour and Analytical utility of Toxic gases (Chlorine and Methylamine) in Room Temperature Ionic Liquids (RTILs): A comparison between Micro Electrodes and Screen Printed Electrodes (SPEs)

s15-037

Marta Neves (Department of R&D, DropSens S.L., Llanera, Spain), Pablo Fanjul-Bolado, David Hernández-Santos

Electrochemical Magneto-immunoassay for Cardiac Troponin Detection

s15-038

Eduardo Mathias Richter (Institute of Chemistry, Federal University of Uberlândia, Uberlândia, Brazil), Thiago Faria Tormin, Rafael Rodrigues Cunha, Rodrigo Alejandro Abarza Muñoz

Combination of Screen-printed Electrodes and Batch Injection Analysis: A Simple, Robust, High-throughput, and Portable Electrochemical System

s15-039

Thalita Rocha Saciloto (Department of Chemistry and Molecular Physics, University of São Paulo, Institute of Chemistry, São Carlos, Brazil), Priscila Cervini, Eder Tadeu Gomes Cavalheiro

Application of Graphite and Polyurethane Screen-printed Composite Electrode for Voltammetric Determination of Epinephrine

s15-040

Thiago Selva (Departamento de Química Fundamental, Instituto de Química, Universidade de São Paulo, São Paulo, Brazil), William Araujo, Thiago Paixão

Electrochemical Determination of Aldicarb Pesticide Using Platinum Electrode and a Derivatization Process

s15-041

Liis Siinor (Institute of Chemistry, University of Tartu, Tartu, Estonia), Joosep Poom, Karmen Lust, Enn Lust

Electrochemical Characterization of the Interface between PG | x% EMImI+EMImBF$_4$

s15-042

José Luiz Silva (Department of Chemistry, Institute of Chemistry, UNESP – Univ Estadual Paulista, Araraquara, Brazil), Maísa Beluomini, Nelson Ramos Stradiotto

Determination of Furan Aldehydes by HPLC-PAD using Electrode Modified with Nickel Nanoparticles in Bagasse sugarcane

s15-043

Bradley D. Stringer (Department of Chemistry, La Trobe University, Melbourne, Australia), Linh M. Quan, Peter J. Barnard, Conor F. Hogan

Iridium complexes bearing N-heterocyclic carbene ligands: Relationship between energetics and efficient electrogenerated chemiluminescence

s15-044

Wenzhi Tang (College of Biosystems Engineering and Food Science, Zhejiang University, Hangzhou, China)

Integration of sample preconcentration and detection of methyl parathion by a composite electrode

s15-045

Mei-Sheng Wu (Department of Chemistry, Nanjing University, Nanjing, China), Li-Jing He, Jing-Juan Xu, Hong-Yuan Chen

Electrochemiluminescence Resonance Energy Transfer System for Sensitive DNA Detection

s15-046

Wei-Wei Zhao (School of Chemistry and Chemical Engineering, Nanjing University, Nanjing, China), Jing-Juan Xu, Hong-Yuan Chen

Bismuthoxyiodide Nanoflakes/Titania Nanotubes Arrayed p-n Heterostructure for Protein Detection

s15-047

Tingting Zheng (School of Chemistry & Chemical Engineering, Nanjing University, Nanjing, China), Jun-Jie Zhu

Nanoarchitectured Electrochemical Cytosensors for Selective Detection of Leukemia Cells and Quantitative Evaluation of Death Receptor Expression on Cell Surfaces

s15-048

Guzel Ziyatdinova (Department of Analytical Chemistry, Kazan Federal University, Kazan, Russia), Endzhe Ziganshina, Herman Budnikov

Voltammetry of Morin on Electrode Modified with Carbon Nanotubes and Surfactants

s15-049

Guzel Ziyatdinova (Department of Analytical Chemistry, Kazan Federal University, Kazan, Russia), Endzhe Ziganshina, Herman Budnikov

Reactions of Natural Phenolic Antioxidants with Electrogenerated Hexacyanoferrate(III) Ions in Micellar Media

s15-050

José Ricardo da Silva (Instituto de Química, Universidade de São Paulo, São Paulo, Brazil), William Reis de Araujo, Thiago R. L. C. da Paixão

A Simple Office Paper-based Electrochemical Device for Stripping Voltammetric Detection of Metal Ions

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s15-051

Alexey Davydov (Physical Electrochemistry, Frumkin Institute of Physical Chemistry and Electrochemistry, Moscow, Russia), Mark Goldin, Anatoly Evseev, Igor Mikhailov

Electrochemical Endovascular Coagulation for Arresting Bleeding

s15-052

Adrian Enache (Chemistry Departament, University of Coimbra, Coimbra, Portugal), Victor Diculescu

Electrochemical Assay for ABL1 Tyrosine Kinase-catalysed Posphorylation

s15-053

Doris Grumelli (Instituto Nacional de Investigaciones Fisicoquímicas, Teóric, CONICET, La Plata, Argentina), Rico Gutzler, Klaus Kern

Bimetallic molecular networks involved in electrocatalysis of the oxygen evolution reaction

s15-054

Magdalena Jarosz (Department of Physical Chemistry and Electrochemistry, Jagiellonian University, Krakow, Poland), Anna Pawlik, Marian Jaskula, Grzegorz D. Sulka

Nanoporous titanium dioxide layers as a potential drug delivery system

s15-055

Hoon Jun Kim (Department of Chemistry, Seoul National University, Seoul, Korea) Jong-In Hong

Electrogenerated Chemiluminescence Chemodosimetric Sensing Strategies for Anions Based on Cyclometalated Ir(III) Complexes

s15-056

Tae Hyun Kim (Department of Chemistry, Soonchunhyang University, Asan, Korea), Chang-Seuk Lee, Jong Seung Kim

Cyteine-selective Electrochemical Nanosensor Based on Chemodosimeter-modified Carbon Nanotubes

s15-057

Vimal Sharma (Department of Chemistry, Masaryk University, Brno, Czech Republic)

The Enhancement of Electrochemical Sensing of Guanine Derivatives by Using PVP capped Copper Nanoparticles

s15-058

Juan Arturo Squella (Department of Organic and Physical Chemistry, University of Chile, Santiago, Chile), Raúl Moscoso, José Carbajo

Voltammetric studies of encapsulated nitroquinolines on MWCNT modified electrodes

s15-059

Priscila Tamiasso-Martinhon (Department of Physical Chemistry, Federal University of Rio de Janeiro, Rio de Janeiro, Brazil), Raíssa Carvalho Martins, Rene Pfeifer, Célia Sousa

Investigation of the pH Effect on the Kinetic Behavior of Urea in Aqueous Solutions by Cyclic Voltammetry

s15-060

Maotian Xu (Department of Chemistry & Chemical Engineering, Shangqiu Normal University, Shangqiu, China), Xu Zhu, Shufang Wu

Electrochemical Detection of Rotundine Based on DNA Modified Electrode

Biosensors

s15-061

Katarzyna Biala (Department of Chemistry, University of Rostock, Rostock, Germany), Gerd-Uwe Flechsig

Influence of temperature on the electrochemical detection of DNA Sequences at gold electrodes

Electrochemical Energy Conversion and Storage (d3)

s15-063

Liang-Yih Chen (Department of Chemical Engineering, National Taiwan University of Science and Technology, Taipei, Taiwan), Yen-Jhih Chen

The Effect of Morphology for Hematite Based Photoelectrochemical Study

s15-064

Andrzej Czerwinski (Faculty of Chemistry, University of Warsaw, Warsaw, Poland), Zbigniew Rogulski, Jakub Lach, Justyna Wrobel, Kamil Wrobel

New carbon lead acid battery (CLAB)

s15-065

Vitali Grozovski (Institute of Chemistry, University of Tartu, Tartu, Estonia), Heili Kasuk, Jaak Nerut, Eneli Härk, Indrek Tallo, Enn Lust

Oxygen reduction at bare and carbon-supported shape-controlled nanoparticles

s15-066

Ayaz Hassan (Department of Chemistry of Sao Carlos, University of Sao Paulo, Sao Carlos, Brazil), Valdecir Antonio Paganin

A Highly Stable Anode Catalyst Based on Tungsten Carbide for Proton Exchange Membrane Fuel Cells

s15-067

Sun-Dong Kim (Materials Research Laboratory, Korea Institute of Energy Research, Daejeon, Korea), Hyang-Tae Kim, Doo-Won Seo, Min-Soo Suh, Sang-Kuk Woo

Novel Composite Electrode for Alkali Metal Thermal to Electric Converter (AMTEC)

Electrochemical Materials Science (d4)

s15-068

Jadielson Antonio (Department of Chemistry, Institute of Chemistry, University of Sao Paulo (USP), Sao Paulo, Brazil), Roberto Torresi, Susana Cordoba de Torresi

Polypyrrole Thin Films Structured with Methyl Orange Template

s15-069

Hidetaka Asoh (Department of Applied Chemistry, Kogakuin University, Tokyo, Japan), Sachiko Ono

Formation of Nanoporous Oxide Film on Stainless Steel by Anodizing in Sulfuric Acid Containing Hydrogen Peroxide

s15-070

Theodoros Baimpos (Department for Interface Chemistry and Surface Engineering, Max Planck Institut für Eisenforschung GmbH, Düsseldorf, Germany), Buddha Ratna Shrestha, Markus Valtiner

Complementary AFM/SFA study on ion-structuring and the adhesive interactions at mica/electrolyte interfaces

s15-071

Sebastian Bochmann (Department of Chemistry and Pharmacy, Friedrich-Alexander-University Erlangen-Nuremberg , Erlangen, Germany), Amalio Fernandez-Pacheco, Russell Cowburn, Julien Bachmann

Galvanic preparation of segmented magnetic nanowires in ordered arrays

s15-072

Jen-Sue Chen (Materials Science and Engineering, National Cheng Kung University, Tainan, Taiwan), Jiun-Jie Fang, Yu-Lung Chung

Impedance Characterization on Electrochemical Reaction in Resistive Switching of Metal-TaO_x-Metal Structure

s15-073

Jongwon Kim (Chemistry, Chungbuk National University, Cheongju, Korea), Hwakyeung Jeong, Minju Kim

Preparation of Nanoporous Gold by Anodization: Highly Porous Structures for Electrochemical Glucose Detection

s15-074

Young Jin Kim (Materials Science and Engineering, Kyonggi University, Suwon, Korea), Jung Hye Park, Jaehan Park, Wonsik Ahn

Preparation and Luminescence of $(Ba,Sr)_3MgSi_2O_8:Eu^{2+}$ Nanopowders Prepared by the Hybrid Process

s15-075

Gabriela Kissling (Department of Chemistry, University of Southampton, Southampton, United Kingdom), Sophie Benjamin, Andrew Jolleys, Ruomeng Huang, Philip Bartlett, Kees de Groot, Andrew Hector, William Levason, Gillian Reid

Electrodeposition of Ternary Alloys Inside Micro- and Nanostructured Electronic Devices

s15-076

Liang Liu (Institute of Chemistry, The Hebrew University of Jerusalem, Jerusalem, Israel), Shai Yellinek, Ido Valdinger, Daniel Mandler

Electrochemical Reduction of Indium Tin Oxide (ITO): To Prevent and to Use

s15-077

Yunny Meas-Vong (Posgrado, CIDETEQ, Pedro Escobedo, Mexico), Ildefonso Zamudio-Torres, José de Jesús Pérez-Bueno

TiO_2 nanotubes obtained by anodization in organic media and surface study

s15-078

Teko W. Napporn (IC2MP UMR CNRS 7285, Universite de Poitiers, Poitiers, France), Seydou Hebie, Claudia Morais, Karine Servat, Boniface Kokoh

Shape Controlled Gold Nanoparticles: Correlation Structure-electroactivity

s15-079

Nebojsa Nikolic (Department of Electrochemistry, ICTM, University of Belgrade, Belgrade, Serbia)

Mechanism of Pb electrodeposition in the granular form

s15-080

Raul Ortega Borges (Grupo de Recubrimientos Funcionales y Materiales Compuestos, CIDETEQ, Sanfandila, Pedro Escobedo, Mexico), Gerardo Hernandez Sanchez, Céline Cannes, Veronika Zinovyeva, Claire Le Naour, Gabriel Trejo Cordova, Yunny Meas-Vong

Electrochemical behavior of Samarium(III) salts in protic and aprotic room temperature ionic liquids

s15-081

Mutsuhiro Shima (Department of Materials Science and Technology, Gifu University, Gifu, Japan), Wakako Shimada

Electrochemical Behavior of Fe-Pt Alloy Nanoparticles in Ordered Phases

s15-082

Liren Tsai (Department of Mechanical Engineering, National Kaohsiung University of Applied Sciences, Kaohsiung, Taiwan), Shih-Han Wang, Ting-Hao Cheng

Pre-treatment effects of electroless Fe-Ni-P on silicon substrates

Electrochemical Process Engineering and Technology (d5)

s15-083

Olga Berkh (Department of Physical Electronics, School of Engineering, Tel Aviv University, Tel Aviv, Israel), Noam Eliaz, Eliezer Gileadi

The electrodeposited Re-Ni alloys and the early stages of their deposition

s15-084

Alexey Davydov (Physical Electrochemistry, Frumkin Institute of Physical Chemistry and Electrochemistry, Moscow, Russia), Vladimir Volgin, Tatyana Kabanova

Modeling of Electrochemical Dissolution for the Formation of Nanostructured Metal Surfaces by Nanosphere Template Method

s15-085

Muhammad Noman (Department of Electronics and Telecommunications (DET), Politecnico di Torino, Torino, Italy), Danilo Demarchi, Pravin Jagdale, Alessandro Sanginario, Alberto Tagliaferro

Carbon Fibers a Potential Candidate for Electrochemiluminescence

s15-086

Juan Carlos Flores-Segura (Area Academica De Ciencias De La Tierra Y Materiales, Universidad Autónoma Del Estado De Hidalgo, Pachuca De Soto, Mexico), Victor Esteban Reyes-Cruz

Iron Electrodeposition from Clays

s15-087

Takuma Hachisu (Institute for Nanoscience and Nanotechnology, Waseda University, Shinjuku, Japan), Kazuaki Shi, Kiichiro Ishii, Tokihiko Yokoshima, Atsushi Sugiyama, Masahiro Yoshino, Itsuaki Matsuda, Tetsuya Osaka

Electrodeposition of Titanium Oxide Film with High Adhesion from N,N-Dimethyl Formamide Bath

s15-088

Kristoffer Hedenstedt (Department of Chemistry and Molecular Biology, University of Gothenburg, Gothenburg, Sweden), Adriano Gomes, Michael Busch, Elisabet Ahlberg

Electrochemical Kinetic Study on Hypochlorite Reduction Related to the Sodium Chlorate Process

s15-089

Gha-Young Kim (Nuclear Fuel Cycle Process Development Division, Korea Atomic Energy Research Institute, Daejeon, Korea), Tack-Jin Kim, Si-Hyung Kim, Seungwoo Paek

Behavior of Li-B Alloy during Anodic Dissolution in Molten Chloride Electrolyte

s15-090

Sangchul Kim (Department of Flash Cheongju Cu Technology, SK hynix, Cheongju-si, Korea)

Evaluation of air gap technology on electrochemical plated coppe in semiconductor

s15-091

Sonia Lanzalaco (Ingegneria Chimica Gestionale Informatica Meccanica, Università di Palermo, Palermo, Italy), Alessandro Galia, Rosalia Mauro, Flavia Lazzano, Onofrio Scialdone

Study of Atrp Process for the Grafting of Vinyl Monomers on PVC and PVDF

s15-092

Ho-Nyun Lee (Surface Technology R&BD Group, Korea Institute of Industrial Technology, Incheon, Korea), Jin-Young Hur, Hyun Jong Kim, Min Hyung Lee, Hong-Kee Lee

Changes in Crystallinity and Resistivity of ITO Film by Bias Voltage

s15-093

Yunny Meas-Vong (Department of Electrochemistry, CIDETEQ, Pedro Escobedo, Mexico), Juan Ramon López López, Perla Méndez Herrera, José de Jesús Pérez Bueno, Gabriel Trejo Córdoba, Raúl Ortega-Borges, Guy Stremsdoerfer

Hardness and corrosion resistance of Ni/NiB and Ni/NiB/NiB-PTFE multilayer coatings prepared by employing electrodeposition and dynamic chemical plating (DCP) techniques

s15-094

Artur Motheo (Department of Physical Chemistry, Sao Carlos Institute of Chemistry, University of Sao Paulo, Sao Carlos, Brazil), Juliana Steter, Míriam Kossuga, Eli Pimenta

Carbofuran Degradation by Sonoelectrochemical Method

s15-095

Mi-Seok Park (Department of Materials Science and Engineering, Korea Advanced Institute of Science and Technology, Daehak-ro, Yuseong-gu, Daejeon, Korea), Do-Hwan Nam, KyungSik Hong, SungJin Lim

Electrophoretic Co-deposition of Graphene Oxide and Metal Hybrid-structure for Resistive Switching Memory

s15-096

Luis Ruotolo (Department of Chemical Engineering, Federal University of Sao Carlos, Sao Carlos, Brazil), Rafael Zornitta

Brackish Water Desalination by Capacitive Deionization

s15-097

Vladimir Volgin (Department of Electro- and Nanotechnology, Tula State University, Tula, Russia), Victor Lyubimov, Alexey Davydov

Metal Dissolution through a Mask with Cylindrical Pores

s15-098

Vladimir Volgin (Department of Electro- and Nanotechnology, Tula State University, Tula, Russia), Alexey Davydov

Effective Method of Simulation of Transport Processes in Electrochemical Systems in the Case of using Ultra-short Current Pulses

Molecular Electrochemistry (d6)

s15-099

Abdirisak Ahmed Isse (Department of Chemical Sciences, University of Padova, Padova, Italy), Francesca Lorandi, Marco Fantin, Armando Gennaro

Role of Metallic Copper in Atom Transfer Radical Polymerization

s15-100

Anne Neudörffer (UMR 8638, University Paris Descartes, Paris, France), Kevin Cottet, Marie-Christine Lallemand, Sylvie Michel, Martine Largeron

A convenient biomimetic electrosynthesis of naturally occurring polyisoprenylated xanthones

s15-101

Marcos Teixeira (Faculty of Science and Technology, São Paulo State University (UNESP), Presidente Prudente, Brazil), Wesley Machini, Patricia Seraphim

Electrochemical properties of the biomimetic $[\mathrm{Mn}^{IV}(\mu\text{-O})(\mathit{salpn})]_2$ complex in organic medium

s15-102

Malcolm Tessensohn (School of Physical and Mathematical Sciences, Nanyang Technological University, Singapore, Singapore), Melvyn Lee, Richard Webster

Assessing the Hydrogen-bonding Strengths of Simple Alcohols via the Electrochemistry of Quinones

Physical Electrochemistry (d7)

s15-103

Constanze Donner (Atotech Deutschland GmbH, Berlin, Germany), Yunus Bingöltekin, Mathias Wünsche, Olivier Mann

Study of the role of Cu(I) complexes with respect to cyclic voltammetry stripping analysis for online bath analysis in PCB industry

s15-104

Boris Grafov (Department of Physical Electrochemistry, Frumkin Institute of Physical Chemistry and Electrochemistry, Moscow, Russia)

Dynamic Equation for Probability Distribution for Electrochemical Stochastic Diffusion

s15-105

Jonnathan Cesar Hidalgo Acosta (Laboratoire d'Electrochemie Physique et Analytique (LEPA), Ecole Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland)

Water Oxidation Mediated by Citrate-Stabilized Iridium Oxide Nanoparticles in Organic Media

s15-106

Magdalena Jarosz (Department of Physical Chemistry and Electrochemistry, Jagiellonian University, Krakow, Poland), Joanna Grudzien, Marian Jaskula, Wojciech Simka, Grzegorz D. Sulka

One-step anodization of Ti13Nb13Zr alloy in the ethylene glycol-based electrolyte

s15-107

Yuwen Liu (Department of Chemistry, Wuhan University, Wuhan, China), Shengli Chen

Extended Electron Transfer at Nanoelectrodes

s15-108

Roman Manzhos (Department of Laser Electrochemistry, Institute of Problems of Chemical Physics, Chernogolovka, Moscow Region, Russia), Victor Krivchenko, Kirill Mironovich, Pavel Voronin, Aleksandr Krivenko, Elena Stenina, Liana Sviridova

Adsorption of surface-active organic substances on carbon nanowalls

s15-109

Roman Manzhos (Laboratory of Laser Electrochemistry, The Institute of Problems of Chemical Physics of the RAS, Chernogolovka, Russia), Sergey Doronin, Alexander Krivenko

The Method of Laser-induced Temperature Jump of Potential as Applied to the Surface Segregation in Au-Ag Alloy

s15-110

Yasumichi Matsumoto (Department of Applied Chemistry, Kumamoto University, Kurokami 2-39-1, Japan), Kazuto Hatakeyama, Michio Koinuma, Takaaki Taniguchi

Proton Conduction of Graphene Oxide

s15-111

Rene Pfeifer (Department of Chemistry, Federal University of Rio de Janeiro, Rio de Janeiro, Brazil), Priscila Martinhon, Célia Sousa, Josino Moreira, Marco Antonio Chaer Nascimento, Jirí Barek

The Study of the Electrochemical Mechanism of PNA using Cyclic Voltammetry

s15-112

Ingrid Ponce (Facultad de Química y Biología, Universidad de Santiago de Chile, Santiago, Chile), Ruben Oñate, Francisco Silva, Carmen Castro, José H. Zagal, Jorge Pavez, Marcos Flores

Study of the Electron Transport and Inductive Effects in FePc Self-assembled Systems for the Reduction of Molecular Oxygen

s15-113

Victor Safonov (Department of Electrochemistry, Moscow State University, Faculty of Chemistry, Moscow, Russia), Maria Choba

The Effect of Surface Segregation at the Interface of Mechanically Renewable Ag-Bi Alloy Electrodes on the Rate of Electrochemical Reactions

s15-114

Raphaël Trouillon (Laboratory of Microsystems, EPFL, Lausanne, Switzerland), Martin A.M. Gijs

Delayed electrochemical response of voltammetry, in comparison to amperometry, to variations of analyte concentration in microchannels

s15-115

Mario Castaño-Álvarez (R & D Department, MicruX Technologies, Oviedo, Spain), Ana Fernández-la-Villa, Diego F. Pozo Ayuso

Development of Innovative Platforms for Improving the Use of a New Generation of Low-cost Thin-film Electrochemical Sensors

s15-116

Viktor Colic (Center for Electrochemical Sciences, Ruhr-Universität Bochum, Bochum, Germany) Jakub Tymoczko, Wolfgang Schuhmann, Aliaksandr Bandarenka

Detection of 2D phase transitions at the electrochemical interface using impedance spectroscopy

Late Registrations: Tuesday poster session

Yan Fang (Resource Chemistry Lab, Qinghai Institute of Salt Lakes, Chinese Academy of Sciences, Xining, China) Chun-hui Fang, Yong-quan Zhou, Fa-yan Zhu

Determination of Borohydride in Alkaline Solution in Oxidation Process

Chun-hui Fang (Resource Chemistry Lab, Qinghai Institute of Salt Lakes, Chinese Academy of Sciences, Xixing, China) Zi-xiang Yang, Yan Fang, Yong-quan Zhou, Fa-yan Zhu

Electrochemical Synthesis of High Quality Graphene

Enabling Oxygen Electrocatalysis for Sustainable Energy

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The development of sustainable energy is one of the most important scientific challenges in the 21st century. A critical element for sustainable energy implementation is to have efficient energy conversion and storage. Oxygen electrocatalysis is central to enable photoelectrochemical and electrolytic water-splitting, fuel cells, and metal-air batteries. Probing a fundamental catalyst “design” principle” that links surface structure and chemistry to the catalytic activity can guide the search for highly active catalysts that are cost effective and abundant in nature. While such a design concept exists for metal catalysts, little is known about the design principles for oxygen electrocatalysis on oxides. Recent advances in identifying the design principles and activity descriptors of transition metal oxides will be presented. We will show that these fundamental concepts can be used to tune transition metal oxide surfaces with much enhanced catalytic activities. Moreover, we will discuss how oxide bulk electronic structures can influence the catalytic activities of oxides, from which two different reaction mechanisms are proposed. Lastly, connecting bulk to surface electronic structures is challenging but much needed to provide mechanistic insights, and some in-situ synchrotron X-ray measurements to this end will be discussed.

From Meldola Blue to *Cyanobacter* – 30 Years of Bioelectrochemistry

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30 years ago I showed that Meldola Blue (MB, 8-dimethylamino-2,3-benzophenoxazine) not only strongly adsorbed on graphite to form a chemically modified elecrode but also drastically lowered the very high overpotential for electrooxidation of NAD(P)H [1] and as well showed that the reaction between NAD(P)H and MB occurs through a charge-transfer complex, later confirmed in many other studies [2]. This was the starting point of my academic carrier. Since 1989 studies of direct electron transfer (DET) between redox enzymes and electrodes have been at focus, e.g., horseradish and other plant peroxidases [4,5] including the effect of deglycosylation of enzymes and their orientation on electrodes. Later on studies included multicofactor containing redox enzymes, such as cellobiose dehydrogenase [6,7]. From 2004 another direction has been explored, i.e., mediated and direct electrochemical communication between viable bacterial cells and electrodes [8,9]. Currently photosynthetic membranes [10] and cells are at focus and will continue for another few years before my retirement.

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Small Electrochemical Sensors and Single Cells: Zeptomoles, Milliseconds, and the Nature of Reality in Exocytosis

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We have used small electrodes to measure neurotransmitter release from single cells, a method that has become commonplace after twenty years. Here, we have analyzed amperometric peaks corresponding to release at PC12 cells and found stable plateau currents during the decay of the peaks (post-spike feet), indicating closing of the vesicle after incomplete release of the vesicular content. From careful analysis of these data, we propose a process for most exocytosis events where the vesicle partially opens to release transmitter and then closes directly again, leaving the possibility for both a stable pre and post spike feet to be observed with amperometry. In addition, those experiments correlate well with those from the electrochemical cytometry method we have concurrently developed to count electroactive molecules in individual synaptic vesicles in directly sampled populations from cells or brain tissue. With this method we have compared the total numbers of molecules in vesicles to those released and only a fraction of these are, in fact, released both in the PC12 cell model and in mammalian brains. Partial release is important in that it produces a new pharmaceutical paradigm and could be important in understanding learning and memory. It also makes it clear that the dynamics of vesicle opening, controlled largely by lipids, might be an important characteristic in neurotransmission. The interplay of lipids and proteins mitigating open and closed exocytosis might form part of the basis for short term memory.

Recent developments and applications of fluorescence microscopy coupled to electrochemistry

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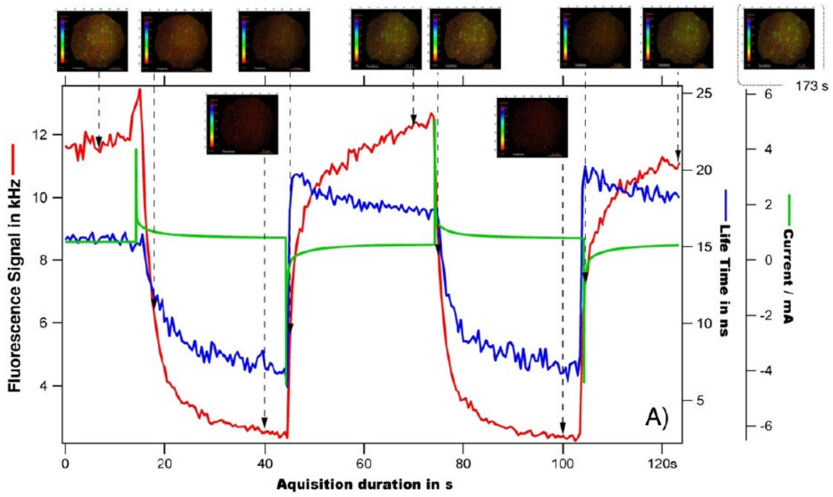
The coupling of fluorescence microscopy with an electrochemistry has known a recent growing interest for various reasons. One is that fluorescence and electrochemistry are complementary techniques: the former can be used to localize a phenomenon using luminescent probes with a very good spatial resolution while the latter can allow species identification and analysis of diffusion processes [1]. Another reason comes from the possibility of interplay between both properties : the fluorescence can be reversibly switched on and off by changing the redox state in an organic or inorganic compound through several mechanisms : direct conversion, electron or energy transfers [2]. Using fluorescence microscopy in Total Internal Reflexion (TIRF) configuration with pulse excitation leads to the simultaneous recording of light intensity, fluorescence imaging and lifetimes and electrochemical current as illustrated below [3].



This lecture will present the versatility of this coupled technique, from its use in dual detection of biochemical events to the investigation of 'electrofluorochromic' systems, i.e. those in which emitted light can be reversibly monitored electrochemically, with applications in smart displays.

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In situ/in operando characterization of electrical energy storage systems

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The performance of current electrical energy storage (EES) systems falls short of requirements for using electrical energy efficiently in transportation, smart grid, commercial, and residential applications. Although batteries have been available for over 150 years there are still many fundamental gaps in understanding the atomic- and molecular level processes that determine and govern their function, operation, performance limitations and failure. Fundamental knowledge is critically needed to uncover the underlying principles that control these complex and interrelated processes.

A new paradigm is required to design new stable anode and cathode materials to provide electrochemical cells with high energy, high power, long lifetime and adequate safety at a competitive manufacturing cost. The ability to address fundamental questions related to advanced electrochemical energy storage devices relies critically on the development and application of novel *in situ*/*in operando* characterization tools with increased spatial, energy, and temporal resolution.

Current battery design is a highly empirical process and the optimum solution is often compromised by greatly overdesigning the battery cell. Therefore, coordinated efforts in fundamental research and advanced engineering are needed to combine effectively new materials, electrode architectures and manufacturing technologies to achieve substantial improvements in energy and power densities of EES systems.

The advent of femtosecond (fs) lasers and near-field optical probes and advanced synchrotron-based x-ray spectroscopy and imaging techniques during the past decade has led to the development of new breakthrough experimental approaches and has revealed new effects and phenomena. With this underpinning knowledge, new concepts in materials design can be developed for producing battery cells that are capable of storing more energy and having longer cycle lifetimes. This presentation provides an overview of novel *in* and *ex situ* experimental approaches aimed at probing battery materials and electrodes in electrical storage systems at an atom, molecular or nanoparticulate level.

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Tunneling Layers, Stabilizing Layers, and Waterproofing Layers for Boosting the Performance and Enhancing the Molecular Diversity of Grätzel Cells

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Classic Grätzel cells (molecular-dye-sensitized solar cells) constitute both a promising photovoltaic technology and a terrifically useful "laboratory" for investigating fundamental photochemistry, electrochemistry, and charge-transfer chemistry. This presentation will describe recent and new results that utilize classic Grätzel cells as platforms for quantitatively investigating interfacial electron-tunneling processes and closely related superexchange-facilitated charge-transfer processes. A key experimental tool in both cases is synthesis of desired interfacial layers or hybrid structures via conformal, self-limiting, atomic-layer deposition (ALD).

This presentation will also describe the use of ALD to: a) render dye cells stable in aqueous electrolytes, b) stabilize electrode/dye/solution interfaces against disruption by other chemical processes, and c) enable attractive, but seemingly chemically incompatible combinations of dye-cell components to be used in operating devices.

Systematic increase of electrocatalytic turnover based on the geometry of nanostructured electrodes

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We coat the pore walls of an anodic nanoporous template with either galvanic deposition or atomic layer deposition (ALD) to obtain structured electrode surfaces that provide the experimentalist with a well-defined, tunable geometry. Indeed, the platform consists of a hexagonally ordered array of metallic or oxidic nanotubes of cylindrical shape, embedded in an inert matrix. The diameter of the tubes can be defined between 20 and 300 nm and their length between 0.5 and 100 µm, approximately. We utilize them as a model system in which the electrode's specific surface area can be increased and its effect on the electrocatalytic current characterized systematically.

Diffusion-limited electrochemical transformations remain unaffected by changes in the length of the electrode's pores, whereas the steady-state galvanic current density observed for slow multielectron transformations increases linearly with the pore length. In particular, this approach enables us to reach a tenfold increase of the electrochemical water oxidation turnover at iron oxide surfaces. These results highlight a strategy for optimizing electrochemical energy transformation devices which could be generalized: the geometric tuning of catalytically mediocre but abundant and cost-effective material systems.

Long Range Electron Transport in Molecular Junctions

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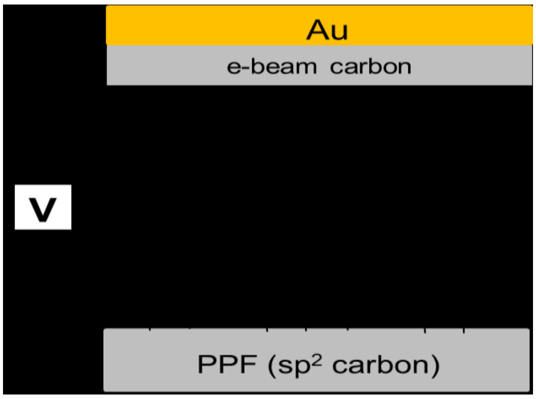
Electron transport in molecular junctions (shown below) is often controlled by quantum mechanical tunnelling, particularly for molecular layer thicknesses of < 6 nm. When the layer thickness exceeds ~8 nm, alternative mechanisms become operative, notably the "hopping" by redox exchange observed in bulk organic semiconductors. We showed previously that tunnelling is relatively insensitive to modifications to the molecule involving electron donation and withdrawal, due to a "levelling effect" caused by electronic coupling between the molecular layer and the contact material. Current work examines the thickness range beyond tunnelling (8-30 nm) where structural modifications may have much larger effects. In particular, thiophene derivatives containing EDOT groups, or alternative materials containing Ferrocene or electron acceptors are compared to past experiments based on bis-thienyl-benzene multilayers. Large differences in the attenuation coefficient (β) are observed, including low values (<1 nm^{-1}). These results will be described, including temperature dependence, in order to identify new transport mechanisms and extend the possible electronic behaviours possible with molecular electronic devices.



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Tailoring Interfaces and Microstructures of a Solid Oxide Fuel Cell for Low-Temperature Operation

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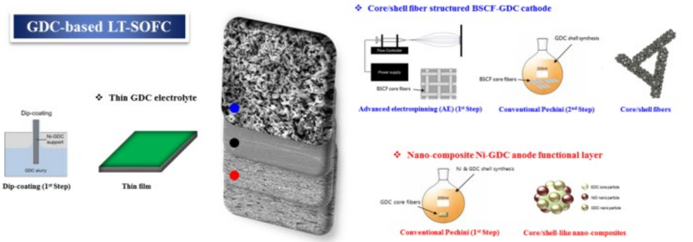
Low-temperature solid oxide fuel cells (LT-SOFCs) have attracted significant attention because of their potential long-term stability, shorter start-up times, and economic competitiveness for a large number of applications, such as small-scale portable devices, auxiliary power units for automobiles, and large distributed power generation systems. However, low operating temperatures lead to significant increases in fuel cell losses, which reduce cell performance and conversion efficiency. In this study, $Gd_{0.1}Ce_{0.9}O_{1.95}$ (GDC)-based low-temperature solid oxide fuel cells (LT-SOFCs) are fabricated by tailoring the microstructures of the components. To reduce the ohmic loss, a thin GDC electrolyte is deposited by controlling the compositions of the GDC electrolyte slurries used in the cost-effective dip-coating method. Here, we propose that the thickness of a single GDC electrolyte should be restricted to approximately 4-5 µm to ensure a high OCV value due to the unstable OCV when using 3-µm thick electrolytes. The activation losses are reduced by the nanocomposite Ni-GDC AFL and the core/shell fibre cathode. In particular, this is the first report to describe the use of the advanced electrospinning & Pechini (AE&P) process, which simplifies the fabrication of inorganic core/shell fibres, in the preparation of core/shell-fibre-structure $Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$-$Gd_{0.1}Ce_{0.9}O_{1.95}$ (BSCF-GDC) cathodes. The core/shell fibre structures are confirmed using various analysis techniques. Interestingly, the GDC-based LT-SOFC with the tailored components exhibits a very high performance of 2 W cm^{-2} at 550 °C in hydrogen. Despite the high current density of 1 A cm^{-2}, the GDC-based LT-SOFC is stable for the tested time period of approximately 300 h. We suggest an original cell design for stable- and high-performance LT-SOFCs, which can be obtained simply by manipulating the electrode microstructures and the electrolyte thickness through cost-effective and straightforward processes instead of relatively expensive and intricate nanotechnologies.



Scheme. $Gd_{0.1}Ce_{0.9}O_{1.95}$-based cell configuration and fabrication processes of each layer: nano-composite Ni-GDC anode functional layer (AFL), GDC thin electrolyte, and core/shell fibre structured BSCF-GDC cathode.

Investigation of Supercapacitors Through an Original Lattice Simulation Method Combined with *In Situ* NMR Experiments

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Supercapacitors exhibit a number of attractive characteristics such as high rates of charge/discharge, low costs and weights, and the absence of chemical reactions in the storage process which allows for higher security and better cyclability. In electrochemical double layer capacitors, the energy is stored at the electrode/electrolyte interface through reversible ion adsorption. The study of these systems represents a challenge as a result of the complexity and multi-scale nature of the materials used as electrodes and the requirement for an understanding of the evolution of the interface with the applied potential. To fully understand the interplay between the electrode structure, the electrolyte nature and the resulting electrochemical properties, experimental and theoretical methods should be able to deal with *complex porous materials* and to probe *local processes*.

On the experimental point of view, techniques suitable for the detailed study of supercapacitors are still rare. Very recently, *in situ* NMR techniques were developed which allow for the characterisation of the structural and dynamical properties of the electrode/electrolyte interface [1]. While these techniques are very powerful, the interpretation of the resulting data is not straightforward and can take advantage of adequate theoretical studies.

The theoretical research is currently oriented towards analytical models on the one hand and molecular simulations on the other hand. Here, we use a *lattice simulation method,* combined with *in situ* NMR experiments, to investigate supercapacitors. Lattice methods are efficient simulation techniques which have not been used in the context of supercapacitors and bridge the gap between analytical and molecular methods. In particular, lattice simulations are in principle applicable to much larger systems than the ones studied by classical molecular simulations. The model is based on the calculation of the NMR signal in a complex porous material using a propagation method [2] which includes the effect of the diffusion of molecules in the porous network. The model uses input of higher level theories such as molecular dynamics simulations or *ab initio* calculations. In particular, free energy profiles can be extracted from molecular dynamics simulations and used to represent ion adsorption/desorption at the interface. The model allows for the investigation of molecular diffusion and the prediction of NMR spectra in complex porous materials.

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Dynamic Voltammetric Ion Selective Electrodes: Principles and Applications to the Determination of Na^+, K^+ and Ca^{2+} in Blood and other Matrices

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Abstract

The ability of 2 different classes of voltammetric ion selective electrodes (VISEs) to measure Na^+, K^+ and Ca^{2+} ion activity in blood and environmentally important matrices has been explored. Voltammetry of TCNQ and TTF microcrystals adhered to an electrode surface provides an ion sensor with low selectivity. Ohmic drop effects from uncompensated resistance and pH artefacts are minimised by the addition of an "innocent" supporting electrolyte (buffer) to the analyte solution. Addition of an ionophore to improve the selectivity resulted in a lowering of current magnitude, due to competition for the ion. Voltammetry of a thin film containing a redox active species, electrolyte, ionophore and membrane solvent generates highly selective Na^+, K^+ and Ca^{2+} ion sensors. Choice of ionophore affects the upper detection limit. Methods to attach both VISE types to low cost screen printed electrodes have been developed and will be described as will a range of potential referencing techniques. Both the microcrystal and thin film VISEs can be used to determine ion activity in complex matrices as demonstrated in seawater, beverages, plasma and whole blood. Dissolved oxygen does not need to be removed, as it does not affect the response. However calibration methods are important for sensor accuracy and issues relating to electrode fouling must be addressed.

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Recycling CO_2

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Controlling the atmospheric CO_2 concentration may ultimately require recycling CO_2 into liquid fuels and commodity chemicals using renewable energy as the power source. Arguably the greatest challenge for this vision is to develop efficient catalysts that reduce CO_2 and its derivatives to a fuel of choice. This talk will describe our development of "oxide-derived" nanocrystalline electrocatalysts. These materials are prepared by reducing metal oxide precursors to form continuous networks of interconnected metal nanocrystals with a high density of grain boundaries. The process of metal oxide reduction kinetically traps metastable structures with unique catalytic properties. We have developed oxide-derived nanocrystalline catalysts that reduce CO_2 either to CO or to HCO_2^- and operate at diffusion-limited current densities at potentials very close to the thermodynamic minimum. We have also developed oxide-derived catalysts that selectively reduce CO to ethanol and propanol. The catalysts all operate in water at ambient temperature and pressure and are remarkably robust. The structural origins of the catalytic activity will be discussed as well as the prospects of preparing nanocrystalline catalysts by alternative syntheses. Oxide-derived nanocrystalline materials enable electrochemical conversions that could make CO_2 a valuable feedstock for synthetic liquid fuel.

Novel anode materials and triode operation: Two approaches for improving the performance of SOFCs supplied with H_2S containing-methane

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Solid oxide fuel cells have the flexibility, due to their high operating temperature, to use natural gas directly as the fuel in the anodic compartment. A typical problem in this process is the significant degradation in cell voltage and in the catalytic direct internal reforming activity due to H_2S poisoning, which is present in natural gas [1]. The aim of this study is to enhance the sulphur tolerance of SOFCs operated under 2%CH_4-5%H_2O in presence of 1-10 ppm H_2S at 800-900°C. The first aim of this study is the development of novel modified Ni/GDC anodes with improved sulphur tolerance during catalytic CH_4 reforming. The second approach entails the use of triode operation in order to enhance the SOFC performance.

Modified anodic materials were prepared using commercial NiO/GDC powder doped with Au or Mo via the deposition-precipitation method [2]. These materials were used as catalysts for the methane reforming reaction in presence of H_2S. It was found that H_2S has a strong poisoning effect whatever the catalysts. After 1 hour of exposure to 10 ppm H_2S, the samples lost 90-100% of their initial catalytic activity. However, the Au-modified and Au-Mo-modified Ni/GDC materials showed enhanced stability compared to the unmodified sample. This indicates that these anodic materials can be promising anodes for SOFCs. Deep characterizations of the powdered anodes have been carried out to investigate the impact of dopants.

A methodology proposed recently, in order to enhance the performance of fuel cells, is known as triode cell operation [3]. In this operation a third electrode (auxiliary electrode) is introduced in the cell apart from the typical anode and cathode electrodes. Application of electrolytic currents between the anode and the auxiliary electrode can lead to minimization of the total cell overpotential losses. Triode operation allows fuel cell operation under previously inaccessible anode-cathode potential differences.

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The effect of graphitization on the potential dependent capacitance of carbon supercapacitors

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Nowadays, research on supercapacitors follows three mainstream developments to increase the energy density: (1) novel electrolytes with large electrochemical stability window and (2) carbons with optimized pore structure, and (3) implementation of pseudocapacitive elements.[1]

Albeit the long tradition of studying the differential capacitance [2], little attention has been paid to the low charge carrier density of carbon and its effect on the total material capacitance. In literature this effect has been named "electrochemical doping".[3] Cyclic voltammograms of carbon materials, including commonly used commercial activated carbons, may show a "butterfly-like" shape with a pronounced dependence of the specific capacitance on the electrode potential (compare **Figure**). The reason for the magnitude of this effect, so far, had been unclear.

Using carbon onions (OLC) as a model system for carbons with similar particle size but different graphitization, the effect of electrochemical doping and charge screening has been revisited in our study. Three electrode measurements with activated carbon as reference electrode using either solvent based standard electrolytes or solvent free ionic liquids, demonstrate the voltage dependent capacitance on the graphitization. The ohmic resistance of the OLC at different state of charge is investigated using an *in situ* electrochemical resistance cell. The resistance shows a pronounced dependence on the voltage for the highly graphitized OLC and only a minor drop for the OLC with low graphitization, indicating a strong influence of the charge carrier density in the carbon on the overall capacitance of the system. We expand these findings to general activated carbons and, as a result, have identified graphitization as a universal concept to tailor the energy density and material capacitance for carbon supercapacitors.

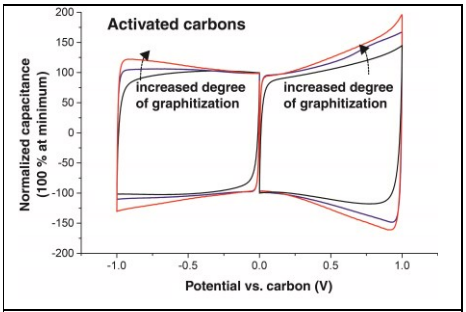

Figure: Cyclic voltammograms of activated carbons in 1 M TEABF$_4$ / ACN illustrating the influence of graphitization.

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Actin contributes to the regulation of quantal release during exocytosis

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Exocytosis is a fundamental mechanism allowing neuronal communication. This phenomenon is initiated by the fusion of a neurotransmitter-filled vesicle with the cell membrane. The vesicular content is then released into the extracellular space. The neurotransmitters freely diffuse in the intracellular region and stimulate another neuron, thus enabling signal transmission. Single cell amperometry can be used for the real-time, quantitative analysis of single exocytotic events. In this method, a 5-µm carbon fiber microelectrode is used to oxidize, in a diffusion-limited manner, the neurotransmitters released from the vesicle. This technique has been extensively used to investigate the biophysical regulation of exocytosis, and the dynamics of the fusion pore formed between the vesicle and the membrane.

Even though the regulation of the fusion pore in exocytosis has been widely studied, the effects of the physical properties of the extracellular and intracellular environments are not well understood. In this study, the effect of latrunculin A, an inhibitor of actin cross-linking, on exocytosis in PC12 cells was investigated with single cell amperometry. The exocytotic spikes were wider and higher after exposure to latrunculin A (Fig. 1), thus indicating a wider fusion pore when the vesicle is less constrained by the actin cytoskeleton. This analysis strongly suggests that the actin cytoskeleton is involved in regulating exocytosis, especially by mediating the constriction of the pore.

Furthermore, in an extended kiss-and-run release mode, actin could actually control the fraction of neurotransmitters released by the vesicle. An increasing body of evidence indeed indicates that the vesicle does not release its full content during exocytosis and that the fusion pore may close at the end of the event. The actin scaffold appears to contribute, with the lipid membrane and the protein machinery, to the closing dynamics of the pore, in competition with other forces mediating the opening of the exocytotic channel.

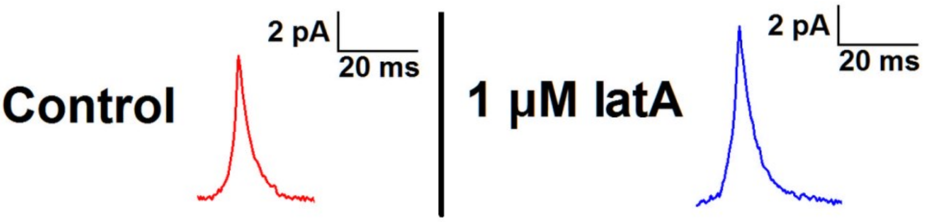

Fig. 1: Average peaks from typical single cell amperometric traces for control (left) and 1 µM latA (right) conditions. The cells were stimulated with K^+ for 5 s.

Novel Signal Transduction Principle for Ion Sensors

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Ionophore-based sensors are usually employed in the potentiometric mode, *i.e.* the ion activity in solution is related to the equilibrium (zero current) open-circuit potential of the sensor versus the reference electrode. However, significant research efforts are currently directed towards new signal transduction mechanisms for ionophore-based sensors. A recent and interesting approach is the use of controlled potential thin layer coulometry, which is an important step towards calibration-free determinations of ion concentrations in aqueous sample solutions [1].

In this presentation, a novel signal transduction principle for ion sensors having a solid internal contact is introduced and discussed. A key feature of the suggested approach is to utilize the capacitance of the solid contact to convert ion activity into an electrical current that is integrated to obtain the charge. This would essentially mean that we go from classical "zero-current potentiometry" to "zero-potential coulometry".

In this method, the potential of the ionophore-based sensor (with solid internal contact) is held constant (*vs.* the reference electrode) and whenever the ion activity in the solution changes it will give rise to a current flow that will charge the solid contact material of the sensor until a new equilibrium is reached. The charge passed should thus be proportional to the potential change.

If successfully implemented, such a signal transduction principle would allow coulometric determination of ion activity in solution. Furthermore, the obtained charge for a given change of the ion activity in solution will be proportional to the capacitance of the solid contact [2].

The novel transduction principle will be discussed in relation to preliminary experimental results obtained by using poly(3,4-ethylenedioxythiophene) (PEDOT) as solid contact material in ion sensors.

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Applications of Optical Spectroelectrochemistry Combining with Low Temperature Technique

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Coordination compounds, in particular transition metal complexes with redox active (non-innocent) ligands have continued to attract much research attention, specifically for their rich redox behaviour and photophysical properties being widely used as sensitizers in electron and energy transfer processes [1,2]. Thus, a better understanding of the redox properties and pathway of these materials is significantly important to aid their application in areas such as photo/electrochromism, molecular electronic devices and photo/redox catalysis. Optical spectroelectrochemistry in the UV-Vis-NIR-IR region can be employed as a convenient tool to assign and identify the redox mechanism and electrogenerated intermediates formed in a series of cathodic and anodic steps.

The redox products of many complexes, however, are short-lived at room temperature. Their spectroscopic characterization is often precluded by their instability. Obviously, spectroelectrochemistry conducted at reduced temperatures to inhibit secondary reactions can provide an effective way to resolve this problem [3,4]. Differently from reviews on room temperature cells, those on low temperature spectroelectrochemical cells are absent in the literatures, which can be ascribed to technical challenges encountered in their construction. Herein, we will comment several constructions of optical spectroelectrochemical cells suited for low temperature experiments. Subsequently, selected examples of low temperature applications of optical spectroelectrochemistry will be discussed in different fields of coordination chemistry.

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Recent progresses on photoelectrochemical bioanalysis

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The photoelectrochemical (PEC) approach is a newly appeared yet dynamically developing technique for biological analysis. In recent years, its development has resulted in great progresses in their analysis performance and bioanalytical applications. Due to its desirable advantages and attractive potential in future biological analysis, its popularity has grown tremendously among the analytical community. From its very beginning, many efforts have been devoted to its exploitation, and significant progresses have achieved. Now, more strategies to new PEC bioanalysis are proposed in increased scholarly articles. The aim of this report is to provide a concise introduction of recent advances in PEC bioanalysis in our group, with special emphasis on PEC DNA analysis, immunoassay and enzyme biosensing. The future prospects in this area are also evaluated and discussed.

Physics of supercapacitors at the nanoscale

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This *keynote lecture* will overview our current understanding of the mechanisms of charge storage and charging dynamics in supercapacitors with ionic liquids. It will focus on the following points:

1. Charge storage equilibria: from flat interfaces to nanoscale pores
    a) Double layer and electrical capacitance at flat interfaces
    b) Renormalized interionic interactions in nanoconfinement: the superionic state in a nanopore
    c) Approximate and exactly solvable models of charge storage: the capacitance of single cylindrical and slit pores as a function of voltage and the size of the pore; calculating the stored energy
    d) The effect of pore size distribution and complexity of the pore space

2. Charging dynamics and the laws of ion transport in nanoconfinement: theory versus simulations
    a) Charging of quasi single file pores
    b) Charging of slit pores

3. The energy-to-power trade-off: new optimization scenarios, and nano-engineering of supercapacitor electrodes

4. Leading-to-degradation: the unwanted ‘electroactuation’ (mechanisms, theory, and the ways to avoid it)

5. A challenge to experimentalists: what do we need to measure to check the theory and to know, in order to improve both the stored energy and power

A combined electrochemical and theoretical study of H_2 binding and activation in FeFe hydrogenases

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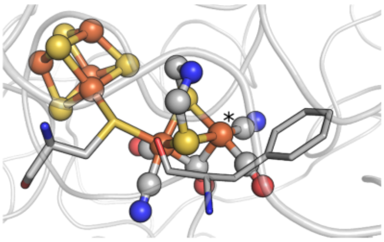
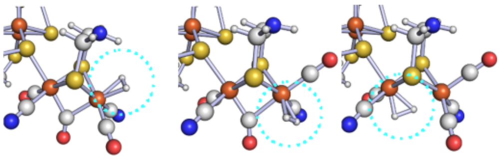
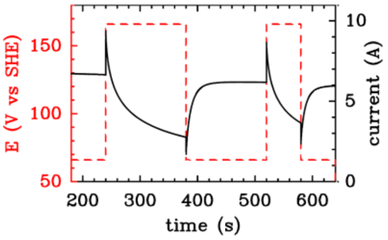
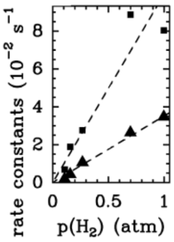
Hydrogenases, the enzymes that oxidize and produce H_2, can be adsorbed or attached to electrodes, in a configuration that allows direct electron transfer and complete retention of the native properties. This can be used for learning about the catalytic mechanism [1-5]. We have recently combined electrochemistry, site-directed mutagenesis and theoretical calculations (DFT, QM, MD) to investigate H_2 binding at the active site H-cluster of FeFe hydrogenase. We found that the reversible oxidative inactivation of this enzyme results from the binding of H_2 to coordination positions that are normally blocked by intrinsic CO ligands. This demonstrates the flexibility and versatility of the H-cluster [1].









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Bimetallic Electrodes with Well-defined Nanostructure - Preparation and Characterization on an Atomic Scale

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Bimetallic electrodes with well defined nanoscale surface structure have attracted considerable interest in recent years as model systems for a variety of different applications, including, e.g., electrocatalytic reactions in the area of energy conversion (fuel cell electrocatalysis).

The considerable progress in this area is mainly due to two different features. First, high resolution scanning tunnelling microscopy (STM) imaging with chemical contrast has been demonstrated to resolve the different metal species in a surface and thus give direct access to the quantity [1,2] and, after appropriate statistical evaluation, to the lateral distribution of the respective surface species [3,4]. Second, modifying the deposition conditions allows us to vary the structural properties of the resulting bimetallic surfaces, specifically the nature and abundance of specific (bi-)metallic nanostructures, in a controlled way and over a wide range. In addition to electrodeposition, this also includes the use of Surface Science techniques for the controlled preparation and characterization of bimetallic electrode surfaces.

The potential of this approach for the controlled preparation of bimetallic electrodes with well defined nanoscale structure and their application in electrocatalytic studies will be demonstrated using recent results obtained in a coupled ultrahigh vacuum – electrochemistry system [5,6].

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Charge compensation at the mesoporous semiconductor / dye / electrolyte interface

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Electrons accumulated in the mesoporous semiconductor electrodes are thought to be charge compensated by cations in surrounding electrolyte, but it is unclear whether these ions are adsorbed at the semiconductor surface or free in the electrolyte. Here we will present a study where a combination of techniques is used to investigate the charge compensation mechanism.

When electrons are present in the mesoporous semiconductor, the charge-compensating cations are adsorbed at the interface, or in solution. The position of the cations will affect the electric field across adsorbed dye molecules, see Figure 1. This will lead to differences in the absorption spectrum of the dye due to a Stark shift.[1] Adsorbed dye molecules are thought to be, at least partially, located within the Helmholtz double layer at the semiconductor / electrolyte interface. Electroabsorption techniques can thus be used to determine the mechanism of charge compensation of electrons in these electrodes. We will present new experimental data that will give new insights into the charge compensation mechanism in dye-sensitized solar cells.

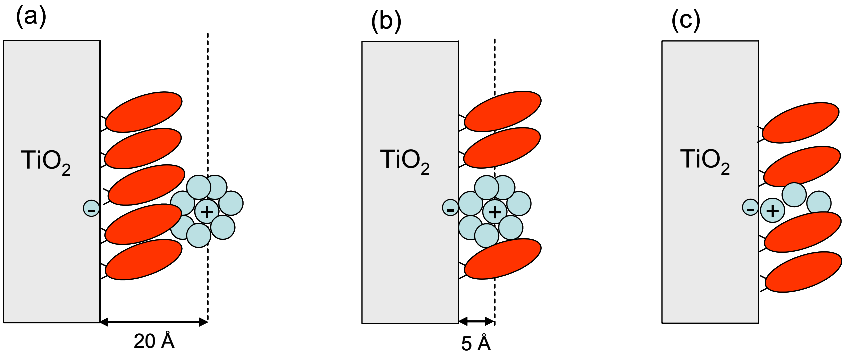

Figure 1: Charge compensation at the semiconductor / dye /electrolyte interface. (a)The counter charge for the electron in TiO_2 is a solvated cation outside the densely packed dye monolayer (red). Dye molecules are inside the Helmholtz double layer (indicated with a dotted line) and will experience an electric field. (b) If solvation ions can penetrate the dye layer, the HH layer will be thinner (about 5 Å, defined by the radius of the solvated cation). (c) The counter charge is an adsorbed cation (without solvation shell). The dye molecules will not experience an electric field from the electron–cation pair.

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Combining 3D effective conductivity modeling with electrochemical performance prediction for solid oxide fuel cell electrodes

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The microstructure of solid oxide fuel cell (SOFC) electrodes is key to the performance of these electrochemical devices. Understanding the relation between the microstructure and its performance is thus crucial. This paper reports our continuous efforts in this area.

A 3D microstructure model was developed to predict electrode performance based on the fundamental properties of the underlying microstructure. The model was based on the discretization of the 3D microstructure into finite volumes and linked the electrochemical reaction with the transport of electrons, ions and gasses using the fluid-of-volume (VOF) approach [1, 2]. In this approach, the microstructure in the individual finite volumes was assumed to be homogeneous and the effective conductivities of these volumes were simply related to the conductivity of the bulk materials and their volume fractions. To enable a more accurate performance prediction, a 3D effective conductivity model [3] has been developed separately to calculate the effective electronic, ion conductivities and gas diffusivities of the microstructure. The model can be applied to any structures including those of synthetic and real SOFC electrodes.

The 3D effective conductivity model was validated by computing the effective conductivities of Ni/10ScSZ microstructures reconstructed from real electrodes using focused-ion-beam (FIB) and scanning electron microscopy (SEM), and comparing against the experimentally measured effective conductivities on the same electrodes. Good agreement was observed for Ni/10ScSZ electrodes of 20-50% Ni content, indicating the validity of the model for the prediction of the effective conductivities. The 3D effective conductivity model was then incorporated with the VOF approach to predict the electrochemical performance of Ni/10ScSZ anode, taking into account the heterogeneity of the local microstructure. The results showe that electrochemical performance is sensitive to the local ionic conductivity within the electrode, and therefore it is important that the local effective ionic conductivity is described.

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Recent Advances in Electrochemical Detection of Oxidative Stress

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For the last twenty years, electroanalytical methods have been developed in order to study biological mechanisms. More particularly, amperometry with ultramicroelectrodes appears to be a very convenient technique. Indeed, by positioning a micrometric electrode in the close vicinity of the investigated cell ("artificial synapse" configuration), the electroactive species released by the cell can be collected and analyzed by the surface electrode in real time at the single cell level. Such an electrochemical method has been adapted in our laboratory to the investigations of oxidative stress[1]. Particularly, the direct detection at the surface of a platinized carbon fiber ultramicroelectrode (10 µm diameter) of several superoxide and nitric oxide derivatives released at minute amounts (atto- to femto-moles) by a single living cell (macrophages, fibroblasts) has been achieved and contributed to the understanding of oxidative stress (enzymatic systems, phagocytosis…). In that way, recent works devoted to the effects of SOD mimics towards the production of reactive oxygen and nitrogen species will be presented[2,3].

However, such investigations were based on independent amperometric measurements at several oxidation potentials to determine the nature and the fluxes of the species released by the cell (H_2O_2, $ONOO^-$, NO°, NO_2^-). Despite the adequate analytical properties (selectivity, time resolution, sensitivity), this approach is time-consuming since many experiments are required to overcome the cell variability. Furthermore, because the ultramicroelectrode is located in the extracellular medium, the electrochemical detection is blind to the phenomena occurring within the cytoplasm. Therefore, recent developments of methodologies devoted to overcome such limitations (nanoelectrodes, microsystems) will be also discussed[4,5].

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In-situ TEM and cyclic voltammetry study of a single $LiMn_2O_4$ nanowire battery

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In lithium ion batteries, structural phase transformation of electrode materials during battery cycles is an important issue, because it influences the life and capacity of the battery via diffusion process of lithium ions. For clarifying the phase transformation process, we developed nano-lithium ion battery having a bundle of $LiMn_2O_4$ nanowires as the cathode material [1]. Recently, we have developed « a sigle nanowire » battery, which consists of a single $LiMn_2O_4$ nanowire cathode, ionic liquid electrolyte and $Li_4Ti_5O_{12}$ anode. We observed structural changes of the $LiMn_2O_4$ nanowire by *in-situ* transmission electron micoroscopy (TEM)(Roo5 microscope) during charge/discharge cycles, observed simultaneously by cyclic voltametry.
The $LiMn_2O_4$ nanowire battery seen by cyclic voltammetry (CV) displayed a pair of double current peaks, which represent the charateristics of 4 V reaction of $LiMn_2O_4$ crystal. The cell current directly corresponded to the amount of diffused lithium ions in the single $LiMn_2O_4$ nanowire. The cell capacity was found to be about 80% of theoretical capacity of the nanowire cathod. During the charge/discharge process, the structure change of a $LiMn_2O_4$ nanowire observed by TEM was 50 μm apart from electrolyte, where the nanowire had a length of 200μm. The maximum current at the peak of 4V reaction in CV curve was 15pA.
During *in-situ* TEM, we observed a phase boundary which separates between Li-rich phase and Li-poor phase in the nanowire. The phase boundary was found to show characteristic behavior while the charge/discharge cycle : The boundary moves reversibly along the axis of nanowire. Electron diffraction intensity of the rich and poor region suggested different lithium ions' concentration : one in the Li-rich region was higher than 0.3, while one in the Li-poor region, almost zero after charge process has completed. A particularly intersting finding is that the phase boundary can never disappear but remain during the cycles. This means that the rich and poor phases are coexisted always of their charge/discharge processes. This always coexistence did not repored in particle shaped $LiMn_2O_4$ cathods : In a charge process, the cathod can have two phases only when Li composition is lower than 0.5 [2].

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Single Particle Measurement of Battery Electrode Materials by the Particle/Current Collector Integrated Microelectrode

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A single particle measurement is known as a characterization method of electrode material [1]. In a conventional single particle measurement, electrical contact between a microelectrode and an electrode particle is made while observing with an optical microscope.

In this study, a single particle was bonded to the tip of a microelectrode by Pt metal in the Focused Ion Beam (FIB) apparatus. This method enabled direct observation of the target particle by SEM, SIM and also gave more reliable electrical contact. We carried out single particle measurements of $Li_4Ti_5O_{12}$ by the novel particle/current collector integrated microelectrode and evaluated the Li ion diffusion behavior in a $Li_4Ti_5O_{12}$ particle.

The integrated microelectrode was fabricated as shown in Fig. 1 and its electrochemical properties were successfully evaluated in a 1M $LiN(SO_2CF_3)_2$/ EC+PC[1:1] electrolyte using the two electrode cell with lithium counter electrode. Fig. 2 depicts rate capability of the $Li_4Ti_5O_{12}$ single particle electrode at 2C~500C, showing inherent good rate capability of $Li_4Ti_5O_{12}$.

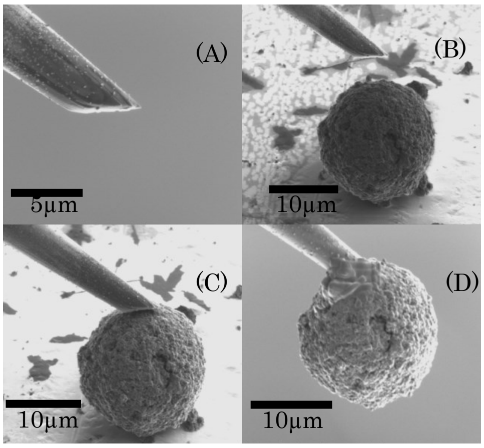

Fig.1. Process of creating particle/current collector integrated microelectrode.

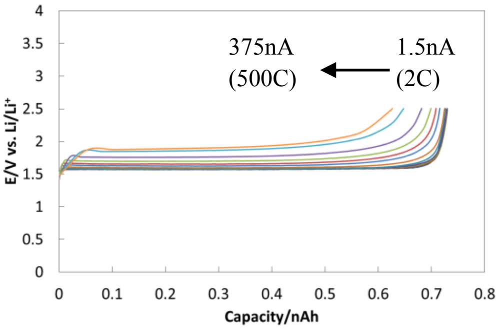

Fig. 2. Rate capability of the $Li_4Ti_5O_{12}$ single particle electrode at 2C~500C.

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Alkaline Oxygen Electrocatalysis of Iron Triad Elements in Chemical Energy Conversions

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Oxygen electrocatalysis is considered as the most important physicochemical reaction in nearly all electrochemical industries, since it involves the two most sluggish reactions (reduction and evolution) that govern the overall reaction rate in fuel cells, metal-air batteries, and water electrolyzers. In this presentation, I shall intend to cover two main areas: oxygen reduction to water (ORR) and oxygen evolution reaction (OER) from water molecule. In particular, it aims to provide the researchers with an understanding of the critical scientific challenges facing the development of oxygen electrocatalysts, specifically, various unique attributes of recent non-noble iron triad elements (Fe, Co, Ni) based C-N nano-structures. This presentaion will be of value to both electrochemists and industrial engineers interested in the field of chemical energy storage and conversion.

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Thin PEDOT films for neurochemical measurements

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Chemical Vapor Deposition (CVD) is a rapid approach to producing high high-purity semiconductors. In this work CVD is used to synthesize thin thin-film polymer electrodes composed of poly(3,4-ethylenedioxythiophene):tosylate (PEDOT:Tosylate). This reaction proceeds via the acid acid-catalyzed radical polymerization of 3,4-ethylenedioxythiophene (EDOT) using IronIII Tosylate as the radical initiator and pyridine as a weak base to control the reaction rate. By varying the ratios of these precursors as well as the reaction temperature it is possible to control the thickness of the deposited polymer film. Films can be synthesized with thicknesses varying from thickness was measured to be in the range of 40 nm to -500 nm as measured by using Atomic Force Microscopy (AFM). A low-pressure microwave-generated plasma was used to dry etch the films forming patterned electrodes with submicrometer scale features. The resulting PEDOT:Tosylate electrodes were electrochemically characterized using steady-state cyclic voltammetry and were found to have capacitances as low as 200 μF/cm2. The utility of conductive polymer electrodes with low capacitance is demonstrated by performing Fast Scan Cyclic Voltammetry (FSCV) of redox redox-active neurotransmitters released from individual cells.

Monitoring the passage of redox oscillations across soft interfaces: towards communicating liposomes.

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Symposium 1 : Dynamic Ion Sensing: from ITIES to ISEs

The transmission of chemical information between compartments is an essential behavior in life and environment. In this context, it is necessary to develop strategies to analyze, to intercept or to guide chemical information from a compartment to another one. As a model, we propose to use cell-like compartments, such as giant phospholipid vesicles (liposomes) to monitor and understand how chemical information can cross their membrane to generate communication between such different biomimetic compartments. Chemical systems such as the Belousov-Zhabotinsky (BZ) reaction appear as a good model to apprehend the propagation and processing of chemical information.[1] This reaction provides regular oscillating signals over time, which allows a convenient analysis of the propagation of a chemical information and then of the communication phenomenon.

As a first approach we study chemical transmission across the interface between two immiscible liquids, eventually in the presence of lipid, by local electrochemical probing. We show that chemical information is transmitted either by direct transfer of redox active species and or by interfacial electron transfer. Insights obtained by electrochemical measurements, together with numerical simulations, are then used to transpose the communication across a phospholipid bilayer among oscillators compartmentalized in liposomes and dispersed in a water medium (Fig.1).

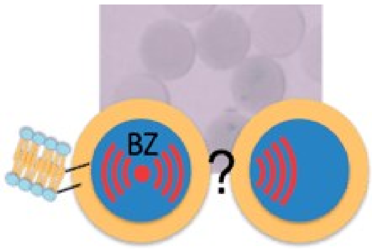

Fig. 1. BZ reaction encapsulated inside liposome. How works the communication between two compartments?

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Single-Molecule Charge Transport in Organometallic systems

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Single-molecule Junction approaches [1] have advanced the comprehension of charge transport in a large variety of molecular backbones and brought fine details on the molecule-electrode electrical communication [2]. Latest efforts in the field of Molecular Electronics are focused on the design of nanoscale molecular contacts with new electrical functionalities [3]. Organometallic compounds constitute an extensive family of molecular backbones with a number of potential applications in nanoscale electrical interfaces. Although single-molecule organometallic wires have been less explored, some interesting examples exploiting the magnetic anisotropy in single-molecule magnets have been shown [4]. Another acute example is the single-molecule wires built using metalloporphyrins, whose perfect molecular energy level alignment and good electronic coupling to the metal electrodes provide with ultralow current decay constants [5].

In this contribution, we bring two more examples of single-molecule transport in organometallic systems. First, a spin crossover (SCO) system based on an Fe(II) complex is studied. Here, spin-dependent transport is measured in a single-molecule wire by bridging the Fe(II) complex between a Au and a magnetically polarized Ni electrodes. Large magnetoresistance (>100%) is observed in the single-molecule contact at applied low biases depending upon the direction of the Ni electrode magnetization. Our calculations evidence the existence of a polarized hybrid Fe complex-Au electrode state responsible for the spin-polarization of the current crossing the molecular junctions and the observed strong magnetoresistance in the single-molecule transport. This constitutes a direct example of the *spinterface* effects in a nanoscale spintronic device [6]. The second example illustrates the use of the metal coordination chemistry to *wire* a single metalloporphyrin ring between two metal electrodes in a fully flat conformation. This special geometry allows enhanced electrical coupling between the metal electrodes and the molecule through the porphyrin metal center thus resulting in high conductance values for the overall single-molecule contact. A full electrical characterization as a function of the electrode-electrode distance is presented.

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Electrochemical Properties of Perovskite- and Ruddlesden-Popper-Type Cathode Materials in Oxygen-Excess-Type Solid Electrolyte (OESE)

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Lanthanum silicate ($La_{9.33+x}Si_6O_{26+1.5x}$: LSO)[1)] is regarded as a new class of oxide ion conductors based on the oxygen-excess-type solid electrolytes (OESEs), and has been considered as promising electrolytes for intermediate temperature solid oxide fuel cells (IT-SOFCs) because of its high ion conductivity, low activation energy for conduction, and high ionic transference number. However, cathode materials suitable for LSO has not been optimized yet. It is necessary to reduce large polarization resistance (R_{pol}) at the interface between LSO and conventional cathode materials at IT-range. In addittion, a durability test of LSO-based OESE cells has not been conducted yet. In the present study, an electrochemical property of Ruddlesden-Popper (RP)-type cathode materials, $A_{n+1}B_nO_{3n+1}$ (n = 1, 2, 3) were studied in the LSO-based SOFC.

For cathode materials, $(La_{2-x}Sr_x)(Co_{0.5}Fe_{0.5})O_{4\pm\delta}$ ($n = 1$, $0.1 \leqq x \leqq 1.8$) were synthesized by solid-state reaction. Required amounts of La_2O_3, $SrCO_3$, Fe_2O_3 and Co_3O_4 were mixed and calcined at 1273 K for 12 hrs, followed by firing at 1673 K for 12 hrs. Phase relation and crystal structure of cathode materials were studied by powder X-ray diffraction. Oxygen nonstoichiometry was studied by iodometry. These materials were used as a working electrode of the Al-doped LSO electrolyte cells. Electrochemical behavior of cathode materials was investigated by ac impedance and steady-state dc polarization methods under 3-electrode configuration.

Temperature dependence of area specific resistance (ASR) of the prepared RP electrode materials in air showed that interface property could be improved at the measuring temperature of 873 K compared with perovskite-type cathode. Among them, $(LaSr)(Co_{0.5}Fe_{0.5})O_{4\pm\delta}$ (x = 1.0) exhibited the lowest ASR in the Al-doped LSO electrolyte cell. It is probably due to the improvement in the mixed ionic and electronic properties in case of the RP-type cathode. Therefore, it was concluded that LSO electrolyte could form a good interface with RP-type cathode materials at IT range.

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Charge Collection and Separation in Sensitized Mesoscopic Solar Cells: An Account of Studies from NUS

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Dye-sensitized solar cells (DSCs) have been considered to be a promising photovoltaic technology to address the increasing energy and environmental challenges since the pioneering work of O'Regan and Grätzel. To date, power conversion efficiencies greater than 12% have been achieved. While encouraging, owing to the complexity of the multiple kinetic processes charge transport in DSCs has not been thoroughly and unambiguously understood. This talk will summarizes our recent progress achieved at National University of Singapore (NUS), in the fundamental understanding of charge separation and charge collection — the two crucial, efficiency-determining processes, as relevant to DSCs. Problems surrounding the experimental determination of electron diffusion length in dye-sensitized solar cells will be addressed, together with the physical interpretation of this quantity and its usefulness in predicting charge collection losses in working dye-sensitized solar cells. In the second part of this talk, the predicted effect of sensitizer regeneration on the *j*-V characteristics of DSCs will be presented and recent experimental affirmation will be highlighted. In addition, with cobalt polypyridyl complexes-based electrolyte as an example, the effects of electrolyte ionic strength on sensitizer regeneration will be discussed. We anticipate that these results strengthen our understanding on charge collection and separation process of DSCs in order for more efficient and more stable solar energy conversion.

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Monitoring electrochemically early events of hydrogen peroxide production by mitochondria

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Mitochondria are the site of metabolic transformation of organic substrates into the energetic molecule ATP. The respiratory chain couples electron transfers to proton extrusion to generate a membrane electrochemical potential used by the ATP synthase. The final electron acceptor of the respiratory chain is oxygen that is converted into water. However, it is demonstrated that the respiratory chain is also producing reactive oxygen species (ROS), involved either in signaling pathways or in oxidative stress situations. Dysregulation of mitochondria metabolism leads to many pathological processes (myopathies, neurodegenerative diseases, cardiac injuries …).

We have developed electrochemical biosensors to monitor quantitatively and kinetically the production by mitochondria of a major ROS: hydrogen peroxide. Our approach consisted in embedding horseradish peroxidase (HRP) in a cross-linked 3D-polymer matrix bearing mobile osmium-based redox (Os^+ / Os^{2+}) mediators and permitting diffusion of substrate. We optimized the ratio between components (HRP/polymer/cross-linker) and the whole loading on electrode surface, so as to reach high analytical performances: a specific amperometric detection of H_2O_2 at +0 V vs. Ag/AgCl, 1 nM LOD for H_2O_2, and a linear response over 5 concentration-decades.

Biosensors could monitor the release of H_2O_2 by mitochondria (from *saccharomyces cerevisiae* yeasts) under several conditions (non-phosphorylating, phosphorylating or inhibited respiration). We report the detection of two concomitant regimes of H_2O_2 release: large fluxes (hundreds of nM) under the typical complex III-blockade, and bursts of a few nanomolars and few minutes-duration immediately following mitochondria activation. These bursts of H_2O_2 match superoxide flashes observed by fluorescence, and are assigned to the recently reported-role of mitochondria as the central hub of redox signaling in cells.

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Half of the Experiment: Different Approaches to Deal with Reference Electrode Problems

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Most electroanalytical measurements are performed with reference electrodes separated from samples by salt bridges. The latter were introduced more than 100 years ago and enable the analysis of billions of samples per year, in particular in clinical chemistry. Unfortunately, salt bridges can be the cause substantial error.

Nanoporous glass plugs are widely used to contain the electrolyte solution that forms a salt bridge between the sample and the reference electrode. Even though reference electrodes with plugs made of nanoporous glass (such as Vycor or CoralPor glass) are commercially available and are frequently used, the limits of their use were not explored until very recently [1]. We have shown that at ionic strengths lower than 100 mM, the half-cell potentials of reference electrodes with nanoporous glass plugs are not sample independent, as it would be desirable, but they depend on the ionic sample composition. Sample dependent shifts of more than 50 mV in the half cell potential were encountered. Reference potentials were found to be affected in aqueous solutions by HCl, NaCl, KCl, and $CaCl_2$, and in acetonitrile by CF_3COOH and the supporting electrolyte tetrabutylammonium perchlorate. These observations cannot be explained by the liquid junction potential between two mutually miscible electrolyte solutions, as commonly described with the Henderson equation. Instead, they result from the surface charge density on the glass surface and the resulting electrostatic screening of ion transfer into the glass pores when the latter have dimensions comparable to or smaller than the Debye length. Users of reference electrodes with nanoporous plugs at the junction to the sample need to be aware of these limitations to avoid measurement errors. Motivated by these findings, we are exploring new nanoporous materials with controlled dimensions and surface chemistry.

Reference electrodes with hydrophobic ion-doped polymeric membranes offer a promising alternative to reference electrodes with conventional salt bridges. We introduced the current pulse operation of liquid junction free reference electrodes. A brief current pulse is applied to an ion exchanger membrane, releasing a well-controlled amount of cations from the membrane into to the sample and, thereby, determes the boundary potential of the sample/reference membrane interface. Measurements with ion-selective electrodes are performed relative to these reference electrodes immediately after the current pulse and exhibit the same Nernstian responses as typical for potentiometry.

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New NMR and X-ray Diffraction Based Approaches for Studying Electrode Reaction Mechanisms

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A full understanding of the operation of a battery requires that we utilize methods that allow devices or materials to be probed while they are operating (i.e., *in-situ*). This allows, for example, the transformations of the various cell components to be followed under realistic conditions without having to disassemble and take apart the cell. To this end, the application of new *in* and *ex-situ* Nuclear Magnetic Resonance (NMR) and X-ray diffraction (XRD) approaches to correlate structure and dynamics with function in lithium-ion batteries will be described. The *in-situ* approach allows processes to be captured, which are very difficult to detect directly by *ex-situ* methods. For example, we can detect side reactions involving the electrolyte and electrode materials and non-equilibrium processes that can occur during extremely fast charging and discharging. *Ex-situ* NMR investigations allow more detailed structural studies to be performed to correlate local and long-range structure with performance in battery materials.

In this talk, I will describe the use of NMR spectroscopy and X-ray diffraction to probe local structure changes in lithium ion batteries focusing on our work on olivines, spinels and lithium air cathodes. In the olivine work, we show how the use of fast charging allows us to capture metastable/non-equilibrium states. Mapping of the electrodes allows the distribution of the reaction front across the electrode to be followed. Second, the development of new NMR approaches to investigate paramagnetic battery materials, both *in* and *ex situ,* will be discussed, the approach making use of both theory and experiment. Although it is difficult to achieve high-resolution spectra from these paramagnetic materials in the *in situ* experiments, measurements of the relaxation time allow access to the dynamics of the lithium ions in real time as a function of state of charge.

Highly Efficient Black-Dye-Based Dye-Sensitized Solar Cells – Effect of Imidazolium-Iodide Species on Solar Cell Performance –

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The electrolyte composition is one of the most important factors for efficiency improvement of dye-sensitized solar cells (DSCs). We have reported the addition of a small amount of bulky tetra-alkyl-ammonium-iodide in electrolyte solution effectively suppressed the backward electron transfer reaction from TiO_2 to I_3^- in electrolyte, resulted the high efficiency over 11%.$^{1,2)}$ As a charge carrier in electrolyte solution, dimethyl-propyl-imidazolium-iodie (DMPII) is generally utilized so far, however, it is reported recently that ethyl-methyl-imidazolium-iodide (EMII) shows better performance than DMPII.$^{3)}$ Therefore, we investigated the effect of imidazolium-iodide species on the solar cell performance of cosensitized DSC with Black dye and D131.

Six different imidazolium-iodides with different alkyl-substituents, dimethyl-imidazolium-iodide (DMII), EMII, methyl-propyl imidazolium-iodide (MPII), DMPII, hexyl-methil-imidazolium-iodide (HMII) and butyl-dimethyl-imidozolium-iodide (BDMII) were utilized. The electrolyte solution composed of I_2, LiI, TBP, tetra-heptyl-ammoniumu-iodide (THAI) and imidazolium-iodide in acetonitrile solvent. The TiO_2 photoelectrode composed of seven different TiO_2 layers on FTO-glass. TiO_2 film thickness was about 40 μm. A 5mm-square DSC composed of the dye-adsorbed TiO photoeelctrode, a Pt-sputtered counter electrode, a spacer film and an electrolyte solution. The I-V characteristic of DSC was measured under irradiation of AM 1.5, 100mW/cm^2.

Table 1 shows performances of DSCs using different imidazolium iodides in electrolyte. The DSC using EMII showed the best efficiency 11.4%, which was 0.3% higher than DSC using DMPII. EIS measurement showed the resistivity of electrolyte of DSC increased with increasing the bulkiness of imidazolium-iodide, resulted in the decrease of *Voc* and *FF*. On the other hand, the electron lifetime of DSC increases with increasing the bulkiness of imidazolium-iodide, resulted in the increase of *Jsc*. Therefore, appropriate *Jsc*, *Voc* and *FF* lead the highest η in DSC with EMII. Finally, efficiency of 12% was obtained by using optimized TiO_2 photoelectrode.

Table 1 Solar cell performances of different DSCs

Imidazolium -iodide	*Jsc* [mA/cm^2]	*Voc* [V]	*FF* [-]	η [%]
DMII	21.14	0.71	0.73	10.87
EMII	22.15	0.71	0.73	11.43
MPII	22.67	0.71	0.69	11.14
DMPII	22.68	0.69	0.70	11.06
HMII	22.60	0.69	0.69	10.73
BDMII	22.80	0.69	0.69	10.80

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Functionalized solid-state nanopores for biosensing applications

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Solid-state nanopore devices are a new class of sensors for the structural and compositional analysis of biopolymers such as DNA, RNA and peptides, as well as biomolecular complexes.[1] Typically, they consist of a liquid cell, separated into two compartments by a thin, solid-state membrane. A single, nanometer-sized opening in the membrane (the "nanopore") connects these two compartments and allows for the exchange of ions and liquid between them. Upon application of an electric field across the membrane, charged biopolymers are pulled through the nanopore one-by-one, modulating the ion current in a characteristic way. This modulation in the current-time trace can then be related to the properties of the translocating biomolecule and perhaps even to the composition of the analyte. Therefore DNA sequencing has been a long-term goal and major driving force in the field, since the approach would be fast, inexpensive and not require any labelling. Unfortunately, the implementation of these promises has proven very difficult. Some of the reasons are the lack of control of DNA motion in the nanopore; insufficient spatial and temporal resolution (i.e. to resolve individual bases or base pairs); and the lack of specificity of the sensing region.[2]

However, these challenges can be overcome, as we and others have shown. In my presentation, I will discuss a select number of examples from our own work and put them into context with the state-of-the-art in the field.

These examples include the use of bipotentiostatic electrodeposition, with *in situ* ion current feedback through the pore, as a tool for fabricating sub-10 nm metallic pores;[3] SERRS-based detection of translocation events and plasmonic enhancement in the nanopore;[4] embedding of electrode junctions in the nanopore and the notion of tunnelling-by-sequencing;[5,6] and the integration of glass nanopipettes with droplet microfluidics.[7] In addition to DNA, we have also studied small proteins, such as insulin, and complexes between DNA and proteins, for example p53, single-stranded binding protein (SSB) and methylation-specific antibodies. In this context, nanopore sensing proves to be a valuable biophysical tool and may find applications in gene profiling or molecular barcoding.

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Biosensors for ATP and adenosine: new insights from real-time measurement of purine release

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In addition to its central role in cellular biochemistry, ATP acts as a neurotransmitter and neuromodulator in the nervous system. ATP is particularly important as a neurotransmitter in sensory pathways and can act as a co-transmitter with many other neurotransmitters such as acetylcholine, noradrenaline, GABA and glutamate. ATP is also used by glial cells communicate with other glial cells and neurons. Adenosine is one of the most widely acting neuromodulators in the brain and is particualarly important in homeostatic functions such as sleep and cardiovascular control.

There is a multiplicity of mechanisms by which ATP and adenosine can be released [1]. Both can be released via conventional Ca^{2+}-dependent exocytosis. However ATP can also be released via large conductance channels. Adenosine can arise by breakdown of previously released ATP by ectonucleotidases in the extracellular space. Adenosine can also be released directly via transporters [4]. The diversity of release mechanisms, many of which do not correspond to direct anatomical structures means that direct measurement of ATP and adenosine release is necessary to understand the release mechanisms, signalling roles, and systems functions of these purines.

To address this need for real-time measurement, I invented microelectrode biosensors for ATP, adenosine and related purines [1]. I shall outline the principles underlying the operation of these biosensors and give two examples of their use. In the first, I shall examine activity dependent adenosine release and show novel aspects of this highly complex phenomenon [3]. In the second example, I shall show how ATP biosensing has led to a new discovery of general significance: that gap junction hemichannels can act as ligand-gated receptors for CO_2, and permit CO_2-dependent ATP release [2]. I shall demonstrate the structural basis of CO_2 binding to the channel, and document our pharmacological and genetic evidence that shows the importance of this novel sensing mechanism for the control of breathing.

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Modelling Ion Adsorption and Dynamics in Nanoporous Carbon Electrodes

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The recent demonstration that in supercapacitors ions from the electrolyte could enter sub-nanometer pores increasing greatly the capacitance opened the way for valuable improvements of the devices performances [1]. Many experimental and fundamental studies have therefore focused recently on the understanding of the molecular mechanism(s) at the origin of this capacitance enhancement. We report here molecular dynamics simulations including two key features: the use of realistic electrode structures comparable with carbide-derived carbons and the polarization of the electrode atoms by the electrolyte [2]. This original design of an electrochemical cell allows us to recover capacitance values in quantitative agreement with experiment and to gain knowledge about the local structure and dynamics of the ionic liquid inside the pores. Then, from the comparison between planar (graphite) and porous electrodes, we propose a new mechanism explaining the capacitance enhancement in nanoporous carbons [3,4]. We also set up some simulations where, starting from 0V, an electric potential is applied between the electrodes. It is then possible to follow the dynamical aspects of the charging of supercapacitors [5].

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Hydrocarbon Ionomer Membranes: Current Issues and Future Prospects

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Proton exchange membranes (PEMs) are one of the key materials of PEMFCs. Major roles of PEMs involve transportation of protons from the anode to the cathode and prevention of direct contact of fuels and oxidants. Perfluorosulfonic acid (PFSA) ionomer membranes such as Nafion are state-of-the-art PEMs, however, alternative PEMs free from fluorine atoms have been in demand because of several disadvantages of PFSA membranes including high production cost, low glass-transition temperature, high gas permeability, and environmental incompatibility.

Aromatic hydrocarbon ionomers have attracted much interest as a promising candidate because of their easy synthesis and versatility in molecular design. In the last decade, a number of aromatic hydrocarbon ionomer membranes have been proposed. It has been well-recognized that block copolymers composed of sulfonated hydrophilic blocks and unsulfonated hydrophobic blocks provide much higher proton conductivity compared to the randomly sulfonated compolymers sharing the similar chemical components. The block copolymer ionomer membranes owe to their high proton conductivity to well-developed hydrophilic/hydrophobic phase-separated morphology and inter-connected ionic domains as proton transporting pathways. In order to further strengthen this effect, ionic clusters or densely ionized components have been introduced into the hydrophilic blocks so that the resulting membranes showed comparable proton conductivity to Nafion even under low humidity and high temperature conditions.

Issues still remain on the durability for hydrocarbon ionomer PEMs since the block copolymer building blocks do not help improve chemical stubbornness and mechanical toughness. In this paper, we report our molecular approach to these issues. Our idea is to introduce phosphine oxide groups, which are known to deactivate the hydroxyl radicals resulting in the suppression of the oxidative degradation of ionomer membranes. Triphenyl phosphine oxide groups, which also serve as scaffolds for sulfonic acid groups, were successfully introduced into the hydrophilic blocks. The resulting block copolymer membranes exhibited high proton conductivity and outstanding oxidative stability even under accelerated testing conditions.1) More recently, we have developed a novel synthetic method for ladder-type aromatic ionomers via a highly selective and quantitative intrapolymer Heck reaction. The newly proposed molecular design proves that the fused structure is highly effective in balancing the proton conductivity and mechanical stability of aromatic ionomer membranes.2)

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New Approaches to Coupling IR Spectroscopy with Electrochemistry for Addressing Supported Catalysts: from Hydrogenase Enzymes to Metal Nanoparticles

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Spectroelectrochemistry has been a valuable tool in bio-inorganic chemistry in elucidating states of redox proteins. These studies have typically been carried out in solution with the protein engaging in diffusion-controlled electron transfer with the electrode, often *via* small molecule redox mediators. More direct electrochemical control is provided by an approach in which redox proteins are immobilised on an electrode and can undergo rapid and direct exchange of electrons with the electrode surface. This technique, known as protein film electrochemistry (PFE), has been applied widely to biocatalysis, where the immobilised redox enzyme is handled as a heterogeneous electrocatalyst, directly comparable to a metal electrode or supported nanoparticle catalyst.[1] There have been several recent reports of electrode configurations designed to allow spectroscopic and microscopic sampling to be coupled with this precise electrochemical control in order to gain deeper molecular understanding of redox proteins.[2] Our focus has been on coupling infrared spectroscopy with direct electrochemical control of metalloproteins adsorbed on carbon electrodes, in particular the hydrogenase enzymes that are nature's efficient catalysts for oxidation and production of H_2. Carbon is attractive as an electrode material for bioelectrochemistry because it offers access to the full biologically relevant potential window and is relatively unreactive towards small molecule substrates and inhibitors.[3] We describe results that provide insight into the catalytic mechanism of H_2 activation by nickel-iron hydrogenase enzymes and their reactions with inhibitors.

Carbon is also commonly used as a support for heterogeneous catalysts, and the infrared spectroelectrochemical approach we have developed for looking at immobilised enzymes is equally applicable to addressing supported metal nanoparticle catalysts *in situ*. We describe spectra obtained during electrocatalytic formic acid oxidation on platinum nanoparticles supported on carbon black as a demonstration of the versatility of our method.

The range of approaches discussed in this talk show that it is possible to obtain *in situ* structural and mechanistic information on electrocatalysts under turnover conditions with efficient mass transport. Therefore it is becoming increasingly possible to link directly the wealth of information obtained previously from rotating disc electrocatalysis studies with new molecular insight into catalytic intermediates.

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Bio-electrocatalysis Using Enzymes Modified for Enhanced Stability

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It is known that enzymes are able to promote complex multi-electron transfer reactions such as CO_2 reduction with very low overpotentials and high product selectivity.[1] In order to exploit these properties in electrocatalysis, it is important to immobilize enzymes onto appropriate electrodes using robust molecular scaffolds capable of preserving their structural integrity and reactivity. One of the problems encountered in using enzymes is that in their native form they tend to have a working lifetime on the order of hours to days and so, in order to be feasible, techniques to improve stability must be developed.[2] Recently, the modification of enzymes to create surfactant-conjugated variants has successfully resulted in the development of liquid protein melts which have been found to have improved thermal stability over native protein, as well as exhibiting redox activity.[3-5] Following on from this work, native myoglobin (Mb) and cytochrome C (CytC) containing a redox active heme group are modified using bio-conjugation techniques to produce surfactant-conjugated forms. These are subsequently immobilized onto carbon-based electrodes using polyelectrolyte linkers to produce stable electrodes for solution based bio-electrocatalysis. Modifying CytC causes the redox activity observed for the native enzyme to be lost. It is found that altering the charge on the polyelectrolyte linker can have the same effect when using native CytC and it is proposed that electrostatic interactions have a significant influence on enzyme orientation but that only some orientations are beneficial for electron transfer. Modifications to CytC alter the surface charge distribution on the enzyme, disrupting its natural propensity for this beneficial orientation. However, surfactant modified Mb is shown to retain significant catalytic activity in the presence of O_2 compared to the native form, as well as exhibiting enhanced stability over time.
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Ion Transfer across the Water/1,2-DCE Interface Facilitated by Solvent Effect

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The liquid/liquid (L/L) interface, also called the water/oil (W/O) interface, or the interface between two immiscible electrolytic solutions (ITIES), is a kind of soft interface which can be polarized to study the interfacial charge transfer phenomena. Nitrobenzene (NB), 1,2-dichloroethane (1,2-DCE), o-nitrophenyl octyl ether (NPOE), ionic liquids, and their mixtures have been used as organic solvents to form an L/L interface with aqueous solution. In general, there exist three kinds of elemental charge transfer reactions across the L/L interface: (1) simple ion transfer, in which an ion transfers across the interface directly; (2) facilitated ion transfer, in which ion transfer is assisted by its ionophores; (3) electron transfer, in which an electron transfers between the redox couples in each phase.

As for the ions which are difficult to transfer across the L/L interface, ionophores are adopted to facilitate their transfer because the interfacial complex reactions between them make the ion transfer much easier. However, proper ionophores are not available conveniently. We demonstrate that the solvation effect can be the driving force for ion transfer across the water/1,2-dichloroethane interface, including both cations and anions. In this way, we propose an ionophore-free method for the facilitated ion transfer across the ITIES.

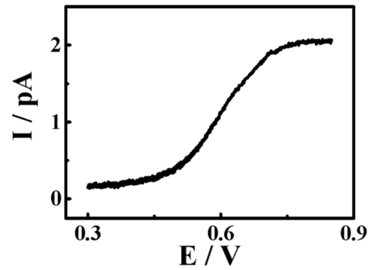

Fig. 1 Steady-state voltammogram of PC facilitated Li^+ ion transfer across a nanopipette supported W/1,2-DCE interface with an orifice diameter of 20 nm; the concentration of LiCl is 20 mM, the scan rate is 0.02 V/s, and the volume ration $V_{PC}/V_{1,2\text{-}DCE}$ is 1/3.

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Multinuclear NMR Investigation of Nb_2O_5 Polymorphs Calcined from NbO_2

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Recent studies have shown that Nb_2O_5 can act as a high-rate cathode material in lithium-ion batteries; mesoporous, orthorhombic T-Nb_2O_5 has demonstrated reversible capacity of 130 $mA{\cdot}h{\cdot}g^{-1}$ at a 10C rate and over 100 $mA{\cdot}h{\cdot}g^{-1}$ even at a 100C rate.[1,2] Intercalation in this material therefore occurs at noticeably higher rates than in a standard lithium-ion battery. Inspired by this work from the Dunn group at UCLA and the work of others[3,4] on the relationship between structure and electrochemical performance in Nb_2O_5 polymorphs, an investigation was opened into the mechanisms responsible for the rapid lithium-ion intercalation in niobium(V) oxides.

TT (pseudohexagonal), T (orthorhombic), B (monoclinic), and H (monoclinic) polymorphs of Nb_2O_5 were synthesized by calcining NbO_2 for 24 hours over a range of temperatures. Samples were prepared at every 50 °C interval from 200 °C to 1100 °C and analyzed by X-ray diffraction (XRD). Electrochemically, H-Nb_2O_5 exhibited the highest capacity but poor reversibility relative to the low temperature species. Akin to the nanostructured mesoporous oxides, TT-Nb_2O_5 and T-Nb_2O_5 from NbO_2 displayed impressive intercalation kinetics and no phase change upon discharge-charge cycling.

Solid state NMR is being used to understand the different electrochemical behaviors of the niobium(IV) oxide-derived phases. Results will be presented from e*x situ* magic angle spinning (MAS) ^{93}Nb, ^{17}O, and ^{7}Li solid state NMR experiments, which were performed on pristine niobia samples and cycled coin cell cathodes to examine the different local atomic environments within each structural moiety and to correlate local and long range structural changes and lithium transport with rate performance for the different polymorphs. Changes in NMR chemical shift, peak shape, intensity, and relaxation parameters were observed as a function of degree of lithiation for each structure, as shown for the orthorhombic phase in Figure 1.

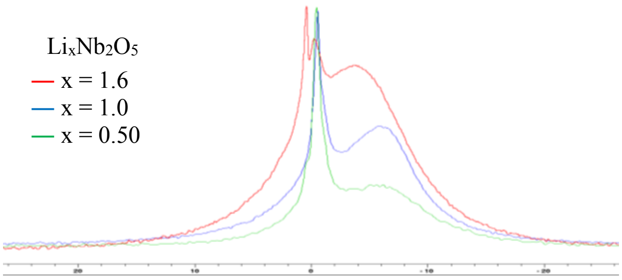

Fig. 1. ^{7}Li MAS–NMR spectra of lithiated T-Nb_2O_5 referenced to $^{7}LiCl$ at 0 ppm. MAS at 20 kHz.

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Protein Electrochemistry Using Graphene-Based Nano-Assembly

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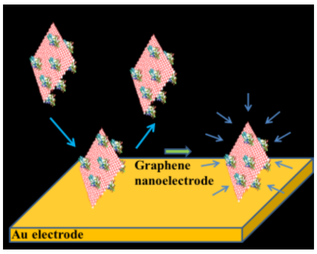
Herein, we reported a simple and effective way to build up multilayer electroactive proteins structures using graphene as a soft building blocks substrate. Graphene sheets as new two-dimensional carbon sheet with a carbon atom thickness have attracted great interest due to their superior mechanical, electrical, and thermal properties. The two-dimensional graphene sheet of sp2-hybridized carbon offer great opportunity for molecular self-assembly for hybrid nanostrctured materials. Since chemically converted graphene (CCG) sheets in aqueous dispersion are negatively charged, it is expected that CCG sheets can act like a 2D conjugated polyelectrolyte and cationic heme can be assembled onto their surfaces through electrostatic and π–π stacking interactions. These unique structures could be used for future biosensor and biofuel cell development.[1]



Schematics of the single graphene sheet becoming a nanoelectrode on contact with the Au electrode.

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Direct electron Transfer and Protein Engineering of a Heterotrimetric Flavoprotein-Cytochrome *c* Complex, Fructose Dehydrogenase

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Electrode reaction coupled with enzyme reaction without any mediators is called direct electron transfer (DET)-type bioelectrocatalysis. Although there are only a limited number of DET-type redox enzymes, DET-type bioelectrocatalysis has received considerable attention for construction of electrochemical applications, such as biosensors and biofuel cells. There must be several factors governing the DET reaction, but the details have not yet clearly elucidated.

D-Fructose dehydrogenase (FDH; EC 1.1.99.11) from *Gluconobacter japonicus* NCBR 3260 is a heterotrimeric membrane-bound enzyme. Subunits I has covalently bound flavin adenine dinucleotide (FAD), while subunit II has three heme C moieties. FDH shows strict substrate specificity to D-fructose and is used in diagnosis and food analysis. FDH is one of the DET-type enzymes and has high DET activity. DET reaction of FDH occurs at a large variety of electrodes. The FAD in subunit I is the catalytic site to accept electrons form the substrate. It is thought that the electrons are transferred to the electrode through the heme C in subunit II, but no direct evidence has been reported to support the idea.

For the first step to explore the mechanisms of the DET reaction of FDH, the genes encoding each subunit of the FDH complex from *G. japonicus* NBRC3260 were sequenced and an expression system was constructed to highly produce FDH in a *G. oxydans* strain. A derivative modified in subunit I/III subcomplex lacking of the heme C subunit (ΔcFDH) was also constructed. The recombinant FDH reacts with electrode directly to show DET-type bioelectrocatalysis. On the other hand, ΔcFDH catalyzes the oxidation of D-fructose with several artificial electron acceptors, but loses the DET ability. The formal potentials ($E^{\circ\prime}$) of the three heme C moieties of FDH have been determined to be -10 ± 4, 60 ± 8 and 150 ± 4 mV (vs. Ag|AgCl|sat. KCl) at pH 5.0, while the onset potential of FDH-catalyzed DET-type bioelectrocatalytic wave is -100 mV. ΔcFDH can stoichiometrically bind the heme C subunit expressed separately. The resultant complex recovers the ability of the DET-type bioelectrocatalysis. Judging from these results, we conclude that FDH communicates electrochemically with electrodes via the heme C.

The surfactant and the surface condition of electrode also play important roles in DET-type bioelectrocatalysis of FDH. A model of the surface state will be proposed to explain several electrochemical and QCM results.

Block Copolymer based Dye Sensitized Solar Cells

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This presentation will describe the use of block copolymer (BCP) self-assembly directed titania nanostructures in dye sensitized solar cells. After a short introduction into BCP self-assembly, different approaches will be discussed in order to better understand the correlation between BCP directed titania nanostructure and power conversion efficiency of dye sensitized solar cells. Topics will include discussion of three dimensionally continuous gryroidal photoanodes, formation of thick BCP directed titania photoanodes via layer-by-layer techniques, the effects of enhanced titania crystallinity on device performance, effects of BCP-inorganic composition on sub-bandgap states in resulting titania photoanodes, differences in diblock copolymers versus triblock terpolymers as structure directing agends for titania photoanodes, as well as the enhancement of performance via the use of Au@silica core-shell plasmonic nanoparticles in hybrid solar cells.

Monitoring D-serine concentration in the brain interstitial fluid using microelectrode biosensors

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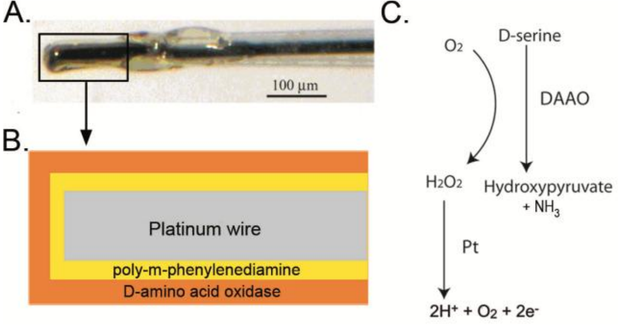
Symposium S14 **Brain Electrochemistry**

D-serine is an excitatory amino acid that has been implicated in several neurological and psychiatric disorders. Correspondingly, D-serine signaling may represent an important pharmacological target for treating these diseases. However, the biochemical mechanisms that control extracellular concentrations of D-serine *in vivo* remain unclear. We have developed biosensors to monitor D-serine concentration in the brain interstitial fluid *in vivo*. These biosensors are cylindrical platinum microelectrodes (20 µm diameter) that have been coated with a layer of poly-m-phenylenediamine and a membrane of immobilized D-amino acid oxidase (DAAO) obtained from the yeast, *Rhodotorula gracilis*. The microelectrodes were polarized at + 500 mV vs. an Ag/AgCl pseudo-reference to monitor hydrogen peroxide (H_2O_2) production by enzymatic degradation of D-serine. These biosensors were stable *in vivo* for more than 5 hours and detected D-serine with a response time of 2s and a detection limit of about 0.6 µM. Extracellular levels of D-serine in the rat frontal cortex were investigated. D-serine was detected at about 2.3 µM in the interstitial fluid, and was observed to diffuse slowly through the blood-brain barrier following peripheral administration of exogenous D-serine. By coupling these biosensor measurements with HPLC analysis of whole tissue D-serine contents, we have showed that intracellular stores represent more than 99% of the total brain D-serine contents. Moreover, D-serine was released from intracellular stores through membrane transporters that are specific for small neutral amino acids like serine, alanine, threonine or cysteine. These transporters mediate a heteroexchange mechanism by which one molecule of D-serine is exchanged with one molecule of another small neutral amino acid present *in vivo*. Therefore, the development of DAAO microelectrode biosensors has improved our understanding of D-serine regulation *in vivo*, and holds great potential for studying its implication in human disease.



Design of a D-serine biosensor. Schematic representation of the coatings used for a D-amino acid oxidase (DAAO) microbiosensor. A platinum wire is covered with a layer of poly-m-phenylenediamine (PPD), then an enzymatic membrane of DAAO.

Photo-ionic Cells: Two Solutions for Solar Energy Storage

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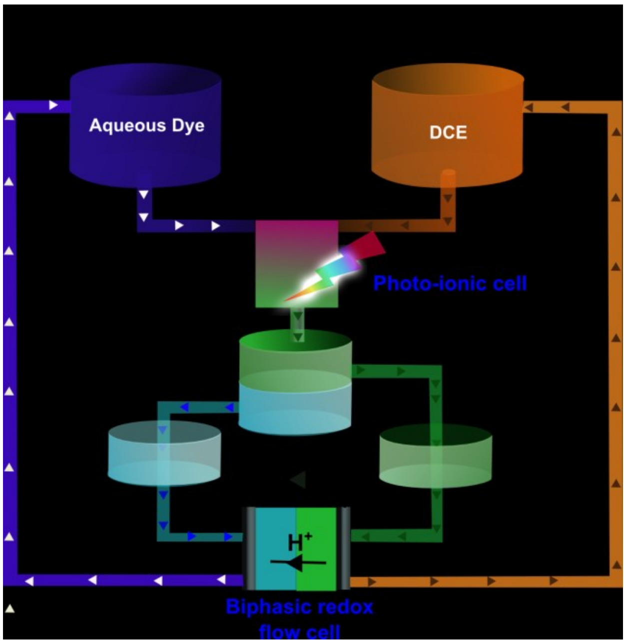
Photogalvanic cells, where solar irradiation is converted to chemical energy in a homogeneous solution, have been investigated since the 1940s.[1] A maximum efficiency of 18 % has been predicted theoretically, but in practice efficiencies of ca. 1 % have been realized.[1] Herein we take this idea further and present a method to store solar energy in a photoionic cell (Scheme 1).[2] The concept is based on the photoinduced separation of the two redox species in a biphasic system. The extraction and phase separation prevent the recombination reactions, and the solar energy is stored in the form of a "redox fuel". The stored energy can be converted back into electricity by passing both phases through a redox flow battery. The system was studied both experimentally and by finite element simulations, showing that electricity can be generated, and that photon to product efficiencies of over 50 % are theoretically possible.



Scheme 1. Biphasic Photo-Redox Battery.

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Understanding and Modeling Water Transport in Proton-Exchange Membranes

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Water management in proton-exchange membrane fuel cells plays an important role in device operation, especially at lower temperatures where liquid water exists. Key to understanding water management is determining the mechanisms of water movement through the proton-exchange membrane, which is indicated by its water profile under operation. Recently, we and others have used computed x-ray microtomography [1] and neutron imaging [2] to determine the transient and steady-state membrane water profile under different operating conditions. Mathematical modeling is ideally suited to explore the genesis of these profiles and subsequently the mechanisms of water movement through the membrane. Recently, such modeling has been receiving increased attention as new knowledge on the impact and control of the membrane/environment interface is elucidated. It is apparent that this interface controls the water-transport behavior, something that was ignored in previous models. In this talk, we will discuss an update to our original membrane model [3] that incorporates the new observations from a variety of sources and enables prediction of the measured water profiles. In the model, we propose a macroscopic treatment that utilizes data on the nanoscale relating to membrane morphology and physically relevant phenomena [4], but in a framework that still allows for easy incorporation into cell-level fuel-cell models. The model and its findings will show the importance of identifying the correct boundary conditions during operation including those of a mixed nature (e.g., solid/liquid/vapor). Finally, use of the model as a function of membrane thickness, and, in particular, for ionomer thin-films in the catalyst layer will be discussed.

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COULOMETRIC ION RELEASE INTO THIN LAYER SAMPLES

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Thin layer coulometry with ion-selective membranes has recently been explored in our group for the detection of a variety of ions [1,2]. Calcium and protamine (polyion of +21 charges) were fully depleted in the thin layer sample as a consequence of applying two consecutive potential pulses (60-s) to the respective systems. Here, the use of a perm-selective membrane is important in order to select the type of analyte that is preferentially transported across the membrane. While a thin layer allows one to work with just a few µL of sample, coulometry is also a promising interrogation platform since the absolute counting approach reduces the need for frequent calibration.

Using a similar strategy (but in release mode instead of depletion mode) we aim here to perform chemical titrations of thin layer samples using ion-selective membranes controlled by coulometric ion release. A tubular polypropylene membrane (PP) (length 4 cm) is used to define the thin layer sample to 5.8 µL. As a proof of concept, a calcium ion-selective membrane (15 mM Ionophore IV and 5 mM KTFPB) is used.

The experiment starts with a release pulse which is achieved as a result of applying a pre-defined overpotential (ca. -250 mV relative to open circuit) to the membrane for a period of 30-s. After that, two pulses (with opposite sign of the release pulse) are subsequently applied for 90-s to measure the released amount of calcium. Both pulses are integrated over this time and subtracted from each other to give the charge only related to calcium. Before introducing a new sample the system was regenerated for a period of 240 s at the open circuit potential determined at the beginning of the experiment.

Preliminary studies suggest that the calcium release range (10-5 to 10-3 M) is tunable with the duration of the release pulse. This is confirmed both by optical readout and potentiometry. For the optical readout, calcium ion-selective nanoparticles were introduced in the thin layer sample and, during the release pulse, the absorption spectrum of the nanoparticles suspension was found to change. This indicates the presence of calcium in the confined volume. Complexometric titration is also carried out using a predefined amount of EDTA in the thin layer sample. We foresee that this type of electrochemical sample manipulation may offer the basis for new tools for in-situ monitoring of parameters such as alkalinity that are so far only possible by traditional sampling and titration techniques.

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New developments in Bidimensional Spectroelectrochemistry

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Our research group developed in 2001 a new instrumental technique called Bidimensional Spectroelectrochemistry (BSEC) that provides significant information on electrochemical processes. BSEC provides three complementary analytical signals on the process occurring on an electrode surface. The electrochemical measurement provides information on the whole process. Signal in normal configuration respect to the electrode surface depends both on surface processes and in solution processes, while the signal in parallel configuration respect to the electrode surface is uniquely related to the species present in solution. Furthermore, electrochemistry allows controlling the rate and extent of reactions being studied.

Hitherto, two different cells have been developed to perform BSEC measurements. In this work, we have constructed three new cell designs.

The first design is based on spatial scanning spectroelectrochemistry [1] allowing us to perform measurements at controlled distances in the parallel configuration respect to the electrode. The other two designs are based on optical fibers [2] that substantially simplify the alignment of the optical system. One of the cells performs measurements in transmission mode and the other one works in reflection mode, in normal configuration respect to electrode surface.

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Development of Nanoscale Meniscus Cell Microscope for Visualizing Li^+ (de)intercalation Dynamics at $LiFePO_4$ Cathodes

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Li-ion transport at the interface between electrode- electrolyte and grain boundaries in electrodes is bottleneck of the lithium conduction path causing fluctuation of the Lithium ion batteries (LIBs) performance. In this study, we visualized the inhomogeneity in local reactivity of $LiFePO_4$ composite electrode by nanoscale meniscus cell microscope, which is a newly developed scanning probe that uses a nano-pipet filled with electrolyte (Figure 1a). First, a meniscus is created at the interface between the pipet and the electrode when the pipet is in proximity of the electrode. Then, current response is only measured through the meniscus as the voltage applied between them. Further, the inhomogeneity in the transport and reactivity has been observed across the interface by scanning the pipet. The methodology herein, which we term nanoscale meniscus cell microscope, uses meniscus contact via a nanopipette electrochemical cell as a high resolution probe for mapping (de)intercalation processes on the surface of battery materials, enabling spatial imhomgeneities in Li^+ fluxes or reactivity to be identified and resolved quantitatively (Figure 1b).

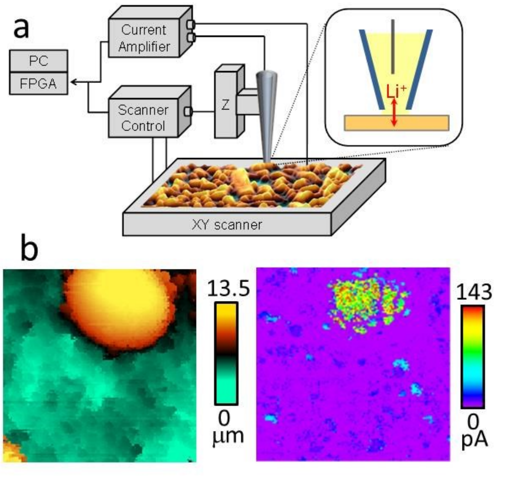

Figure 1 | a. Schematic of nanoscale meniscus cell microscope. **b.** IICM topography (left) and current (right) images of LFP electrode. Scan ranges are 20 × 20 µm. The substrate potential was +0.65 V vs. Ag/AgCl QRCE.

Molecular Mechanisms of Nanoporous Carbon Electrode Supercapacitance

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Thermochemistry and electrochemistry of liquids and solutions sorbed in nanoporous materials is drastically different from bulk systems and planar interfaces due to substantial distortion of charge distribution in nanoporous geometry, including functionalities on the surface of nanopores, coupled with steric effects of nanoporous confinement on electrolyte ions and solvent molecules. At present, molecular simulations of electrolyte solution with complex molecular solvent (such as water, methanol, acetonitrile, or ionic liquids) sorbed in nanoporous electrodes with realistic morphology is virtually unfeasible due to severe challenges with representative sampling, including (i) an interplay of electrostatic and steric forces on large-space and long-time scales, (ii) surface wetting/dewetting, solvent expulsion/condensation in the nanopores, and salination/desalination of sorbed solution depending on the electrode charge, (iii) a necessity to satisfy chemical and mechanical balance between the sorbed and bulk electrolyte solution. The statistical-mechanical, replica RISM-KH-VM molecular theory of solvation in disordered materials[1-3,7] yields the microscopic solvation structure statistical-mechanically averaged over the distribution of nanopores and thermal motion of sorbed solution. It predicts solvent-specific wetting[2] and water depletion in hydrophobic nanopores,[4-6] asymmetry in solvation and adsorption of cations and anions,[3-6] desalination in hydrophobic nanopores and its reversal with external voltage,[3-6] and specific adsorption in functionalized nanopores.[1,3] The method reveals the specific capacitance of nanoporous electrodes is determined by the chemical balance in the Nernst-Planck equation, including the potential drop across the Stern layer at the surface of nanopores and the Gouy-Chapman layer statistically averaged over the nanoporous material, the osmotic term due to a difference in the ionic concentration in the electrodes and bulk solution, and the chemical potentials of sorbed solvated ions statistically averaged over the nanoporous material.[3-7]

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NMR/MRI methods dedicated to the study of water transport in membranes for PEMFC applications

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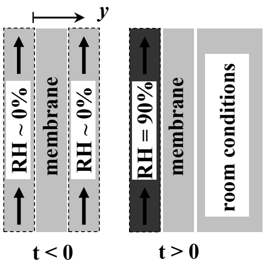
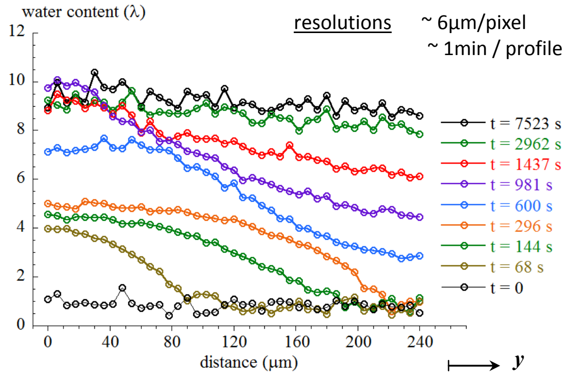
The study of water transport through proton exchange membranes such as Nafion requires sophisticated experimental techniques that are both water sensitive and able to demonstrate good spatial and temporal resolutions. In the last years, the use of conventional NMR hardware to characterize water self-diffusion or measure water profiles through the membrane has been hampered by the necessity of increasing the sample volume (work on several membranes) or accumulating multiple experiments in order to increase the signal to noise ratio. With an adapted NMR coil, however, it is possible to visualize water distribution in a single membrane [1] with good spatial and temporal resolutions. In the present work we followed a similar approach to characterize water diffusion in a Nafion membrane exposed to different conditions. We investigated first the behavior of the water self-diffusion coefficient in a sample under a mechanical load using a NMR surface probe coupled with a mini traction machine. In particular we linked the anisotropy of diffusion induced by the mechanical stress to the polymer structure through a deformation model [2]. Another design was used to measure the time evolution of water profiles through a membrane exposed to different boundary conditions. We will present the results and the outcomes of a series of time-resolved experiments (~ 6 µm per pixel and ~1 minute per profile) performed in a range of experimental conditions (one example is given on the figure).



Initially dry N1100 Nafion membrane exposed at t=0 to humid air (left side) and atmospheric conditions (right side).



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Indium recovery by coupling liquid-liquid extraction and electrodeposition in ionic liquids

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The development of water immiscible room temperature ionic liquids (RTILs) naturally suggested their use for biphasic extraction as an alternative to molecular organic solvents most notably for their low vapor pressure[1]. However, although liquid-liquid extraction processes using RTILs often reach high efficiency and selectivity, the difficult de-extraction of metallic species is to date as a major technical lock. In this context, in situ electrodeposition in the ionic liquid phase after liquid-liquid extraction could allow species recovery in their metallic form.

In this work, we studied the possibility to recover indium by coupling liquid-liquid extraction followed by in situ electrodeposition in the ionic liquid phase. Indium was classified in June 2010 as a critical raw material by the European Commission, due to its high relative economic importance and to high relative supply risk[2].

We first investigated the electrodeposition of In in 1-butyl-1-ethylpiperidinium bis(trifluoromethylsulfonyl)imide (BEPipNTf$_2$) in ambient atmosphere, after its synthesis and its purification[3]. This RTIL, characterized by a wide electrochemical window, a low viscosity and an ultra-low hygroscopic character presents good properties for liquid-liquid extraction and consecutive electrodeposition. Then, based on the works of F. Kubota et al.[4] [4] who showed that In(III) can be quantitatively and selectively extracted in an ionic liquid using trimethylphosphine oxide (TOPO) as extractant, we studied the electrochemical behavior of In(III)-TOPO complex. Voltammetric studies revealed that TOPO is non electroactive and that the In-TOPO complex can be reduced within the electrochemical window of the ionic liquid. The influence of the extractant on the electrodeposition of metallic indium was studied and it appears that indium can be quantitatively electrodeposited in the presence of TOPO. Finally, the feasibility of In electrodeposition in ambient atmosphere after liquid-liquid extraction was then demonstrated.

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P-EIS state of health diagnosis method for Li-ion battery module

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The development of improved State-of-Health (SoH) diagnosis methods is a current research topic for battery-powered applications. For instance, Electric Vehicles (EV) are in rapid extension and create a strong demand for an accurate and reliable SoH indicator during operation. Such an indicator is a key parameter required to optimize battery energy management and to track the degradation of the system performances. Impedance of an electrochemical system is usually measured using a frequency response analyzer [1]. In this study, an electrochemical impedance spectroscopy like (EIS-like) diagnosis technique has been developed (figure 1) based on current and voltage free signal treatment obtained on real EV duty cycle [2].

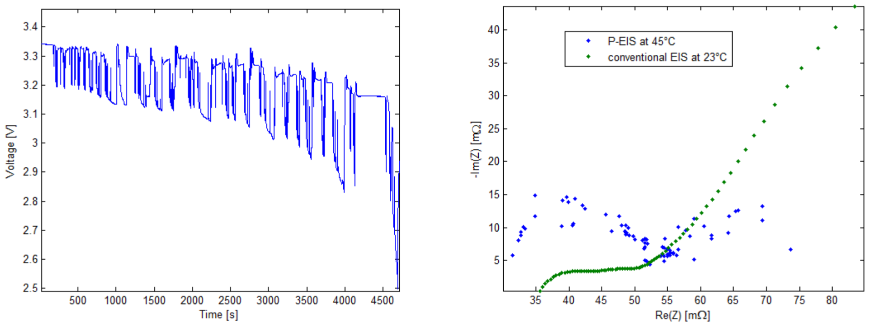

Figure 1: a) EV voltage in a LFP/C 18650 1.4 Ah cell b) comparison between P-EIS and conventional EIS

It is worth noting that no additional current is applied to the cell, since the current flowing into cells during use on-board is directly processed in the data treatment step. Commercial batteries (1.4Ah cylindrical $LiFePO_4$/graphite LFP/C cell) were selected to validate the diagnosis method. The nominal voltage is 3.3V and voltage limits are 2V and 3.6V. In order to study the capability of EIS-like measurements as a diagnosis tool for SoH of Li-ion cells, a test procedure including ageing phases has been defined to characterise Li-ion cells before and along ageing. Voltage and current signals are treated by Fourier transform in order to determine the EIS-like spectra. Then, SoH prediction algorithms can be obtained from a mathematical analysis of the impedance parameters sensitive to SoH [3].

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Enzyme-Modified Microelectrodes for Monitoring Nonelectroactive Neurochemicals in the Brain

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Microbiosensors coupled with fast electrochemical techniques are very attractive analytical tools for monitoring the concentration dynamics of nonelectroactive neurotransmitters and metabolic substrates in the brain with high spatial and temporal resolution and minimal tissue damage. A rational design of microbiosensors for measuring nonelectroactive substances has been accomplished by immobilizing oxidase enzymes in a suitable polymeric film on the electrode surface combined with the amperometric detection of hydrogen peroxide as a reporter molecule. Major types of oxidase-modified biosensors for *in vivo* recordings have been designed and handmade from platinum or platinum/iridium (90:10) and carbon fiber microelectrodes (CFMs). More recently, platinum multisite microelectrode arrays (MEAs) fabricated by photolithographic methods in a well-defined and highly reproducible geometrical configuration have been used allowing multi-analyte detection in different brain areas.
We have developed oxidase-modified microbiosensors based on platinized CFMs and ceramic-based multisite platinum arrays as microelectrode platforms for *in vivo* and *ex vivo* measurements of glutamate, glucose and lactate. Microsensor surface morphology and analytical evaluation have been assessed by scanning electron microscopy and electrochemical techniques, respectively. Moreover, *in vivo* measurements have been done by the FAST-16 electrochemical system (Quanteon, LLC, USA). Results of platinized CFMs for detection of hydrogen peroxide and CFM/Pt microbiosensors prepared by immobilizing oxidases with glutaraldehyde will be presented. The selectivity of the microbiosensors in particular against ascorbate have been improved by electropolymerization of phenylenediamines. We also exploited the use of ceramic-based multi-site Pt microelectrode arrays for glutamate, glucose and lactate for i*n vivo* measurements taking advantage of the self-referencing technique. Tonic and phasic glutamate signals have been recorded in the frontal cortex, striatum and hippocampus of both anesthetized and awake rats using the Pt microarrays.

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Direct Electron Transfer Principle Based Continuous Glucose Monitoring ~*in vitro*, *in vivo* and *in situ* studies~

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The electrochemical enzyme glucose sensors based on the principle of the 3rd generation principle, that is the direct electron transfer principle, will be achieved by employing either or combining chemical modification, nano-technology approaches, or/and employing specific enzyme capable of direct electron transfer. We have been engaged in the development of 3rd generation principle based bio-devices, such as enzyme sensors[1], enzyme fuel[2] cells and also novel bio-devices designated as BioCapacitor[3]. These researches were achieved by employing bacterial FAD dependent glucose dehydrogenase complex (FADGDH).The FADGDH harbors FAD as the catalytic cofactor in its catalytic subunit and also cytochrome c as the electron transfer subunit.

In this paper we present our current progress in the construction of continuous glucose monitoring based on 3rd generation principle, by using FADGDH and gold spattered microelectrode, to allow its use for *in vitro*, *in vivo* and *in situ* studies. The *in vitro* performance of thus constructed glucose sensor revealed that the sensor was not inactivated at least for 1 week continuous operation. Following the animal experiments, we have carried out human trial for *in vivo* glucose monitoring using thus constructed sensor. The results are in good agreement with intermittently monitored blood glucose concentration for at least 3 days. Furthermore, the application of thus constructed sensor for the continuous *in situ* glucose monitoring of the bioprocesses, such as bacterial cultivation and mammalian cell culture were possible.

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Raman spectroelectrochemistry at liquid/liquid interfaces.

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Processes that occur at the interface between two immiscible electrolyte solutions (ITIES) have become one of the most interesting systems in electrochemistry [1,2]. Although Raman spectroelectrochemistry is a powerful technique to understand complex processes, detecting reactants, products, intermediate compounds and/or side reactions, it has not been frequently used in this field due to the absence of instrumental configurations suitable to perform measurements at the liquid/liquid (L/L) interface.

In this work we have developed a new cell to perform *in-situ* Raman measurements during electrochemical experiments at the ITIES. Several problems can be encountered in L/L electrochemistry, such as the mechanical instability of the interface or a large ohmic drop in the organic phase, making *in-situ* spectroscopic studies difficult to perform. To overcome these problems it is possible to study ion/electron transfer reactions across the interfaces using gellified electrolytes [3]. We have observed changes in the Raman spectra of the hexacyanoferrate (II/III) couple due to electron transfer processes between organic and aqueous phases at different potentials.

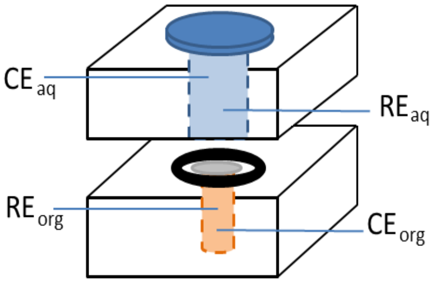

Fig 1. Cell scheme

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Improved thin-layer electrolysis cell for ion transfer at the liquid|liquid interface using a conducting polymer-coated electrode

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Voltammetry for ion transfer at the interface between the aqueous phase (W) and the organic phase (O) has been employed not only for the analysis of the interfacial reaction at the W|O interface but also for separation and determination of ionic species. In this method, the distribution ratio of an ionic species between W and O is controlled by applying an interfacial potential, and the amount of ionic species transferred from W to O is simultaneously estimated as a current signal.

For ion transfer at the W|O interface, the use of thin-layer electrolysis cells is promising in separation of ionic species and the absolute determination of redox-inactive ions, because the cell achieves the complete extraction of ions by electrolysis [1-5]. To date, electrolysis cells with only a thin W layer have been reported, and applied to the absolute determination of redox-inactive ions based on ion transfer at the W|O interface [1-3]. In these cells, the absolute determination of a redox-inactive ion using the injection method [1,2], the absolute determination using the continuous flow method [2,4], and the selective absolute determination with the addition of an ionophore into O [2] have been realized.

In the present work, a novel thin-layer electrolysis flow cell based on ion transfer at the liquid | liquid interface was proposed for the absolute determination of a sub-nanomole ionic species [5]. By using the conducting polymer-coated electrode as an electrode in organic phase, the flow cell was developed as a laminate structure incorporating a thin aqueous layer and a thin organic layer, which were set between an Ag/AgCl electrode and the conducting polymer-coated electrode. Its simple structure made it possible to miniaturize the flow cell and to reduce the required sample volume to only 1 μl. In the present electrolysis cell, both quantitative extraction and quantitative back-extraction of total amount of the ionic species were achieved. This advantage was applied to two absolute determinations. One is that by flow injection method, and the other is that by pre-concentration into the thin Org and the following back-extraction of the species from the thin Org to the thin W (i.e., the stripping technique). In these methods, coulometrical determination of sub-nanomol ionic species was realized without a calibration curve.

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Performance improvement of AC/AC capacitors in aqueous medium through modification of the current collector/active material interface

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Important research in electrochemical capacitors (ECs) is dedicated to the use of low cost, safe and environment friendly components, while keeping optimal performance of the systems. In case of electrolytes, aqueous solutions were not much considered till a recent period, because the use of H_2SO_4 and KOH limits the maximum operating voltage at ca. 0.7-0.8 V. Notwithstanding, we demonstrated good performance of AC/AC capacitors with stainless steel collectors in Li_2SO_4 under floating up to 1.5 V [1]. The objective of this paper is two design pouch cells with coated electrodes on stainless steel or nickel collectors in 1 mol L^{-1} Li_2SO_4 electrolyte. Since it was already demonstrated that power of capacitors in organic medium is enhanced by etching of aluminum, allowing a better adhesion of the electrode coating on the collector, we decided to define etching conditions of stainless steel and nickel to obtain a rough surface with sub-micrometric pores.
Stainless steel foil (1.4310 grade) was etched with a diluted 'aqua regia' solution (volume ratio HNO_3:HCl:H_2O - 1:3:50). Figure 1 presents the electrochemical investigations on AC/AC capacitors with coated electrodes on non-etched and etched stainless steel. As compared to the cell with the as-received substrate, the cell with the etched substrate exhibits a better charge propagation on the cyclic voltammograms at high scan rate and a lower charge transfer resistance on the Nyquist plots. The presentation will demonstrate how the substrate preparation and other cells' components can strongly affect the electrochemical performance of the system.

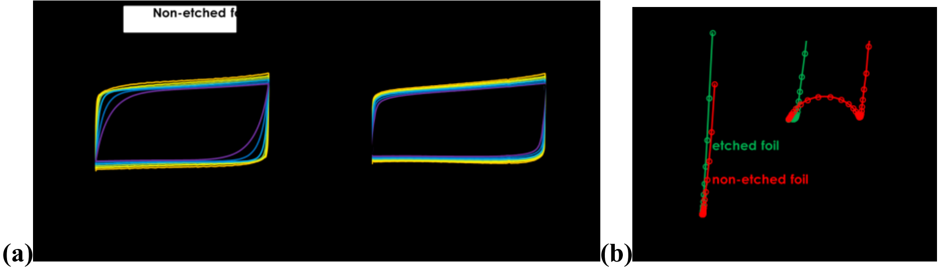

Fig. 1. Cyclic voltammograms at scan rates 2-200 mV s^{-1} on non-etched (left) and etched stainless steel foil (right) (a); Nyquist plots on non-etched and etched stainless steel foil (b).

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Organic Sensitizers from D-*π*-A to D-A-*π*-A: Effect of the Internal Electron-Withdrawing Units on Molecular Absorption, Energy Levels and Photovoltaic Performances

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The high performance and low cost of dye-sensitized solar cells (DSSCs) have drawn numerous interests from both academic and industrial circles. The research on exploring novel efficient sensitizers, especially on inexpensive metal-free pure organic dyes, has never been suspended. Donor-*π* bridge-acceptor (D-*π*-A) configuration is the mainstream in the design of organic sensitizers due to its convenient modulation in the intramolecular charge-transfer nature. Recently, it has been found that incorporation of additional electron-withdrawing unit (such as benzothiadiazole, benzotriazole, quinoxaline, phthalimide, diketopyrrolopyrrole, thienopyrazine, thiazole, triazine, cyanovinyl, cyano- and fluoro-substituted phenyl) into the π bridge as internal acceptor, termed as D-A-π-A configuration, displays several advantages in tuning the molecular energy levels, red-shifting charge-transfer absorption band, and distinctly improving photovoltaic performances and stabilities. We apply D-A-π-A concept broadly to the organic sensitizers containing additional electron-withdrawing units between electron donors and acceptors. By comparing the structure–property relationship of typical photovoltaic D-A-π-A dyes, the important guidelines in design of such materials are highlighted.

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A Real View of Electrochemistry at Graphene and Graphite: Solid/Liquid or Liquid/Liquid Interface?

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In this presentation, I will demonstrate that the electrochemical behavior of graphene and highly oriented pyrolytic graphite (HOPG) is strongly relevant to electrochemistry at the liquid/liquid interface. This unexpected and real relevance is revealed by employing scanning electrochemical microscopy (SECM). Subsequently, some unnoticed experimental procedures are required to study the intrinsic electroactivity of the pristine basal surfaces of the graphene and HOPG electrodes. Significantly, their intrinsic electroactivity is much higher than currently known and as high as platinum. The liquid/liquid mechanism of slower electron transfer at these basal surfaces under conventional experimental conditions will be also discussed.

Dye-sensitized Solar Cells – On the Organization of the Sensitizing Dye Molecules

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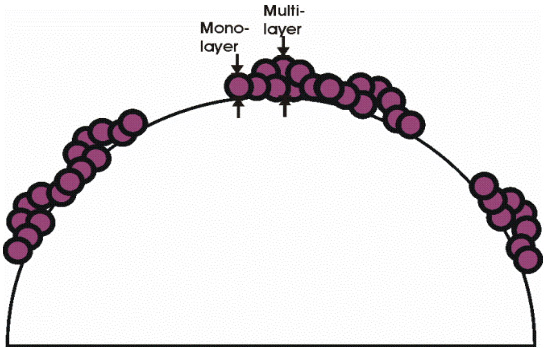
The dye-sensitized solar cell (DSSC), the so-called Grätzel cell, is conceptually very simple but in reality a devices relying on a subtle balance between reactions at the component interfaces. Most significantly, the interface of the photoelectrode will affect the DSSC performance. Thus, the proper understanding of the structure and processes at the semiconductor/dye/electrolyte interface will be of essential importance to finding good strategies to device improvement in the future. Ever since the pioneering work by Grätzel and O'Regan [1], the dye organization has been presumed to be based on the adsorption of dye molecules into a self-assembled monolayer.



Almost all experiments to study the dye/semiconductor interface have been based on indirect techniques interpreted into a structural model. That can properly, but not evidently, be described in terms of a self-assembled monolayer. Recent and direct studies based on NICISS, AFM TERS-AFM and other direct techniques have challenged this simplified model [2,3]. Recent results will be reviewed, as will results giving insight into organization and decomposition reactions of the adsorbed dye molecules giving insights into dye design criteria for the future.

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Sensing of Acetylcholine Release from an Artificial Secretory Cell Model

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Electrochemical detection is an excellent method for detection of neurotransmitter release during exocytosis events because it is fast, sensitive and the surface of the electrode can be held close proximity to the surface of a single cell. For the detection of non-electroactive neurotransmitters, for instance, enzyme based electrochemical sensors have been developed. These in general have a slow response time on the order of seconds and are too slow for recordings of single vesicle release events during exocytosis that occur on millisecond time scale.

We have used the two-enzyme system consisting of acetylcholine esterase and choline oxidase to construct an enzyme-based electrochemical sensor for detection of the non-electroactive neurotransmitter acetylcholine. The catalytic reaction of these two enzymes can convert the non-electroactive acetylcholine molecules to an electroactive secondary product, such as hydrogen peroxide. In this work we used a carbon fiber microelectrode functionalized with gold nanoparticle to the surface, to increase the effective surface area and to retain the activity and secondary structure of the enzymes bound to the highly curved surface area. This work was first started by performing a careful characterization of the gold nanoparticle enzyme conjugates using these two enzymes to determine the enzyme coverage on the nanoparticles and to determine the enzyme activity. This was used to find the optimal conditions for co-immobilization of the two enzymes to the electrode surface and to maintain the highest retained enzyme activity. The sensor response was tested using an artificial cell model for exocytosis where single vesicle release events were recorded with a time-response on milliseconds, and in comparison to half the rate of single vesicle release events with electro active molecules. This was fast enough to resolve single vesicle release events of acetylcholine.

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Membrane Durability Testing and Lifetime Predictions for Heavy Duty Fuel Cells

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Through a concerted research agenda involving Ballard Power Systems, Simon Fraser University, and University of Victoria, we are currently developing durable and reliable fuel cell technology for transit buses with median lifetime equal to or better than incumbent diesel engines [1]. The lifetime enhancement strategies under development are based on mitigation of membrane degradation, which has been identified by Ballard as the lifetime limiting failure mode leading to stack failure under bus operating conditions. Load transients in heavy duty automotive fuel cells may induce rapid swings in membrane degradation stressors, such as voltage, temperature, and membrane hydration. In addition, frequent idling periods with high cell voltage and low current density may lead to elevated rates of gas crossover through the membrane, known to be a source of chemical membrane degradation through hydrogen peroxide formation and radical attack. Failure modes associated with gas leaks are predominantly caused by a combination of chemical and mechanical membrane degradation [2]. Due to the stringent product lifetime requirements for heavy duty applications and the complexity of the degradation mechanisms, durability evaluations and predictions are a significant challenge.

The objective of the present work is to establish a specialized accelerated membrane durability test (AMDT) for heavy duty fuel cells that can be utilized to predict membrane lifetime during field operation of fuel cell buses. The proposed AMDT applies enhanced levels of stress, such as elevated voltage, temperature, and humidity cycling, to ensure rapid membrane failure. Results have shown to be in good agreement with failures observed in historical bus field trials. Decay in membrane mechanical properties is found to play a central role in the degradation process [2], and the relative effects of chemical and mechanical stressors are evaluated through comprehensive ex situ characterization of AMDT degraded samples. Moreover, the platinum band that forms during fuel cell operation is demonstrated to enhance AMDT lifetime by mitigation of chemical degradation [3]. Acceleration factors for each stressor are determined and employed to develop an empirical lifetime prediction model based on the general log linear - Weibull stress life distribution. The empirical model focuses on extrapolating the lifetime of membranes under AMDT conditions to a lifetime expected under actual bus conditions. The predictive ability of the model is benchmarked with recent field data from the fuel cell bus fleet in Whistler, BC.

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Operando Soft X-ray Emission Spectroscopy of Electrode Materials for Li-Ion Batteries

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Improving the energy density and power density of electrode materials for Li-ion batteries (LIBs) are highly important to further develop electric and hybrid-electric vehicles. In order to perform the improvements, understanding the charge-discharge mechanisms of the electrode materials from a viewpoint of the electronic structure is indispensable. Recently, electronic-structure analyses for the electrode materials using soft x-ray spectroscopy, which directly reveals the 3*d* orbital of transition metals, have been of particular importance.

In this study we demonstrate *operando* soft x-ray emission spectroscopy (SXES) for $LiMn_2O_4$[1] which is a typical cathode material for LIB. We developed an *in situ* cell consisting of the $LiMn_2O_4$ cathode, a counter electrode and an electrolyte solution by modifying the *in situ* cell for the catalyst of fuel cells[2]. The *operando* SXES experiments were carried out using ultrahigh-resolution SXES spectrometer[3] at BL07LSU of SPring-8. The charge-discharge experiments were performed by cyclic voltammetry.

The Mn 2*p*-3*d*-2*p* resonant SXES spectra revealed redox reaction of $Mn^{3+} \leftrightarrow Mn^{4+}$ due to the charge-discharge reactions (Li-ion extraction/insertion). Moreover, Jahn-Teller effect on the Mn^{3+} site and charge-transfer effects between the Mn 3*d* and O 2*p* orbitals for each valence state were clarified by theoretical analyses using the configuration-interaction full-multiplet calculation[4,5]. In the presentation, details of the *operando* experiments will be reported, and the relationship between the electronic structure and electrochemical performance will be discussed.

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Electrochemical Kinetic Study on the Manganese oxides for Electrochemical Capacitor Applications

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Electrochemical capacitors (ECs), which are electrochemical energy storage devices with a high power density, have gained significant attention for use in a wide range of applications. From an electrode materials perspective, various transition metal oxides for ECs have been actively investigated owing to their high theoretical specific capacitance ascribed to fast faradaic reactions throughout their entire volume.[1,2] Among the transition metal oxides, manganese oxide (MnO_2) has attracted attention due to its low cost, natural abundance, environmental friendliness, and high theoretical specific capacitance (1370 F g^{-1}).[3] However, MnO_2 has also shown unsatisfactory electrochemical performance for utilization in EC applications due to its low electrical conductivity and dense morphology.[4,5] Therefore, there have been many researches to improve the electrochemical properties of MnO_2. While there are many papers on the synthesis of MnO_2 based electrode materials with enhance electrochemical properties,[6,7] few of studies are dedicated to fundamental investigation of electrochemical properties of MnO_2.

In this study, we investigate the electrochemical kinetic properties of charge storage process of MnO_2 composite with multiwall carbon nanotubes (MWCNTs). In particular, kinetic study on the charge storage process of MnO_2 in the composites is of interest, since this mechanism must be taken into account when fabricating modified electrode materials to achieve enhanced electrochemical performance. More details on the electrochemical properties of MnO_2 will be presented at the meeting.

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Photocurrent generation of photosystem I arranged in mono- and multilayers within an artificial protein platform

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The fabrication of artificial photoreactive electrodes by using biological components is an emerging research area with importance in photobiocatalytic systems and photobiovoltaic applications. Here we present a strategy to combine the photon converting pigment-protein super-complex - photosystem I (PSI) - with a small electron carrier in a mono- and multilayer arrangement. By this approach we can manage an unidirectional assembly and efficient connectivity with the electrode. PSI is involved in the photosynthesis pathway of plants and cyanobacteria[1] and shows a light conversion effiency of nearly unity[2,3], which makes it ideal to be used for light-harvesting biohybrid electrodes. Often PSI has a randomized orientation when self-assembled on surfaces and provides a slow direct electron transfer (DET).[4] Our strategy to overcome these issues is to assemble PSI with electron carriers involved in native electron transport. This provides two advantages: (1) redox protein mediated indirect electron transfer (IET) may yield high photocurrents, due to rather small electron tunneling distances (2) redox proteins can be considered as an assembly template on which PSI can adsorb efficiently, by reason of electrostatic and/or native affinity. Using the well-known redox protein cytochrome *c* (cyt *c*) as an assembly template so as wiring agent, we can show high deposition rates of PSI on a cyt c layer and are able to guide the photocurrent of these electrodes. While PSI is interacting with the underlying cyt *c* the electrochemical properties of the redox protein are changed, i.e. the redox potential. Photocurrent measurements in dependence of potential and light intensity have been performed emphasizing a rather unidirectional functional orientation of PSI. Moreover cyt *c*/PSI multilayer structures have been constructed. These 3D protein architectures generate an increased photocurrent density with incorporation of a terminal cyt *c* layer. We demonstrate a cyt *c* mediated enhancement of photocurrent density and an electrochemical connection of the different PSI layers with the electrode. The presented work can be considered as a contribution to current research in order to develop platforms for the effective conversion of light into electrical and/or chemical energy.

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ELECTROCHEMICAL REACTION OF DIPHENYLACETALDEHYDE IN THE PRESENCE OF ALCOHOLS. AN ELECTRODE PROCESS INVOLVING CONSECUTIVE ELECTROCHEMICAL TRANSFORMATIONS AT BOTH ELECTRODES.

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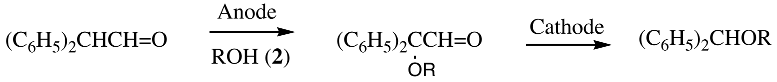
Anodic oxidation of diphenylacetaldehyde (**1**) in $CH_3CN:H_2O$ affords benzophenone [1]. The reaction was shown to involve nucleophilic attack by water upon a cationic intermediate to afford α-hydroxydiphenylacetaldehyde, which then undergoes anodic conversion to benzophenone. Substitution of an alcohol (**2**) for water should produce an α-alkoxyaldehyde (**3**). We describe here the results of a study confirming this expectation but also revealing unsuspected mechanistic complexity. Electrolysis of **1** under N_2 in anhydrous acetonitrile in a undivided cell containing two carbon electrodes in the presence of any of a variety of alcohols does indeed afford the corresponding aldehyde (**3**) initially. However, upon continued electrolysis, **3** is further converted to a benzhydryl alkyl ether **4**. Density functional computations and analysis of the reaction by gas chromatography-mass spectrometry during electrolysis have shed light upon the mechanism of formation of **3**.



$$(C_6H_5)_2CHCH{=}O \xrightarrow[\text{ROH (2)}]{\text{Anode}} (C_6H_5)_2\underset{OR}{\dot{C}}CH{=}O \xrightarrow{\text{Cathode}} (C_6H_5)_2CHOR$$

1 **3** **4**

A surprising and unprecedented feature of these transformations is the fact that *both electrodes are required*. Since **1** is converted to **3** at the anode, we initially assumed that the ethers **4** are also produced at the anode by subsequent oxidation of **3** to **4**. However, two control experiments disproved this hypothesis. First, **3** (R = cyclohexyl) (independently synthesized by reaction of *α*-bromodiphenylacetaldehyde [2] with cyclohexanol in the presence of silver tetrafluoroborate [3]) was placed in the anode compartment of a divided cell. It was found to be *stable* to anodic oxidation. However, when it was placed in the cathode compartment, *it was converted to* **4**. The mechanism of this mild cathodic decarbonylation reaction is under investigation.

Baizer introduced the term 'paired electrolyses" for processes in which both electrodes participate [4]. Examples include (a) parallel electrolyses, in which two components of a solution undergo simultaneous independent and unrelated transformation [5]; (b) generation of two reagents, one at each electrode, that can react with a third component of the medium, as in the conversion of ethylene to propylene oxide by the dual action of electrogenerated hydroxide and bromine [6]; or the simultaneous oxidation of glucose to gluconic acid at the anode and reduction to sorbitol at the cathode [7]. Conversion of **1** to ethers **4** is, however, the first example of an organic electrode reaction involving significant successive structural transformations of a single substance first at one electrode and then at the other .

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Electron Transfer Induced Coordination Changes Based on Non-Innocently Behaving Hemilabile Ligands

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The variation of metal coordination in complexes as a function of the metal oxidation state is a well known phenomenon with implications for redox catalysis. Examples involving the *o*-amidophenolate/*o*-iminoquinone non-innocent [1] ligand family are used to show that *ligand*-based electron transfer can have similar consequences [2]. Structurally supported results from cyclic voltammetry and spectroelectrochemistry (UV-VIS-NIR, EPR) [3] will be presented in conjunction with DFT calculations in order to illustrate the potential of this combination for the assignment and chemical implications of electron transfer processes in coordination compounds of transition metals (Ni, Ir, Ru, Os).

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In Vivo Electrochemistry for Monitoring Cerebral Ascorbate

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To understand the molecular basis of brain functions, researchers would like to be able to quantitatively monitor neurochemicals in vivo. However, the chemical and physiological complexity of the central nervous system (CNS) presents challenges for the development of these analytical methods. We used the redox nature of neurochemicals at the electrode/electrolyte interface to form a basis for selectively monitoring neurochemicals. In this presentation, I would introduce the recent process in our group on in vivo monitoring ascorbate in rat brain.

1) Carbon nanotubes (CNTs) provide an electrode/electrolyte interface for the selective oxidation of ascorbate and, based on this, we have developed both in vivo voltammetry and an online electrochemical detecting system (OECS) for continuously monitoring ascorbate in CNS.
2) By using the CNT-based OECS, we compared the dynamic regional changes of extracellular ascorbate level in four different brain regions 1 h after global cerebral ischemia induced by two-vessel occlusion (2-VO). We also compared the change in the level of ascorbate in the different ischemia model (i.e., left middle cerebral artery occlusion (LMCAO) and 2-VO) in striatum.
3) We also demonstrated the validity of the OECS for ascorbate detection as a platform for in vivo evaluation of neuroprotective efficiency of antioxidants by studying the dynamic change of hippocampal ascorbate during the acute period of cerebral ischemia and its responses to intravenous administration of antioxidants including ascorbate and glutathione.

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Redox Electrolytes for High Efficiency and Stable Mesoscopic Dye Sensitized Solar Cells

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The demand for inexpensive, renewable energy sources is a strong driving force for the research efforts on photovoltaic device technology. Dye-sensitized solar cells (DSC) have aroused intense interest as low-cost alternatives to conventional inorganic photovoltaic devices. Following its inception in 1991 [1] the DSC overall efficiency for solar energy conversion to electricity has presently attains 12-13% [2-4]. Redox electrolyte energy level tuning is detrimental for obtaining high device performance by increasing the device open-circuit potential. Much effort has been devoted to the study of electrolytes that enable light to electrical power conversion for DSC applications. The latest progress in the design and synthesis of new sensitizers and redox electrolytes has allowed attaining unprecedented photovoltaic performance. This lecture will summarize the most recent developments in tuning the redox electrolytes to obtain high power conversion efficiency and device stability.

Modeling and Simulation of Transport and Degradation Mechanisms in Reinforced PFSA Membranes for Automotive Fuel Cell Applications

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In order to represent a reliable alternative to the internal combustion engines in automotive applications, the durability of fuel cells needs to be improved. Among other issues, it is essential to avoid failure of the polymer electrolyte membrane. Therefore, state-of-the-art membranes are reinforced with PTFE to reduce the mechanical degradation. Since chemical degradation is strongly coupled to local species concentrations inside the polymer, a detailed understanding of transport phenomena in such membranes is crucial.

Based upon an existing model [1-2], a transient two-dimensional model for the transport of water (see Fig. 1), protons and dissolved gases in a reinforced PFSA membrane has been developed. It accounts for "Schröder's paradox", hydration dependent gas crossover and chemical degradation of the polymer.

Degradation is initiated by H_2O_2-formation and subsequent formation of radical. These radicals lead to "unzipping" of the polymer backbone by attacking the weak end groups and to side chain scission via attack on the ether linkages and bonds of the tertiary carbon atoms. Loss of functional groups and polymer mass leads to deterioration of membrane properties and increases the rate of degradation. A coupling concept between chemical degradation and the performance of the membrane is presented.

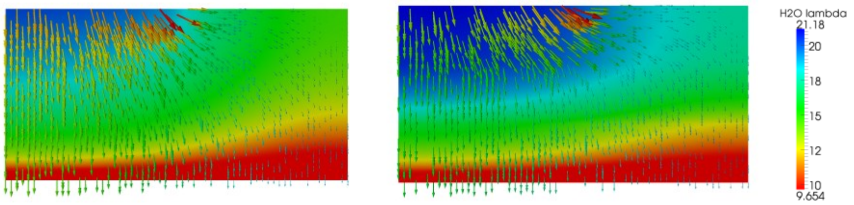

Fig. 1. Spatial distribution of the water content in the membrane. Arrows indicate the direction and magnitude of the water fluxes. Left: no reinforcement. Right: with reinforcement.

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Optimization of AC/AC Electrochemical Capacitors in Salt Aqueous Electrolytes

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Commercially available electrical double-layer capacitors (EDLCs) are based on activated carbon (AC) electrodes and on either organic electrolyte (Et_4NBF_4 in acetonitrile) with voltages of 2.7–2.8 V, or aqueous electrolytes, namely acid (H_2SO_4) and base (KOH) solutions giving voltages of only 0.7–0.8 V. Recently, good performance and high cycle life have been demonstrated up to voltages of 1.6-1.8 V for AC/AC capacitors in salt aqueous electrolytes (alkali sulfate and nitrates)[1,2,3]. Since the energy E of a capacitor is given by formula $E = ½CU^2$, attention of this contribution is directed towards optimizing capacitance C and voltage U of the later systems while using stainless steel current collectors.

Adding sodium molybdate (Na_2MoO_4) to the alkali sulfate electrolyte results in shifting the maximum operating potential of the positive AC electrode from 0.98 V vs NHE in 1 mol.L^{-1} Li_2SO_4 to 0.799 V vs NHE in 1 mol.L^{-1} Li_2SO_4 + 0.1 mol.L^{-1} Na_2MoO_4 when the capacitor is charged up to 1.6 V, preventing this electrode from oxidation. Additionally, a higher capacitance value of 121 F.g^{-1} is measured (at 200 mA.g^{-1}) in Li_2SO_4+Na_2MoO_4 as compared to 103 F.g^{-1} for Li_2SO_4, due to pseudofaradaic processes related with the MoO_4^{2-} anions. Further, the sodium molybdate additive inhibits the corrosion of the positive stainless steel current collector by impeding the ingress of corrosive SO_4^{2-} anions into the passive layer during charging up to 1.6 V. After potentiostatic floating at 1.6 V for 120 hours, the capacitance (125 F.g^{-1}) and the resistance (1.0 Ω) remain unchanged in Li_2SO_4+Na_2MoO_4 as compared to capacitance (~100 F.g^{-1}) and increasing resistance (1.4 Ω to 3.1 Ω) in Li_2SO_4. Post floating CVs and Nyquist plots show that the performance of a capacitor containing Li_2SO_4+Na_2MoO_4 remains nearly unchanged with almost identical R_{ct} after floating. Overall, adding Na_2MoO_4 improves the electrochemical performance of AC/AC capacitors in Li_2SO_4 and enables using low cost stainless steel current collectors up to 1.6 V.

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Electrode-Ionic Liquid Interfaces Studied by EIS, SPM and SHINERS

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Room-temperature ionic liquids have received tremendous interests in recent years by researchers in both fundamental and practical aspects[1,2]. The structure and dynamics of electrode-ionic liquid interfaces are important issues of concern from fundamental point of view. In this paper, we present works on combined characterizations using electrochemical, microscopic and spectroscopic techniques to understand the structure and property at the electrode-ionic liquid interfaces which could be vitally important to the processes taking place in practical systems. High resolution in-situ STM is employed to elucidate the surface structures of immidazolium-based as well as piperidinium-based ionic liquids and influence of lithium salts on Au single crystalline electrodes. The detailed configuration of the ionic liquid molecules and their interactions with the metal surfaces are further studied by Raman spectroscopy with shell-isolated nanoparticle-enhancement strategy (SHINERS[3]). Remarkable changes in the intensities and Raman shift of vibrational modes from imidazolium rings of BMI and OMI cations are observed at negative potentials, suggesting a flat lying configuration at negative potential. On the other hand, the vertical structures along the interface are also probed by in-situ AFM force measurement. Layering of solvent ions is observed, and details of the layered structure can be identified based on potential dependency of the features of the force curves. Finally, electrochemical impedance spectroscopy (EIS) measurements are performed to correlate of the microscopic structures with macroscopic behaviors of the electrode-ionic liquid interfaces through fittings using equivalent circuits that are built based on the physical picture suggested by the microscopic and spectroscopic results. The obtained structural information lays foundation for further investigations on the dynamics of electrode-ionic liquid interfaces.

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FERMI-LEVEL EQUILIBRATION IN GOLD NANOPARTICLES: THEORY AND POTENTIOMETRIC REDOX TITRATIONS

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Exceptionally small gold nanoparticles (AuNPs; diameters < 5 nm) protected by thiol monolayers may be prepared using the method developed by Brust and Schiffrin [1]. These AuNPs are typically referred to as monolayer-protected clusters (MPCs) and experimentally represent a class of materials with properties that transition from those of single molecules to bulk materials. Due to their small sizes, the redox potentials of the different states of charge for the MPCs are separated enough to be measured distinctly. With larger AuNPs (diameters > 5 nm), however, the charge states form a continuum (as for a bulk metal) as their redox potentials are much closer together.

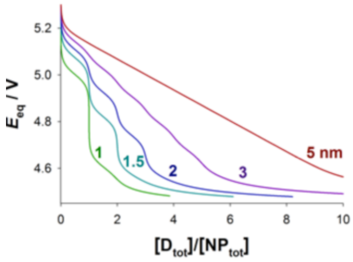

Fig. 1. Equilibrium potential for AuNPs of different mean diameters as a function of the ratio of the total amount of redox probe, D, and total concentration of AuNPs in the DCE solvent.

When a metallic or semiconducting NP is placed in an electrolyte solution containing a redox couple (ox/red), the Fermi level for the electrons on the NP should become equal to the Fermi for the electrons in solution for the given redox couple. The obvious logical conclusion from the latter statement is that ***the charge of a AuNP changes depending on its environment***. While this concept has been intensely researched regarding semi-conductor materials, theoretical and experimental investigations of the notion of Fermi level equilibrium of the electrons on AuNPs with those of a redox active species in solution are rarely, if ever, addressed in the literature. This is surprising considering the widespread use of AuNPs in sensors, catalysis, photovoltaic technology *etc.* where the charge on the AuNP is an influential parameter.

MPCs have multivalent redox characteristics, as shown by microelectrode voltammetry that reveals a series of well-defined steady-state current-potential waves [2]. Each successive wave represents an individual charge (electron) transfer event. In this presentation we will clearly define the theory underpinning the equilibration that occurs between the Fermi level of the electrons on AuNPs of different sizes with those of redox-active probes in solution (Fig. 1). Experimental confirmation of the theory will be provided by the observation of equivalence points during potentiometric redox titration of MPCs dissolved in 1,2-dichloroethane with a series of lipophilic redox probes of different redox potentials. These equivalence points represent the equilibration potentials after Fermi-level equilibration.

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Reference electrode materials for three-electrode impedance measurements: reliability, reproducibility and long-term stability

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Electrochemical Impedance Spectroscopy (EIS) is highly supportive for analyzing the polarization processes in lithium ion batteries, taking place on different time-scales. These studies are performed in experimental cell setups, using a lithium metal counter electrode and/or a lithium metal reference electrode. However, a lithium counter electrode mostly dominates the impedance response, and, overall, lithium metal always adds an undesirable stochastic component to the measurement data. Furthermore, a three-electrode setup [1] with lithium metal as counter and reference electrode is always problematic because of geometrical asymmetries.

Therefore, the choice of the reference electrode is crucial for reliable, reproducible and long-term stable measurements. One of the most promising materials proposed in literature is $Li_4Ti_5O_{12}$ (LTO), showing a stable potential plateau at 1,55 V versus lithium, because of a two-phase equilibrium [2].

This study demonstrates first the error sources arising from a lithium counter electrode second, LTO and lithium are compared as reference electrodes with regard to long-term behavior and reproducibility. Third, the applicability of an LTO–coated Aluminum mesh as reference electrode is shown by potential and impedance measurements under a variety of testing conditions. Finally, the new three-electrode measurement setup is applied to perform electrochemical impedance spectroscopy on a $LiMn_2O_4$-cathode as working electrode. By evaluating the measurement results and comparing those to results from previous studies [3], the reliability of this setup using a LTO coated mesh as reference electrode could be validated.

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Photocurrent generated by Photosystem II adsorbed on a nanostructured titanium dioxide/indium tin oxide electrode

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Progress in the elucidation of the structural and functional characteristics of Photosystem II (PSII) has triggered research into potential applications. The main applications of PSII are associated with its principle biological functions, as the source of electrons for photosynthesis and as one of the main energy inputs into the biosphere. These applications are in the domain of agriculture, bioenergy, ecology and environment. In addition, PSII is the biological paradigm for biomimetic and bioinspired approaches aimed at developing artificial photosynthesis[1,2]. There are numerous reports of PSII being used as a part of photoelectrochemical devices when immobilized onto electrodes (e.g. [3-5]). Isolated PSII is however not likely to be useful for energy production since its central D1 subunit is damaged by light after only a short time. When functioning in the native cell, PSII is systematically processed and repaired, with the D1 subunit having the fastest turn-over of any protein in the organism. Despite this fundamental limitation, work on immobilised PSII has continued partly because PSII is seen as the benchmark water splitting catalyst, partly because of applications as biosensors, where long term function is not required, but also because the immobilization of PSII on an electrode surface may provide a novel method for studying the enzyme.

Here we investigated isolated PSII from *Thermosynechococcus elongatus* when adsorbed on nanostructured titanium dioxide on a conducting inidium tin oxide elelctrode (TiO_2/ITO). Using conditions in which PSII is immobilized as a monolayer on the semiconductor surface and by studying the photocurrent in the presence of the Q_B site inhibitor, DCMU, we obtained evidence suggesting an electron pathway from Q_A directly to the electrode surface. This is in agreement with earlier suggestions[6-9].We also investigated the enhancement of the photocurrent by addition of mobile electron mediators such as DCBQ. By comparing the system with PSII as a monolayer *vs* PSII multilayers on the semiconductor, the results indicated that in the absence of the mediator, electron transfer through the nanostructured metal oxide is the rate-limiting step. We suggest that when the mobile mediator is present it enhances the photocurrent by taking electrons from the nanostructured semiconductor surface to the ITO electrode surface. Overall our model explains the anomalous effects of DCMU and redox mediators on the PSII dependent photocurrent seen here and also those reported earlier. It also implies that semiconducting surfaces are unlikely to prove efficient photocurrent generation from systems that provide electrons with potentials that are unable to access the conduction band of the semiconductor.

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ELECTROCHEMICALLY ASSISTED ASSEMBLY OF MESOPOROUS SILICA AT THE LIQUID-LIQUID INTERFACE

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Controlling the chemical and physical properties of an interface, whether it is solid-liquid or liquid-liquid, constitutes a major challenge, which impacts on various scientific fields (*e.g.* material science, analytical chemistry, energy conversion…). Mesoporous silica offers a wide range of interesting properties and functionalities (*e.g.* large surface area, fast mass transport, high mechanical stability) [1].

We report here the unusual modification of the liquid-liquid interface with mesoporous silica. The aqueous phase contains hydrolysed silica precursors, while a template agent (cetyltrimetylammonium, CTA^+) is dissolved in the organic phase. When CTA^+ ions are transferred to the aqueous phase, the condensation of the precursors is catalyzed and silica is formed around self-assembled template ions. Transmission electron microscopy and small angle X-ray scattering investigations have shown that silica with a 'worm-like' structure is achieved when CTA^+ concentration is sufficiently high [2].

Microscopic liquid-liquid interfaces were modified with the same method and characterized by cyclic voltammetry, scanning electron microscopy, in-situ confocal Raman spectroscopy and shear force profilometry. The results indicated that the silica is formed on the aqueous side of the interface, and grows as CTA^+ diffuse in the aqueous phase. Cyclic voltammetry of model ions (tetramethylammonium, tetraethylammonium, tetrabutylammonium and octylbenzylsulfonate) demonstrated that mesoporous silica may have interesting sieving properties for ion transfer at the liquid-liquid interface.

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Electron relays for biofuel cells and biophotovoltaics.

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The trend in energy conversion based on bioelectrochemical processes is to aim for direct electron transfer between electrodes and the redox centers of the biocatalyst. The intended outcome is to achieve energy conversion at minimal voltage loss. This strategy is ideal when direct electron transfer is fast (1). However, this is not the case for all redox enzymes and in some cases fast direct electron transfer is even related to enzyme deactivation processes.

Electron relays may be implemented as an efficient alternative provided their properties, and in particular their redox potential, are tuned to enable maximal current density at low overpotential. To illustrate the desired parameters of an electron relay and of its polymeric supporting matrix, the example of bio-photoelectrochemical cells as well as a full bio-photovoltaic cell based on photosynthetic protein complexes will be given (2,3).

The direct electron transfer configuration also affects the activity of hydrogenases, in particular at high potential and in presence of oxygen. In biofuel cell applications, the electron relay, beyond its role in electron transfer, may also be applied for shielding the hydrogenase biocatalysts from high potential deactivation and oxygen damage. Various further strategies for shielding from oxygen damage will be presented (4).

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Through-Hole Filling in a Cu Plating Bath with Functional Insoluble Anodes and Acetic Acid as a Supporting Electrolyte

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Through-hole filling of a printed circuit board (PCB) was carried out using a copper electroplating solution.[1-3] Tetranitroblue tetrazolium chloride (TNBT) was used as an inhibitor. Acetic acid instead of traditional H_2SO_4 electrolyte was employed in the copper electroplating solution. Moreover, insoluble anodes, namely dimensionally stable anodes (DSAs), composed of IrO_2, Ta_2O_5 and Ti, instead of common soluble anodes (i.e., P-doped Cu), were employed in this work. The results show that the filling performance of the copper electroplating solution can be significantly enhanced when acetic acid and DSAs are simultaneously employed in the copper electroplating bath.

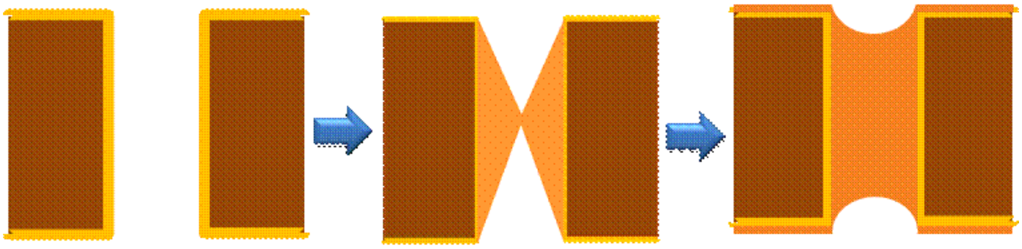

Fig. 1. Copper filling mode in a through hole.

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Buffer Solutions as a New Environmentally Benign Electrolyte for Aqueous Supercapacitors

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Electrochemical supercapacitors using aqueous electrolytes have a number of advantages against devices that use organic electrolyte. The most commonly used electrolytes are H_2SO_4, Li_2SO_4, and KOH, depending on the stability of the electrode material at various pH. Almost all of the studies on ruthenium oxide, known to be the best pseudocapacitve material, has been conducted in H_2SO_4. If a neutral electrolyte such as Li_2SO_4 is used, the specific capacitance is severely decreased to about 1/2 of that in acid. In a recent study, we discovered that the specific capacitance of RuO_2 nanosheets in CH_3COOH-CH_3COOLi (AcOH-AcOLi) buffered solutions can exceed 1,000 F g^{-1}, which is higher than in H_2SO_4 [1] Here we report are recent progresses in this system particularly emphasizing the charge storage mechanism with buffered solutions.

Figure 1 compared the cyclic voltammograms of RuO_2 nanosheet colloid derived from $Na_{0.2}RuO_2$ in 0.5 M H_2SO_4 and 5 M AcOH-AcOLi. The capacitance in 5 AcOH-AcOLi is 1039 F g^{-1}, 25% higher than that in H_2SO_4. In the same 5 AcOH-AcOLi buffered solution, hydrous RuO_2 nanoparticles give 648 F g^{-1}. The A1/C1 peak at $E_{1/2}$~0.4 shows a linear relation to pH change, suggesting that this peak has the same origin as the $E_{1/2}$~0.6 V peak observed in H_2SO_4. In AcOLi, i.e. in the absence of AcOH, only the A2/C2 peak at $E_{1/2}$~0.65 is observed, and the capacitance is decreased to 774 F g^{-1}. Thus, the A1/C1 and A2/C2 peaks are tentatively attributed to hydrated H^+ and Li^+, respectively.

A hybrid capacitor using RuO_2 nanosheets in 5.0 M AcOH-AcOLi buffered electrolyte as the positive electrode with a multi-layered Li electrode exhibited specific energy of 724 Wh (kg-RuO_2)$^{-1}$ [2].

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Acknowledgements

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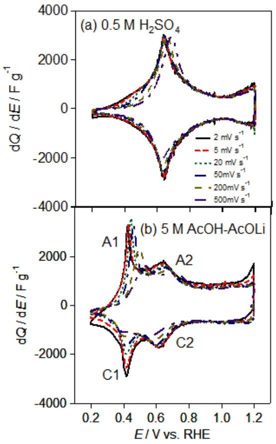

Figure 1. Cyclic voltammograms of RuO_2 nanosheet in (a) 0.5 M H_2SO_4 and (b) 5 M AcOH-AcOLi at 60 °C.

Liquid – gas phase equilibria of phosphoric acid at high temperature electrolyte polymer fuel cell conditions

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Phosphoric acid is used in most high temperature polymer electrolyte membrane fuel cells (HT-PEFC) especially because it exhibits high proton conductivity together with high availability. The nature of the proton conductivity in phosphoric acid and the interaction between the polymer matrix and phosphoric acid were investigated recently by MD simulations [*1*]. Experimental conductivity data are available extensively for temperatures up to 100°C and different water contents, while it gets scares for higher temperatures [*2, 3*]. The reason for this is the complex nature of the phosphoric acid, tending to polymerize from its monomeric form at low temperature and surplus of water towards chain or even ring structures at temperatures above 100°C with depletion of water [*4*]. However, the different species have different chemical but also physical properties. This circumstance is either neglected or not considered for most examinations.

In contrast to most published methods starting with P_2O_5 and defined water content, we start from aqueous orthophosphoric acid (85w%) and impose a fixed water vapour pressure using a climate chamber. The development of the equilibrium state with the gas phase is investigated using time sequenced impedance measurements. Temporal snapshot samples are taken and examined using Karl-Fischer titration method to determine the content of unbound water and Raman spectroscopy to determine changes in molecular interactions. The transitions between the different species and adducts of phosphoric acid can be precisely determined.

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D-π-A Structured Porphyrins for Mesoscopic Solar Cells

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In this presentation, new push-pull structured zinc porphyrin dyes with intramolecular donor-π-acceptor structure for dye-sensitized solar cells (DSC) will be introduced. As an example, new porphyrins with the linkers based on thiophene or 2,3-dihydrothieno[3,4-b][1,4] dioxine with cyanoacetic acid showed the spectral response of prophyrins into near-IR region (~850 nm). Thus, highly efficient DSC devices can be obtained with power conversion efficiency of 9.5% under full sunlight irradiation. Spectral, electrochemical, photovoltage transient decay and impedance measurements are performed to reveal the influence of π-conjugated linkers and anchoring groups upon the optoelectronic features of porphyrins dyes in DSCs.

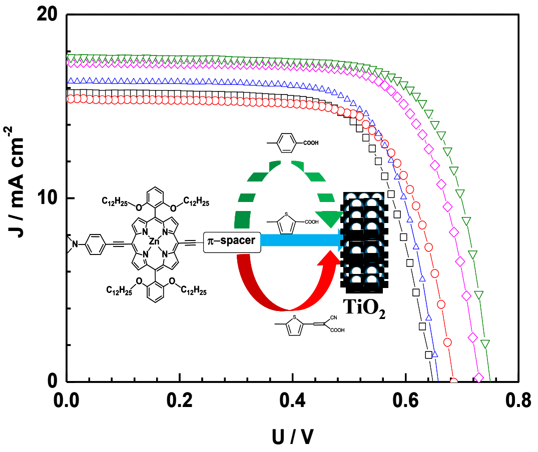

Figure 1 I-V curves of dye-sensitized mesoporous TiO_2 solar cells based on porphyrins.

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Redox Cycling and Single Molecule Spectroelectrochemistry in Zero-Dimensional Electrochemical Nanostructures

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Two different zero-dimensional, electrochemically-active nanopore geometries have been constructed to address the effects of crowding and confinement on electrochemical reactivity. (1) The Au optical cladding layer of a zero-mode waveguide (ZMW) is used as the working electrode together to effect heterogeneous electron transfer reactions that can be studied both by single molecule fluorescence trajectories and fluorescence correlation spectroscopy. Flavin adenine dinucleotide (FAD) exhibits potential-dependent blinking by cycling between a highly fluorescent oxidized state and a dark reduced state. In contrast to its behavior in flavoenzymes, where the transitions are coupled to chemical redox events, here single FAD molecules are chemically immobilized to a Au ZMW array. Single molecule blinking behavior varies as a function of potential with the probability of observing a reduced (oxidized) state increasing (decreasing) as the potential is scanned cathodic of E_{eq}, reflecting the potential-dependent probability of electron transfer for single FAD molecules. Furthermore, the observed transition rate reaches a maximum near E_{eq} and decreases to either anodic or cathodic values, as expected, since the rate is dependent on having significant probabilities for both redox states, a condition that obtains only near E_{eq}. (2) An array of nanoscale recessed ring-disk electrodes (RRDEs) is fabricated using layer-by-layer deposition, nanosphere lithography, and a multistep reactive ion etching process (Figure 1). The resulting device can be operated in generator-collector mode by holding the ring electrodes at a constant potential and sweeping the disk potential. Steady-state response and enhanced (~10x) limiting current are achieved, and the electrochemical reaction occurring at the disk electrodes can be tuned by modulating the potential at the ring electrodes. Integration of the fabricated array within a nanochannel produces up to 50-fold current amplification as well as enhanced selectivity based on differences in redox reversibility, redox potential, or both. For electrochemically reversible interferent species, a ring potential can be chosen such that one species exhibits exclusively cathodic (anodic) current, allowing the other species to be determined from its anodic (cathodic) current. Finally, large current enhancements can be achieved during cyclic voltammetry at RRDE arrays by taking advantage of the redox cycling effect in the absence of supporting electrolyte. Current enhancements as large as 100-fold arising from ion migration effects add to the ~20-fold enhancement due to redox cycling, to produce a total current amplification as large as 2000-fold compared to a single microelectrode of the same total area as the array.

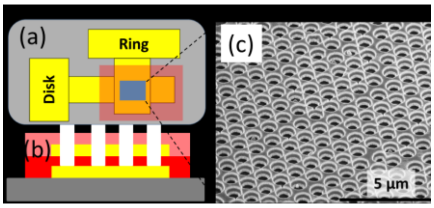

Figure 1. Schematic diagram in (a) plan view and (b) cross section. (c) SEM image of the RRDE array.

In-Operando Tomography and Modeling: Analysis of Species-Distribution in Zinc-Air-Batteries

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The main research focus for next generation batteries is on electrodes and materials, as well as on understanding and manipulating the complex processes occurring within them. On the one hand, imaging techniques are capable of monitoring processes in-operando with high spatial resolution. Recently, zinc-air-battery discharge was monitored with X-ray tomography by the authors [1]. On the other hand, mathematical battery models elucidate detailed information about species concentration, electrode overpotentials and the impact of ambient air on zinc-air-battery operation [2].

In this work we combine X-ray tomography with model-based analysis and apply it on an in-house zinc-air-battery set-up and a commercially available ZA13 button-cell. We show the local distribution of Zn and ZnO inside the battery during discharge, the redistribution of electrolyte inside the zinc electrode, as well as the redistribution of electrolyte in the pores of the gas diffusion layer at the air electrode. The simulation results assist to interpret the physical and chemical processes observed and furthermore reveal cell potential and overpotentials at zinc and air electrode. Exemplary, Fig. 1 shows the results obtained for a ZA13 button-cell: whereas dissolution of Zn particles and zinc electrode expansion is observed in the tomographic images, density changes and convective fluxes are identified as the underlying causes of the observed physical and electrochemical behavior by the simulation results.

Both techniques, X-ray tomography and modeling, complement each other and yield a comprehensive insight into the processes inside zinc-air-batteries. The introduced analysis is flexible and can potentially be applied to understand processes in other next generation batteries.

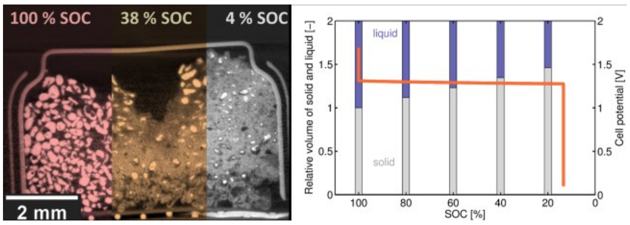

Fig. 1: Species-distribution inside the observed zinc-air-battery with changing state-of-charge (SOC): X-ray tomographic images (left) and simulation results (right)

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MnO2 as ink material for the fabrication of flexible supercapacitor electrodes

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The gap between electronics and users is becoming narrower as the portable electronics comes to wearable. As such, power supply, including storage devices, comes to wearable too. In addition to power and energy, specific characteristics are required for integration: lightweight, thickness, safety, washability, flexibility... and eventually hypoallergenic or biocompatibility. Facing these specifications, integration of storage devices such as Li-ion batteries or supercapacitors in clothes remains an exiting challenge. Supercapacitors based on pseudocapacitive metal oxide -based electrodes operated in neutral aqueous electrolytes could fit most of these requirements. The context of this study is the development of supercapacitor electrodes based on the deposition of MnO2 onto flexible current collectors. Although various approaches have been investigated for the fabrication of high-performance flexible supercapacitors, they have to consider various material/device characteristics including intrinsic flexibility, mechanical integrity of the current collector/electroactive material assemble and retention of the electrochemical performances under stress. The material deposition onto flexible substrates can be carried out by electrodeposition, spin coating, spray or inkjet deposition [1]. Many surfactants have been used such as sodium dodecyl sulfate, Triton X100 or Caffeic acid, for the formulation of the complex MnO_2 particle suspensions required for the fabrication of homogeneous and performing electrodes by these latter techniques.

To enhance the rheological characteristics of the prepared inks, we have considered the use of these surfactants at the preliminary stages of the synthesis of MnO_2 particles by wet chemistry. The present study focuses on the impact of three different surfactants used for the synthesis by co-precipitation of MnO_2 on the electrochemical characteristics of the prepared powders.

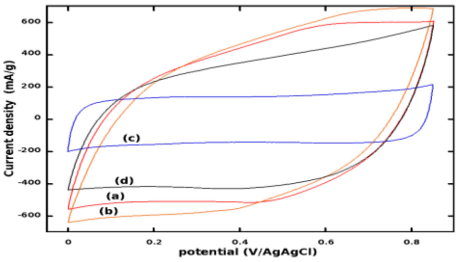

Figure: Cyclic voltammograms of Mn-oxide/free (a), Mn-oxide/SDS (b), Mn-oxide/CA (c), and Mn-oxide/TX100 (d) at a scan rate of 5 mV.s^{-1} in 1M Na2SO4 aqueous electrolyte.

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Disambiguating the Complex Chemical Mechanisms Underlying Basic Brain Function using Hydrogen Peroxide Microelectrochemistry.

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Hydrogen peroxide (H_2O_2) is a small reactive oxygen species present in the brain that has been implicated in a number of neurological disease states and that serves as an important mediator of other neurotransmitters. Because H_2O_2 serves these distinct biological roles, concentrations rise and fall in the extracellular space with precise spatial and temporal resolution, such that functional levels can be achieved for signaling while the pathological consequences resulting from unregulated generation are prevented. However, studies aimed at elucidating these dynamics have been hindered by the paucity of methods available for probing dynamic H_2O_2 fluctuations in living systems with molecular specificity. We have characterized the quantitative analysis of H_2O_2 fluctuations using fast-scan cyclic voltammetry at carbon-fiber electrodes, and have used RAMAN and EPR spectroscopies to investigate the chemistry on the carbon surface that enables this selective detection scheme. H_2O_2 is implicated in the pathogenesis of Parkinson’s disease, a neurodegenerative disorder in which the nigrostriatal dopamine projection becomes dysfunctional and slowly degenerates. Thus, we are using the uncoated carbon-fiber microelectrode as a multivariate sensor to objectively distinguish and simultaneously quantify both H_2O_2 and dopamine at a single recording site in live brain tissue. This approach is enabling elucidation of the precise physiological interaction between H_2O_2 and DA, and the role that these molecular dynamics play in the onset of behavioral and cognitive complications associated with disease progression. Finally, we are exploiting the voltammetric detection of H_2O_2 to quantify fluctuations of non-electroactive molecules in live brain tissue with uprecedented spatial and temporal resolution, using enzyme modified carbon-fiber electrodes. Taken together, these studies are providing insight into the fundamental way in which information is conveyed between neurons, as well as the regulatory mechanisms and the functional implications resulting from this chemistry.

Controlling the Structure and Porosity of Materials for use as the Photoanode in Dye Sensitized Solar Cells

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The ability to engineer the structural properties of a material can significantly enhance the performance of that material. In dye sensitized solar cells the morphology of the photoanode influences a number of parameters. First the nanoparticle size is related to the surface area, an important factor when looking at dye loadings within the photoanode. The interconnection of the nanoparticles is paramount for electron diffusion, while the porosity of the film influences electrolyte infiltration through the photoanode. In addition, improved light harvesting can be achieved with increased scattering within the film. Therefore, careful morphological control of the photoanode can increase the efficiency of such cells.

The use of templates, either preformed or molecules that self-assemble during material synthesis, allow structural variation of both the final shape of the sample and the inner pore system. In this presentation, the ability to engineer the structure of titanium dioxide using such approaches will be discussed. In particular, the synthesis and characterisation of mesoporous titanium dioxide microspheres, see Figure 1, which exhibit high surface areas and light scattering properties when formed into films. The application of these materials as photoanodes in dye sensitized solar cells will be demonstrated.

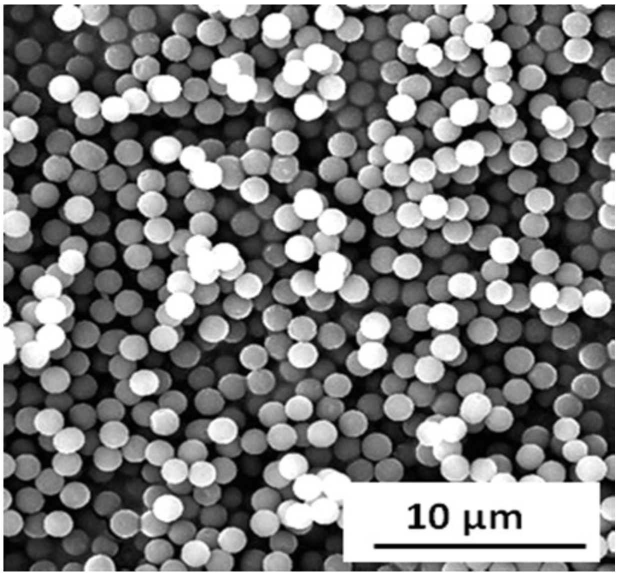

Figure 1. Mesoporous titanium dioxide microspheres.

Spectroscopic Approach to Fast and Ultrafast Dynamics at the Electrochemical Interface

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Dynamic spectroscopic studies of electrode kinetics and dynamics reported in the literature are reviewed and the information gained by such an approach will be discussed.

Conventional electrochemical measurements are convenient and useful ways to examine kinetic and dynamic at the electrochemical interface, but for better understanding they must be supplemented by atomic and molecular level information provided by other physicochemical techniques. If the electrochemical and molecular information of a system can be obtained simultaneously, further deeper insights will be gained. Among several in situ surface analytical techniques available at present, optical (or spectroscopic) ones are most suited for this purpose because they have very high time resolutions comparable to or higher than electrochemical techniques *in principle*.

For realizing time-resolved optical monitoring, the following two requirements must be fulfilled. One is the sensitivity of the technique. It must be high enough to detect submonolayers; otherwise, the time resolution is significantly reduced by signal averaging for enhancing signal-to-noise ratio. Surface-enhanced spectroscopic effects (SERS and SEIRA) can boost the measurements. The other is the response of the electrochemical system against externally applied perturbations. The time region accessible is limited to μs~ms in most cases due the double-layer charging or mass transport (not by spectroscopy). The use of microelectrodes is essential in the μs time region. An alternative way is the laser-induced temperature jump method, in which the electrode surface is heated by visible or near IR laser pulses. Heat diffuses from the electrode to the electrolyte solution and perturbs the orientation of the solvent molecules at the interface, which results in the sudden change of the rest potential (within ~200 ps). Ultrafast dynamics in the ps time region can be studied by combining a pulsed-laser-based spectroscopy technique with the temperature jump method in a pump-and-probe manner.

A totally different way is to examine the phase shift of optical signals against a potential modulation, the basic principle of which is similar to that of impedance spectroscopy and high time resolution is not required in this measurement. A significant difference from impedance spectroscopy is that kinetics and dynamics of each molecular species involved in the reaction can be examined by selecting suitable wavelength (or wavenumber).

Colloidal Pt Nanoparticles: An approach for systematic studies of fuel cell catalysts

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In this talk, I present our recent work on Pt nanoparticles (NPs) prepared by a colloidal method and thereafter are supported on high surface area supports. The electrocatalysts synthesized by this method have well-separated, size-controlled nanoparticles with variable support and Pt loading. Heating steps are not involved in the synthesis (except the colloidal NP synthesis). Therefore influences like the particle proximity effect on the oxygen reduction reaction (ORR) or the type of support on the stability can be investigated in a systematic manner. This particle proximity effect has been previously proposed based on Pt model catalysts. Here it is for the first time demonstrated for high surface area catalyst, which can be used in fuel cells.

In situ X-ray and Neutron Scattering Studies on Electrode-electrolyte Interface in Lithium Battery

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Among the battery reactions, intercalation is the most successful one and is used for the current lithium-ion batteries. During the intercalation process, lithium diffuses through a solid electrode / liquid electrolyte boundary region (Fig. 1), and the reaction at this area has recently been recognized to be a key issue to improve the long-term stability, reliability, and safety performances of the total battery systems. However, detailed information of the reaction of this region remains unclear. High-resolution insight into the interface during the electrochemical reactions is a prerequisite for an atomistic understanding and a control of kinetics in lithium battery reactions.

In the present study, *in situ* technique that enables us to observe directly the surface structural changes has been developed using epitaxial thin-film model electrodes and surface X-ray and neutron scattering techniques. The epitaxial thin-film electrodes were designed as model electrodes with nano-meter size, which have a highly flat surface and restricted reaction plane. The coating layer was introduced on the electrode surface, which may clarify the effect of coating on the electrode materials. The film electrodes used are $LiMO_2$, Li_2MO_3, LiM_2O_4 and $Li_4M_5O_{12}$ (M = transition metals), which were deposited on $SrTiO_3$ single crystal substrates by a pulsed laser deposition (PLD) method. Lithium phosphate was used as the coating material. The surface structure changes detected by the X-ray surface diffraction were different from those for the bulk region. Furthermore, the Li_3PO_4 coating stabilized the surface structure and improved the electrochemical properties. The neutron reflectrometry experiments using *in situ* cell developed in the present study (Fig. 2) clarified the lithium concentration changes at the electrode/electrolyte

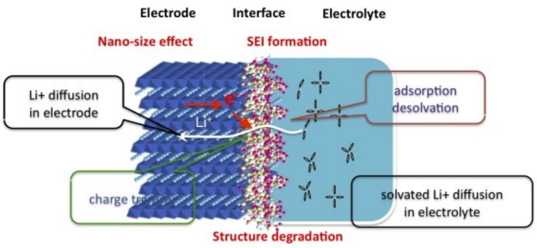

Fig. 1 Electrode reaction in batteries.

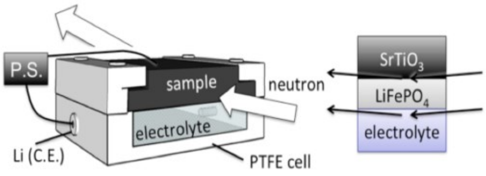

Fig. 2 *In situ* electrochemical cell for neutron reflectometry

interfacial region. The interfacial reaction mechanism will be discussed for those electrodes.

Electrochemical Detection and Removal of Cr(VI)

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Owing to the extreme toxicity and mobility of Cr(VI) in biological and environmental systems, it is of critical importance to develop convenient and reliable methods for its detection and removal. Considerable efforts have been devoted to the selective detection and treatment of Cr(VI) [1-2]. However, coexisting Cr(III) concentrations have been shown to be much higher than Cr(VI) concentrations in some test samples, resulting in serious interference. Therefore, prior separation and/or complexing is required for certain analytical techniques, leading to the disadvantages of complicated and time-consuming procedures. In this talk, we will report on facile electrochemical techniques developed recently in our research group for the sensitive and selective detection and efficient removal of Cr(VI).

A novel Ti/TiO_2NT/Au electrode has been fabricated via the anodic oxidation of a Ti substrate and photo-assisted chemical deposition of Au nanoparticles on the formed TiO_2 nanotube arrays for the sensitive detection of Cr(VI). Our experimental results show that the electrochemical reduction of Cr(VI) at the Ti/TiO_2NT/Au electrode has a nearly 23 fold improvement in activity as compared to a polycrystalline gold electrode. A wide linear concentration range from 0.10 to 105 μM, a low detection limit of 0.03 μM, and a high sensitivity of 6.91 $\mu A \cdot \mu M^{-1}$ Cr(VI) have been achieved, satisfying the detection requirements of the World Health Organization.

In addition, we have developed a new hybrid technology based upon continuous ion exchange and electrodeionization for the effective removal toxic Cr(VI) ions from wastewater as well as for the recovery of chromium ions. Our study has shown that the anionic ion exchange resin used in our study possesses a high capacity for ion exchange with hexavalent chromium. Batch ion exchange trials revealed that 97.7% of the Cr(VI) was removed. When the anionic resin was combined with the cationic resin and utilized in continuous ion exchange, the chromium removal was further enhanced. When the mixed resin bed was completely saturated, over 98.5% of the Cr(VI) was still continuously removed with the continuous electrodeionization process being operated at a 10% over limiting current. The energy consumption of the proposed techniques for the removal of Cr(VI) was also investigated.

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The Modification of Electrodes for Biosensors and Biofuel Cells

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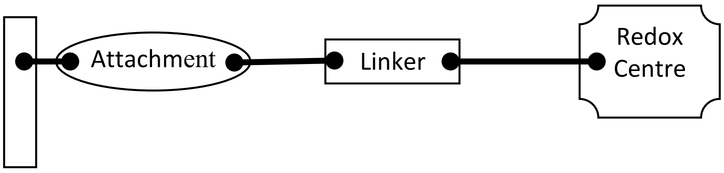
By taking a modular approach to the construction of modified electrodes and using clean, high yielding reactions to connect the different components together it is possible to construct libraries of modified electrodes. These libraries can then be screened to identify those modified electrodes that show the best performance for a particular application.



We have been working to develop this approach using carbon electrodes and attachments to the carbon surface by either diazo coupling of through amine oxidation [1]. Subsequent coupling of linkers and redox centres to the modified carbon electrode surface is then used to build up the library of different modified electrodes [2].

This approach has been used to look at modified electrodes for the oxidation of NADH to NAD$^+$ [3] and to develop modified electrodes for the direct electrochemistry of laccase for oxygen reduction [4].

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Ion-Selective Chemically Modified Solid-State Nanopores

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The use of nanopores for chemical sensing generally narrows down to nanoporous membranes with straight-through pores of uniform size distribution and ultimately to single nanopore membranes. To understand what makes nanopores so unique in terms of their use for chemical sensing we must consider the extremely small volume defined by their interior. Thus species residing within a nanopore can effectively change the physical-chemical properties of the nanopore interior (e.g., conductance), which can be detected in a label-free manner. By having a single nanopore with a volume comparable to that of the targeted species, detection of single species becomes feasible. However, beyond "conventional" resistive pulse sensing of nanoparticles and macromolecules, nanopores can be used also for selective sensing of small ions. The sensing concept is based on restricting the pore diameters to have the surface properties of the pore governing the transpore flux of ions. Gold nanopores can be conveniently modified with thiol derivatives, such as perfluorinated or electrically charged compounds, to infer hydrophobic, water repellent properties, or permselectivity [1], respectively, to the relevant membranes. We have previously demonstrated that high pore density gold membranes modified with a mixed monolayer of three different thiol compounds to infer permselectivity, hydrophobicity and ion selectivity can be used as an ion-selective membrane to fabricate potentiometric ion-selective electrodes (ISEs) [2]. In this presentation we will mainly focus on the transition from an ensemble of chemically modified pores to single nanopore-based ion sensors and new sensing strategies. We will report on the smallest sensing surface potentiometric ion-selective nanoelectrode ever fabricated to best of our knowledge. Unlike conventional liquid membrane-based ion-selective micropipettes that have extremely limited life time (generally less than a day), the new type of single-nanopore based ISEs with all active components immobilised to the nanopore offer a much improved life time and applicability in non-aqueous samples.

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Rational Design of Nanocatalysts with Enhanced Electrocatalytic Performances for Fuel Cell Applications

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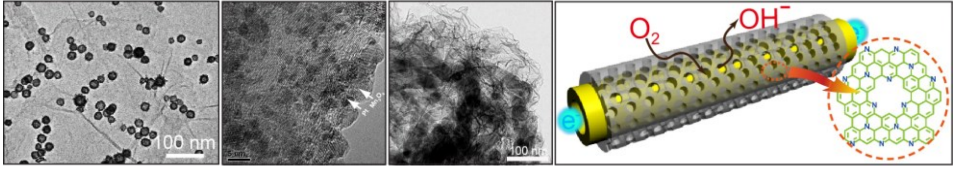
The rapidly increasing energy demand for human activities stimulates the lasting research interests to develop renewable energy alternatives worldwide. Fuel cell, as a clean and efficient energy conversion device, is one of promising techniques in tackling future global energy crisis. The big challenges for the practical application of this technique are to minimize the use and maximize the catalytic activity of scarce, expensive but still best platinum-based catalysts, and tackle the issue of the sluggish cathode oxygen reduction reaction (ORR).[1,2]

In this presentation, several reasonable ways for designing new nanocatalysts with high electrocatalytic activities for ORR will be discussed. For example, 1) By improving the structures of Pt-based catalysts and harnessing the synergetic catalytic effect from support, a series of nanocatalysts with efficient usage of Pt component and enhanced electrocatalytic performance were developed, including Pt nanocrystal assembled hollow Pt nanostructures hanged onto graphene layer,[3] well-dispersed Pt nanocrystals on Mn_3O_4 coated CNTs prepared via an in-situ self-deposition process,[4] etc. 2) For further minimizing the catalyst cost, a variety of non-PGM (platinum group metal) catalysts with comparable/superior electrochemical performance and durability were developed, such as in-situ nitrogen-doped nanoporous carbon nanocables,[5] improved graphene/carbon nanotube composites,[6] and selectively-nitrogen-doped graphene via space confinement etc.[7] 3) As a demonstration for preparing non-Pt electrocatalysts in a large scale, a simple, reproducible and cost-effective protocol to produce a nanocomposite from graphene supported layered double hydroxide will be also discussed, which will be interesting for cost-effective mass production of electrocatalysts for industrial applications.[8]



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Aligned Carbon Nanotube-Sheathed Carbon Fiber Microelectrodes for In Vivo Voltammetry

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Development of highly selective microelectrodes with excellent analytical properties is of great importance for in vivo monitoring of neurochemicals in real time nature. Using the as-synthesized vertically-aligned carbon nanotube (VACNT)-sheathed carbon fibers (CFs) as the microelectrodes, we have developed new methods for in vivo monitoring of neurochemicals, such as ascorbate. The VACNT-sheathed CFs (VACNT-CFs) are produced via pyrolysis of iron phthalocyanine (FePc) on the surface of CFs

Using VACNT-CFs as the microelectrodes without any post-synthesis functionalization, we have developed a new method for in vivo monitoring of ascorbate with a high selectivity and reproducibility. The use of the pristine VACNT-CF microelectrode can effectively avoid any manual electrode modification and is free from person-to-person and/or electrode-to-electrode deviations intrinsically associated with the conventional CF electrode fabrication, which often involves electrode surface modification with randomly distributed CNTs or other pretreatments, and hence an easy fabrication of highly selective, reproducible and stabile microelectrodes even by non-electrochemists.

Moreover, we developed a new electrochemical method for selectively monitoring O_2 in vivo using platinized VACNT-CFs as the electrodes. The resulting Pt/VACNT-CF microelectrodes exhibited fast overall kinetics for the O_2 reduction via a four-electron reduction process without the formation of toxic H_2O_2 intermediate. Compared with the traditional Pt/CF microelectrodes, our Pt/VACNT-CF microelectrodes have shown largely improved overall kinetics and stability for in vitro and in vivo O_2 monitoring in the cerebral systems.

The financial support from Natural National Science Foundation of China and the cooperation with Prof. Lanqun Mao and Prof. Liming Dai are gratefully acknowledged.

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In-situ Infrared Study of Amorphous-Silicon Electrodes for Lithium-Ion Batteries

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At the semiconductor/electrolyte interface, the multiple-reflection, attenuated-total-reflection (ATR) geometry has long proved to be the most useful experimental tool for maximizing the surface vibrational signals and minimizing the effects of electrolyte absorption. The advantages brought by using a thin-film electrode combined with a multiple-reflection, ATR geometry allow for overcoming the limitations encountered in previous in-situ IR studies of electrodes for Li-ion batteries.

Silicon electrodes have therefore been studied using a specific spectroelectrochemical cell, in a half-cell configuration against a lithium-metal electrode. The thin-film-electrode geometry prevents electrode mechanical failure when the films are thin enough and provides a well-controlled geometry allowing for quantitative measurements of electrode evolutions, e.g., the formation of the solid-electrolyte interphase (SEI). Electrodes are thin films of hydrogenated amorphous Si (a-Si:H) deposited by Plasma Enhanced Chemical Vapor Deposition on a crystalline Si ATR prism. Two representative electrolytes have been used.

The experimental spectra consist of positive peaks characteristic of the SEI film formed during the electrochemical process, and negative peaks due to electrolyte exclusion from the interface as a consequence of the SEI growth. The latter peaks can be used for quantitatively monitoring the film growth, which allows for determining the evolution of the SEI thickness during the first lithiation and after subsequent cycles. A noticeable effect is the SEI growth and partial disappearance during the electrochemical lithiation/delithiation cycles. This phenomenon of “SEI breathing” can tentatively be connected with the electrode stability upon cycling.

The experimental spectra can also be corrected for electrolyte absorption. Such a correction yields the genuine SEI spectra, which gives insight into its composition. In this way, Li solvation effects can be evidenced close to the SEI without side effects due to mass-transport limitations in the spectroelectrochemical cell. Additional information includes the effects of lithiation on the bulk silicon thin film, where the Si-H bonds, present in abundance in the a-Si:H network, are gradually and irreversibly consumed during the first silicon lithiation. Finally, the presence of an intense electronic absorption associated with a heavily lithiated phase gives insight into the Li penetration processes into the electrode. Specifically, a progressive invasion of the heavily lithiated phase from the silicon outer surface takes place during the first cycle, whereas subsequent delithiation and relithiation proceed quasi-homogeneously throughout the electrode.

Deep Eutectic Solvents Based on N-Methylacetamide and a Lithium or Sodium Salt as Electrolytes for Activated Carbon-Based Supercapacitors

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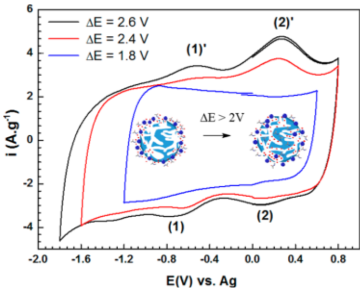
Deep eutectic solvents (DESs), have been paid great attention to replace current organic solvents and can be applied to many chemical processes. DESs are liquid media obtained by mixing in certain ratios a metal salt, with hydrogen bond donor (HBD) such as alcohol, amide and carboxylic acid, as a complexing agent. We recently demonstrate [1, 2] that the N-methylacetamide (MAc) can be considered as a good and green solvent for the formulation of new DES-based electrolytes.

This study describes the utilization of Deep Eutectic Solvents (DESs) based on the mixture of the N-methylacetamide (MAc) with a lithium or sodium salt (LiX or NaX, X = bis[(trifluoromethyl)sulfonyl]imide, TFSI; hexafluorophosphate, PF_6; or nitrate, NO_3) as electrolytes for carbon-based supercapacitors at 80 °C. The investigated DESs were formulated by mixing the salt with the MAc. All DESs show the typical eutectic characteristic with eutectic points localized in the temperature range from -85 °C to -52 °C. DESs (conductivity (σ) and fluidity (η^{-1})) are not very interesting at ambient temperature, while by increasing the temperature up to 80 °C, these properties become more favorable for electrochemical applications. This "superionicity" explains their good cycling ability as electrolytes, determined by cyclic voltammetry and galvanostic charge-discharge methods, with high capacities up to 380 $F.g^{-1}$ at elevated voltage and temperature, i.e. ΔE = 2.8 V and 80 °C for the LiTFSI-MAc mixture at x_{Li} = 0.25, for example. Finally, the efficiency and capacitance of symmetric AC/AC systems were then evaluated to show the imbalance carbon electrodes caused by important lithium insertion at the negative and by the saturation of the positive by anions, both mechanisms prevent in fact the system to be operational. Considering the promising properties, especially, their cost, hazard and risks of these DESs series, their introduction as safer electrolytes could represent an important challenge for the realization of environmentally friendly EDLCs operating at high temperature [3].



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Dual-Barrel Conductance Micropipet as a New Approach to the Study of Local Interfacial Ionic Fluxes and Dissolution Processes

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Ionic fluxes and dissolution processes are of ubiquitous importance across many areas of natural science, including electrochemistry and corrosion. Herein, we present a new dual-barrel micropipet conductance cell, capable of measuring interfacial ion fluxes on unprecedented time scales and spacial resolution [1]. A dual-barrel theta pipet pulled to a sharp point and filled with a low concentration of electrolyte can be used as a mobile conductance cell when a quasi-reference counter electrode is inserted into each of the barrels and a bias is applied to induce an ion conductance current. Lowering the pipet towards a surface of interest lands the meniscus and quantitative information about ion fluxes, dissolution and growth rates can be extracted from the current-time transients recorded during the experiment in combination with a finite element method model of the system. Fast kinetics can be measured due to the inherently fast mass transport in the pipet, and multiple measurements can be made quickly and easily on the same pristine surface by moving the pipet to a new area of the surface. The technique can be applied to a number of different materials and is illustrated herein using crystal dissolution processes (Figure). This project has been funded by the European Research Council (ERC-2009-AdG247143-QUANTIF).

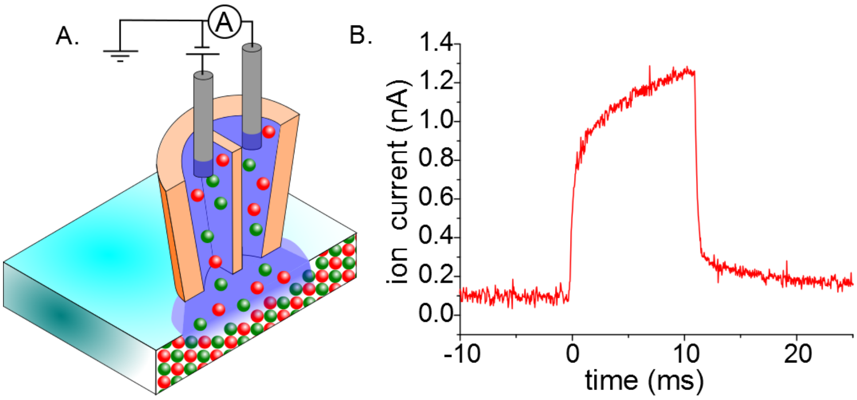

Figure. A. Meniscus contact of a conductance micropipet with a dissolving surface. B. Typical current-time transient obtained for dissolution with the meniscus is in contact with the surface for 10 ms.

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Direct bioelectrocatalysis of NADH oxidation by *Escherichia coli* flavohemoglobin at promoter-modified electrodes

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Over 400 NAD(P)$^+$-dependent dehydrogenases use their soluble cofactor as electron acceptor recycling the enzyme after reaction with the substrate; these biocatalytic reactions are widely used in electrochemical biosensors[1]. However, direct electrochemical regeneration of NAD$^+$ via oxidation of NADH occurs at bare electrodes (platinum and carbon) with high overpotentials and finally causes electrode fouling. Several attempts have been made to reduce the overpotential of this reaction by electroenzymatic oxidation of NADH[1,2]. In the current work we demonstrate the ability of *Escherichia coli* flavohemoglobin (HMP) to bioelectrocatalyticaly oxidise NADH without any mediators. HMP contains one heme and one FAD prosthetic groups. At the later the electrochemical NADH redox transformation may occur similarly to shown with diaphorase or FAD stabilised by a polymer[3, 4]. Here we show that proper orientation of HMP at the promoter modified electrode enables direct electronic communication between the electrode and heme domain of HMP and further oxidation of NADH at FAD active site via internal electron transfer (ET) reaction (Figure 1). The obtained results are of particular importance both for fundamental studies of ET in complex enzymes and development of NAD-dependent bioelectrodes for clinically important analytes.

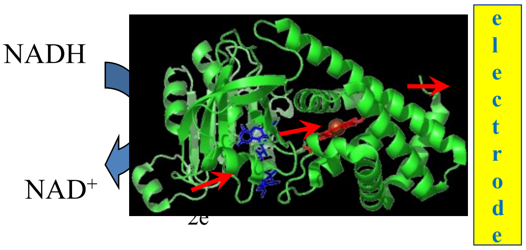

Figure 1. Schematic representaion of bioelectrocatalysis of HMP at the electrode surface.

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Controlling Aqueous Atom Transfer Radical Polymerization

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Aqueous controlled radical polymerization is a powerful technique for the development of water-soluble polymers, for potential biomedical and pharmaceutical applications.[1] Unfortunately, however, full application of atom transfer radical polymerization (ATRP) in water has so far been limited by a poor level of control on polymer growth.

The mechanism of ATRP is well known (Fig. 1) and in aprotic solvents $K_{\mathrm{ATRP}} = k_{\mathrm{act}}/k_{\mathrm{deact}} \leq 10^{-4}$, allowing suppression of radical-radical termination reactions. Conversely, in aqueous environments, the catalysts are highly active ($K_{\mathrm{ATRP}} \sim 1$) and are involved in a series of competitive reactions that can undermine their efficiency. Moreover, pH is a new fundamental variable that has to be considered.

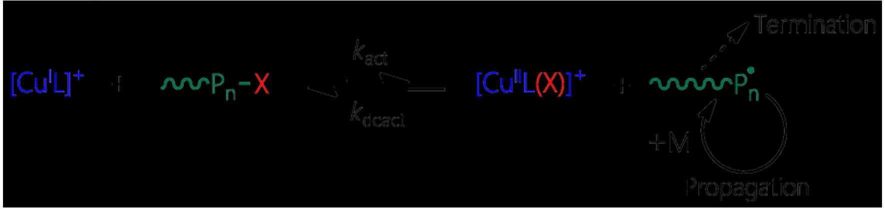

Fig. 1: ATRP mechanism.

To understand better the mechanism of aqueous ATRP, with particular attention to the reasons for loss of control, we have systematically investigated three of the most used copper-amine catalysts (CuL, with L = PMDETA, TPMA and $\mathrm{Me_6TREN}$), from both thermodynamic and kinetic points of view. The process was investigated both in pure water and in water/monomer mixtures, using poly(ethylene glycol) methacrylate, poly(ethylene glycol) acrylate and poly(N-isopropylacrylamide), which are among the most commonly used monomers in water.

Overall the results obtained in this study allow defining a set of guidelines that have been used to conduct several efficient aqueous *e*ATRP (electrochemically mediated ATRP)[2] reactions. In conclusion, to gain control and capacity of prediction on polymer growth, the following aspects must be taken into account: accurate pH control, proper halide ions concentration, use of ligands that stabilize $\mathrm{Cu^I}$ and suitable polymerization initiators. All these parameters, including working electrode potentials, need to be appropriately adjusted for each monomer.

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Temperature-Induced Changeover in the Electron Transfer Kinetics for an Adsorbed Thermophilic Plastocyanin

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Several strategies have been proposed to elucidate the factors that determine the rate of electron exchange between proteins and electrodes. Among them stand out the analysis of the effects of protein-electrode distance, temperature or solution viscosity on the electron transfer (ET) rate constant [1-4]. These studies have revealed two distinct kinetic regimes, in which ET rates are either independent on the protein-electrode distance, characteristic of a non-adiabatic ET mechanism, or exponentially dependent on the protein-electrode distance, where ET rate is proposed to be controlled by a frictional mechanism or by a gating step.

The transition between the two kinetic regimes has been demonstrated by varying systematically the strength of the electronic coupling between electrode and protein by using molecular spacers of variable composition and length. Moreover, each kinetic regime can be further characterized by a distinct dependence of the ET rate constant with temperature and solution viscosity, though temperature or viscosity driven mechanism transitions have not yet been reported for metallo-proteins.

Herein, we report on the effect of a broad variation of temperature (0 -90 ºC) on the electron transfer kinetics of the thermophilic blue copper protein Plastocyanin from *Phormidium laminosum* (Pc-PhoWT) immobilized on gold electrodes modified with 1,ω-alkanedithiol self-assembled monolayers, by determining the standard electron transfer rate constant under variable conditions of protein-electrode distance and solution viscosity. For either thin or thick SAMs, the electron transfer regime remains invariant with temperature; whereas for the 1,11-undecanethiol SAM of intermediate chain-length, a kinetic regime changeover from a gated or friction-controlled mechanism at low temperature (0 - 30º C) to a non-adiabatic mechanism above 40 ºC is observed. To the best of our knowledge, this is the first time a thermal-induced transition between these two kinetic regimes is reported for a metalloprotein.

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All-solid state supercapacitors based on a binary mixture of Ionic liquids & Polymeric Ionic liquid

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Supercapacitors (SCs) are electrochemical energy storage devices that meet requirements for applications where high power values are needed. Different liquid electrolytes have been used for SCs. However, SCs with these electrolytes raised critical concerns due to leakage, safety issues and the difficulty to manufacture flexible devices. Recently, different gel or polymer electrolytes have been synthesized by embedding ILs in polymer matrix and electrochemically characterized with solid state SCs [1,2]. Here, we report the synthesis and electrochemical performance of a binary mixture of polymer electrolyte prepared by blending a polymeric ionic liquid (poly(diallyldimethylammonium TFSI)) with their ionic liquid counterpart N-butyl-N-methylpyrrolidinium bis(trifluoromethanesulfonyl)imide ($PYR_{14}TFSI$). This polymer electrolyte was assembled for the first time in all-solid state SCs and the preliminary results show a specific capacitance (Cam) of 140 Fg^{-1} and real energy (E_{real}) about 50 $WhKg^{-1}$ at 1$mAcm^{-2}$ and 60ºC (Fig.1). Although the performance decreased significantly at higher discharge current, probably due to its high resistance, the synthesized polymeric ionic liquid is still promising for solid-state-electrolyte-based SCs, especially when the overall advantages of the solid-state electrolytes over liquid ones are considered.

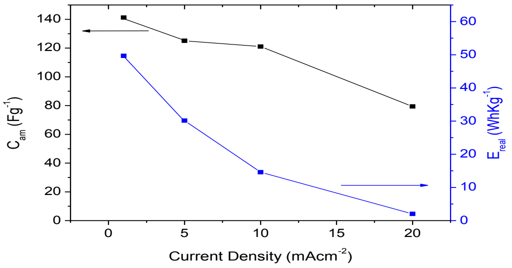

Figure 1. C_{am} and E_{real} of SCs with IL-based polymer electrolytes. Data obtained from charge-discharge experiments from 0 V to 3.5 V at 60ºC.

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Membrane Permeability: Insights from Liquid-Liquid Electrochemistry

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Liquid-liquid electrochemical methods can be readily used to measure the thermodynamics and kinetics of ion transfer across membrane-mimetic phases [1].
An important component of the drug discovery process is the assessment of such membrane transfer processes (permeability): a candidate drug is useless unless its permeability is reasonably high. This need has led to the development of various assays for permeability. However, amongst the pharmacokinetics community, it is generally held that ion transfer across membrane mimetic phases accounts for a negligible fraction of overall drug transfer (pH-partition hypothesis). Here we discuss our recent work [2,3] on the development of a rotating-diffusion type cell, which has enabled permeability of highly lipophilic drugs to be evaluated. We will also discuss our recent work where we have explicitly used liquid-liquid electrochemical methods to assess ion permeability in the case of membranes used as *in vitro* analogues of biological membranes [4-6]: the results of these studies contradict the widely used assumptions of the pH-partition hypothesis.

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Printable Electrochemistry for Analysis of Environmental Significance

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Recently, we name the Printable Electrochemistry for the development field of printable electrochemical devices [1-7]. In the paper, I focus on several printable electrochemical devices such as follows.

(1) Algal biosensor for detection of environmental toxic compounds [1].

A screen-printing algal biosensor was fabricated for evaluation of toxicity of chemicals. An algal ink was prepared by mixing unicellular microalga Chlorella vulgaris cells, carbon nanotubes and sodium alginate solution. The algal ink was immobilized directly on a screen-printed carbon electrode surface using screen printing technique (Fig. 1). Photosynthetically generated oxygen of the immobilized algae was monitored amperometically. The disposable algal biosensor was found to be very useful for evaluation of toxicity of chemicals in environmental water rapidly.

(2) Screen-printed micro-electrochemical cell [2].

The authors developed a novel method for fabrication of micro-electrochemical cell by screen-printing. The authors fabricated a three-electrode type micro-electrochemical cell and investigated its performance under non-flow and flow conditions (Fig. 2).

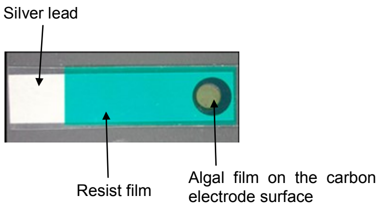

Fig. 1 Photograph of the screen-printed algal biosensor.

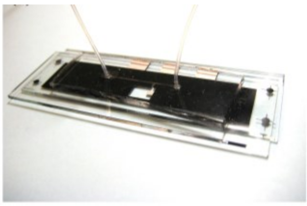

Fig. 2 Photograph of the screen-printed micro-electrochemical cell.

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New carbon electrodes for neurotransmitter detection: nanotubes, nanopetals and nanopipettes

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Carbon nanomaterials have potentially useful electrochemical properties, including fast electron transfer kinetics and high surface areas. Carbon nanotubes have been used in sensors, particularly after acid purification techniques, which result in oxidative functional groups that serve as adsorption sites for neurotransmitters. The use of CNTs in fabricating larger electrodes has been widely demonstrated but the reproducible production of small, sensitive CNT-based sensors is not as well studied. My lab has investigated several different techniques for making CNT-based microelectrodes and tested their response using fast-scan cyclic voltammetry. We have dip-coated carbon-fiber microelectrodes, grown aligned CNTs on substrates with chemical vapor deposition, as well as used CNT yarns and fibers as microelectrodes. In general, alignment of CNTs and chemical functional groups determine the sensitivity of the electrode for neurotransmitters. Also, CNT yarns and fibers have different adsorption/desorption properties for dopamine that allow them to be used with higher temporal resolution without a decrease in sensitivity. Thus, CNT-based microelectrodes are advantageous as high temporal resolution electrochemical sensors for neurotransmitters.

Other types of carbon nanomaterials could be advantageous for microelectrode sensors. Growing aligned CNTs on substrates is challenging because it requires an even catalyst deposition. Our group has collaborated with Oak Ridge national lab to deposit a different type of edge plane graphene on surfaces, termed carbon nanopetals. These nanopetals can be formed with plasma-enhanced CVD and do not require a catalyst. Thus, their surface coverage is greater than CNTs covering cylindrical substrates. Preliminary electrochemical tests reveal that they have good electrochemical properties that depend on the metal substrate they are deposited onto.

For small neuronal substrates, a nanoelectrode would be ideal. However, it must also be robust. In collaboration with Haim Bau’s group at UPenn, we have tested carbon nanopipettes as nano-diameter electrodes. Pulled quartz micropipettes are placed in a CVD oven and carbon deposits preferentially on the inside of the micropipette. Conditions were optimized to seal the end and the quartz is then etched back to reveal a cylindrical carbon nanopipette. The carbon nanopipettes are useful for dopamine detection, especially in small species such as the fruit fly.

Overall, this talk will explore these new types of carbon as electrode materials for neurotransmitters. The ease of making electrodes will be compared, as will the electrochemical properties and implications for in vivo experiments.

Novel synthetic route for the preparation of nanosegregated Pt alloy catalysts for oxygen reduction reaction

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The ORR activity of Pt alloys depends on particle size, shape and composition, which are strongly affected by the preparation methodology. In general, carbon supported PtM alloy catalysts have been prepared by deposition of the transition metal precursors on Pt/C, followed by a thermal treatment at high temperature, usually above 700°C [1]. This annealing process allows surface segregation of Pt alloys by solid diffusion, resulting in Pt-rich surfaces. However, such high temperature treatments also lead to undesired sintering and aggregation of metal particles, which results in a decrease of the active surface area of the catalyst. To avoid this problem, we report a new synthetic process of silica encapsulation to inhibit the sintering of Pt_3Co_1 alloy particles during heat treatment at high temperature. Each Pt alloy nanoparticle was encapsulated by a silica layer and then supported on carbon. After the heat treatment, the silica layer was removed. The overall process in detail is composed of five steps, as shown in Fig. 1. The silica layer will be act as a physical barrier to prevent direct contact of the Pt_3Co_1 core with adjacent particles. Therefore, this process is expected to enable the synthesis of Pt_3Co_1 alloy nanoparticles with a Pt-rich surface. This process is also expected to enable these alloy nanoparticles to be highly dispersed on a carbon support.

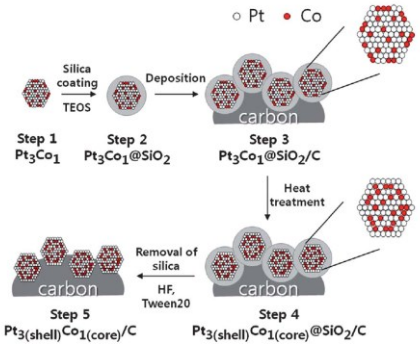

Fig 1. Schematic illustration of the synthesis of the Pt_3Co_1/C catalyst using the silica encapsulation process

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Electrochemical Gate-effect on Single Molecular Junction Conductance

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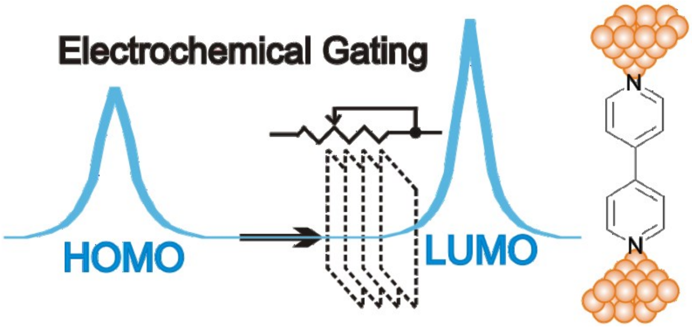
We report a complete study of electrochemical gating effect on single-molecule conductance measurements of 4,4'-bipyridine (44BPy) bridging two Au electrodes using the scanning tunneling microscopy-based break junction (STM-BJ) technique under electrochemical (aqueous electrolyte) conditions[1] and through ab initio simulations based on density functional theory. The results in aqueous electrolyte showed three sets of conductance states (high (H), medium (M), and low (L)), and the origin of these three conductance states were attributed to the following configurations of the molecule: 1. parallel double junction (high (H)), 2. one 44BPy molecule bridged between two electrode with a tilt angle (middle (M)) and 3. the molecule is bound vertically to the apex atoms of the electrodes (low (L)). These processes take place sequentially on the surface of the two bridging electrodes during the retraction process.

Having understood the origin of the three conductance states 44Bpy, we scrutinized the electrochemical gating effect on 44BPy molecular junction conductance. Electrochemical gating aligns molecular frontier orbitals with the electrode Fermi-level, switching the molecule from an *off* resonance state to "partial" resonance upon moving to negative sample potentials. This switching increased the three conductance features of 44BPy molecular junctions by more than one order of magnitude via shifting to negative electrochemical potential. Additionally, we have also demonstrated the effect of pH on the 44BPy single molecular junction conductances.



Schematic illustration of Fermi level energy shift using 'Electrochemical gating' approach.

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In situ SERS Observation on Li Rich High Capacity Cathode Material, $Li[Ni_xLi_{(1-2x)/3}Mn_{(2-x)/3}]O_2$

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The use of surfaced-enhanced Raman spectroscopy (SERS) in lithium-ion battery and Li-O_2 battery studies has proven to be a powerful tool for observing the solid electrolyte interphase (SEI) growth, on the electrode's surface, that is crucial in determining the battery's electrochemical performance. However, until now, studies using SERS to observe SEI growth have been restricted to roughened Au or Ag electrodes and have given little consideration to electrode material effects. Here we have used shell-isolated nanoparticle-enhanced Raman spectroscopy (SHINERS) to investigate SEI layers on Li-rich oxide cathodes and observe the SEI formation directly on the surface of the electrodes during charge and discharge. Understanding the effects of oxygen activating reactions on the cathode's surface during electrochemical cycling can lead to improvements in stability and performance. Here, we demonstrate the direct observation of Li_2O formation during the extended plateau and discuss the consequences of its formation on the cathode and anode[1]. The formation of Li_2O on the cathode leads to the formation of species related to the generation of H_2O together with LiOH and to changes within the electrolyte, which eventually result in diminished performance. Protection from, or mitigation of, such devastating surface reactions on both electrodes will be necessary to help realize the potential of high capacity cathode materials (270 $mAhg^{-1}$ versus 140 $mAhg^{-1}$ for $LiCoO_2$) for practical applications.

Keywords:
Lithium ion batteries, SERS, SEI growth, Li-rich oxide cathodes, Li_2O formation

Reference

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Engineering of TiO_2 Photoanode for Dye-Sensitized Solar Cell

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Dye-sensitized solar cell (DSC, Graetzel cell) has the advantages of low cost, simple preparation procedure and relatively high energy conversion efficiencies[1]. Among others the optimization of the Graetzel cells focuses on the morphological engineering of the TiO_2 photoanode requiring preparation of transparent layers with well developed crystals and high surface area. To meet these demands, hierarchical multimodal TiO_2 layers were designed and prepared. Combined TiO_2 layers could provide rapid electron transportation, large surface area for adsorption of dye molecules, close electrical contact with the redox electrolyte and have been considered as a favorable material for the photoanode application in DSC. Various combinations of multilayer mesoporous TiO_2 films with large surface area, fibrous nanocrystalline TiO_2 layers and nanoparticular anatase layers with well developed crystallinity sensitized with different dye sensitizers (N719, N945, C101) were tested as photoanodes in DSCs[2, 3]. The performance of particular devices is correlated with the structure of their photoanodes. Performance of the DSC with 2.5 µm bimodal TiO_2 photoanode reached 5.35%. Due to the porous structure of TiO_2 films the electrolyte easily penetrates to the FTO surface. The charge recombination due to this contact causes non-negligible loss of efficiency in DSCs. To avoid the recapture of the photoinjected electrons with the I_3^- ions the coverage of FTO with a compact TiO_2 blocking layer was found to be effective. Recently, the preparation of exceptionally dense TiO_2 films by dip-coating from a sol containing poly(hexafluorobutyl methacrylate) has been developed[4]. The parameters of these compact layers are presently optimized and their blocking properties evaluated by cyclic voltammetry and impedance spectroscopy.

Acknowledgement: This work was supported by the Grant Agency of the Czech Republic (contract No. P108/12/0814).

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Enhancement of Electrochemical Capacitor Performance by Understanding its Impedance Response – Theoretical and Experimental Study

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Hybrid electrochemical capacitors merge the advantages of Li-ion batteries (high energy density, low self-discharge) and electrochemical capacitors (high power density and long cycle-life). Contrarily to traditional electrochemical capacitors, the energy storage process is attributed to electrostatic attraction of ions only on one electrode – faradaic interactions of Li insertion/de-insertion occurs on another one.

The system mentioned in this study is composed of graphite electrode pre-intercalated by Li ions, preserving high operating voltage (4.2 V) and activated carbon electrode responsible for capacitive charge storage. The electrolyte was 1 mol L^{-1} $LiPF_6$ dissolved in ethylene carbonate/diethyl carbonate mixture (1:1 mass ratio). Apart from conventional electrochemical techniques usually applied for evaluation of the investigated system, the electrochemical impedance spectroscopy as typical interfacial technique seems to be one of the most useful and sensitive ones to determine the influence of physicochemical properties of the electrodes on the electrochemical performance of hybrid capacitor, in terms of its bottlenecks related with moderate kinetics of charge transfer, ions diffusion into electrode bulk and ionic current flux thorough the membrane. In order to attribute the individual features of the electrode, firstly, Li|Li, graphite|graphite and activated carbon|activated carbon systems were considered, tested and described.

Several parameters such as reaction rate, exchange currents for positive and negative electrodes, transference numbers for ions contributing in charge storage process as well as state of charge (SOC) of graphite electrode were considered. On the other hand, we took into account such parameters as thickness of the electrode material and separator, initial concentration of the electrolyte, diffusion coefficient of ions in the electrode and the Solid Electrolyte Interphase (SEI) resistance. Major part of them was estimated experimentally, compared with the literature data and finally combined in analytical model. Apart from analytical model, the system was described by Equivalent Circuits Method (fitted by randomisation and Levenberg-Marquardt algorithm). Briefly, we found that intercalated electrode is the most influencing one in the considered system: there is an optimal state of charge (SOC) for negative electrode preserving good power performance and cycle life, the consumption of Li-ions from electrolyte is negligible (low concentration gradient) and PF_6^- anions are the main charge carrier in the system. It appears that even porosity and separator thickness might strongly affect the power performance of the capacitor.

In order to validate proposed approach, all theoretical considerations and computations are compared with experimental results.

Aging Diagnosis of $Li_4Ti_5O_{12}$/$LiFePO_4$ Batteries

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Lithium-ion batteries aging is of major concern for electric transportation applications. Degradation of the electrodes can originate from: (i) irreversible loss of active material, (ii) parasitic reactions leading to a loss of cyclable lithium or electrons, (iii) increase in resistance due to passive films formation and loss of contact [1].

After cycling, lab-scale $Li_4Ti_5O_{12}$/$LiFePO_4$ cells exhibited capacity fade. In order to understand aging phenomena, they were disassembled and the recovered electrodes were analyzed using electrochemistry, electron microscopy, XRD and MAS-NMR. Positive and negative electrodes show no loss in active material, no change in structure and no change in electrochemical activity: no irreversible degradation is evidenced. Lithium stoichiometry, estimated by both XRD and electrochemistry, is unexpectedly low in the positive electrode when the aging is stopped at full discharge. That indicates a loss of cyclable lithium or electrons leading to cell balancing evolution.

MAS-NMR evidenced a rich surface chemistry on both electrodes and allowed a quantitative characterization using an original calibration method (see Fig. 1) [2]. Correlations are drawn between the quantity of diamagnetic lithiated species deposited on the surface of both electrodes (mainly LiF) and the amount of cyclable lithium or electrons lost by the cell. This study attempts to develop a parasitic reaction pathway that explains the loss of cyclable lithium or electrons.

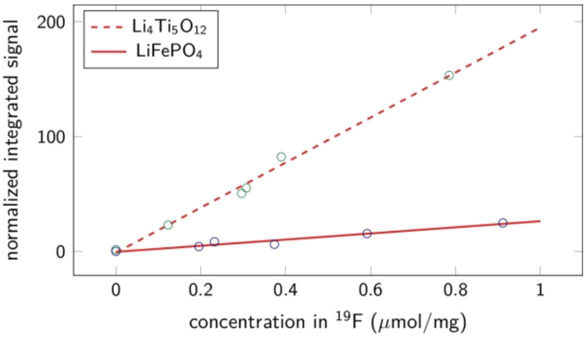

Fig. 1. Calibration of NMR-MAS 19F signal with LiF-electrode mixtures.

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Perovskite-Based Mesoscopic Solar Cells – Industrial vs Academic Challenges

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Perovskite-based mesoscopic and other hybrid cells have attracted unprecedented academic and industrial interest. Drivers for this development are the prospects of device efficiencies on par with or potentially higher than with other thin film photovoltaic technologies such as CIGS or CdTe. In contrast to the latter systems, which require high vacuum processing, most processes for perovskite PV cells can be accomplished at the bench top level with relatively simple equipment.

Despite this very promising outset, there are a number of challenges which need to be resolved at the industrial level before perovskite devices can enjoy a commercial future. Light absorbers based on environmentally more compatible materials than lead would open up the widest commercial avenues to applications, including consumer markets. For scale-up from the laboratory to the production scale, methods such as spin coating or vapour deposition need to be substituted by high-throughput techniques such as various printing and coating techniques. Product durability under harsh environmental conditions in the field is expected to depend not only on the thermal and photochemical stability of a number of materials such as the light absorbers and the hole transport material, but also on the sealing and encapsulation technology.

Performance of state-of-the-art MALI-based devices including strip cells will be presented and the key parameters contributing to cell efficiency highlighted. An effective hole blocking layer at the interface between FTO and the hole transport material is important for maximising cell voltage. For academic cells the most effective hole blocking layers are based on ALD or on spray pyrolysis involving many passes while Dyesol has developed an industrially scalable printing technique. A novel electrochemical method will be presented to characterise the quality and rectifying properties of hole blocking layers, while still allowing for sufficient electron transport to enable effective current collection. The current status in device durability will be presented. Finally, alternatives to MALI will be discussed including lead-free perovskite light absorbers.

In vivo Dopamine Detection with Minimal Fouling at Hydrogenated Conical-tip Carbon Electrodes

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In this work, physically small conical-tip carbon electrodes (~2-5 μm diameter and 4 μm axial length) were initially hydrogenated to exhibit fouling resistance before they were applied to the detection of dopamine *in vivo*. Dopamine is a neurotransmitter involved in several brain processes, as well as being implicated in conditions such as Parkinson's disease, schizophrenia and addiction. Therefore, detection of dopamine is of interest to electroanalytical chemists and neurochemists alike. Very often, a major problem encountered during electrochemical detection of dopamine *in vivo* is electrode fouling caused by adsorption of amphiphilic, high molecular weight proteins, peptides and lipids present in extracellular fluid, which prevents dopamine from making direct contact with an electrode for electron transfer reaction. This leads to a transient loss of dopamine detection signal.

In our laboratory, physically small conical-tip carbon electrodes suitable for dopamine detection *in vivo* were initially constructed by depositing carbon inside and on the shank of capillaries already pulled down to a fine tip.[1,2] The carbon was then hydrogenated by a radio frequency plasma[2] and, more recently, an *n*-butyl silane reduction method, to yield a hydrophobic sp^3 type carbon surface to deter electrode fouling. Following a series of surface characterisation using atomic force microscopy, Raman spectroscopy and X-ray photoelectron spectroscopy, electrochemistry of several redox markers at these hydrogenated carbon electrodes was also studied. The effectiveness of hydrogenated carbon electrodes against fouling was then evaluated during dopamine detection in rat brain.

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Electrochemical Surface-Enhanced Raman Spectroscopy: from Core-shell Nanoparticles to Single Crystal Surfaces, Active Sites and Jellium Model

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The first paper about electrochemical surface-enhanced Raman scattering (EC-SERS) was published by Martin Fleischmann and his coworkers in 1974. [1] In the past four decades, SERS has gone through a tortuous pathway to develop into a powerful diagnostic technique because the versatility of SERS has been questioned frequently. Only three coinage metals (Au, Ag and Cu) and alkali metals can provide the huge enhancement (with the average enhancement factor up to 106), which has limited the breadth of its practical applications. Moreover, it has been very difficult to probe molecules adsorbed at atomically-flat single-crystal surfaces that cannot effectively support surface plasmon resonance (SPR).

Based on the fact that SERS is nanostructure- and SPR-enhancement phenomenon, we have utilized a 'borrowing SERS activity' strategy and rationally designed various nanostructures to break the limitation of materials and morphology generalities. [1-3] In 2010 we have developed a new operation mode different from the contact mode of conventional SERS and non-contact mode of TERS. It is named as Shelled-Isolated Nanoparticle-Enhanced Raman Spectroscopy (SHINERS) [3]. High-quality Raman spectra were obtained on various molecules adsorbed at Pt, Au and Rh single-crystal surfaces and from Si surfaces with hydrogen monolayers.

Very recently we expanded the capability of SERS characterization from surface adsorption to reaction intermediates, reaction active sites and the electronic jellium model. For instance, we utilized electron-enhanced Raman spectroscopy of bulk solution, which uses femtosecond Raman spectroscopy, and adsorbed hydrogen and molecules as the atomic and molecular ruler to measure the potential dependent length of Jellium electrons penetrated from various electrodes to electrolyte solution. Finally the future development of EC-SERS will be discussed briefly.

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Electrochemical Study of Ion Transfer at Nanoscale Liquid/Liquid Interface Arrays

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Electrochemistry at the interface between two immiscible electrolyte solutions (ITIES) has attracted increasing interest for both mechanistic study of ion-transfer reactions and sensing applications for various ion species, ranging from inorganic ions to organic compounds [1]. Since the pioneering work of Taylor and Girault, electrochemistry at miniaturized ITIES has been of special interest due to the enhanced mass transport and the reduced interfacial capacitance [2]. Although great efforts have been made on investigation of microITIES created from micropipettes, microholes or microarrays, it is both challenging and promising to explore electrochemistry at nanoITIES [3], which may enable insights into the behavior of biomacromolecules at liquid/liquid interfaces and offer benefit for improvement in electroanalytical applications.

Recently, we employed silicon nitride nanoporous membranes to form nanoITIES arrays, and monitored the voltammetric and chronoamperometric response at such interfaces [4-6]. By comparison, the miniaturization of ITIES arrays from microscale to nanoscale led to increased sensitivity for electrochemical detection of ions and overlapped diffusion zones at adjacent interfaces. Other interesting features of voltammetry at nanoITIES include the observation of current fluctuations associated with the ion transfer across the interface, and a rise in diffusion current instead of a limiting current plateau as observed at the microITIES arrays. It is suggested that the ion transfer process has a significant effect on the nanoscale liquid/liquid interface, thus rendering unexpected electrochemical signals. Further modification of the nanoITIES and analysis of various ions are under investigation, which will be of importance for the development of chemical and biochemical sensing platforms.

Acknowledgements
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Elimination Voltammetry for the Future

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Electrochemical techniques have undergone many important developments conditioned by a better understanding of electrode processes and improvements in instrumentation, which have allowed faster measurements to be made under better-controlled conditions [1]. In spite of their fast and perspective development some drawbacks persist. The contribution presents an interesting solution for addressing the major shortcomings of linear sweep and sometimes also of square wave voltammetry (low sensitivity, high proportion of capacitive current component, and skewing of overlapping signals) in the form of our elimination voltammetry [2]. Although this method was originally called elimination voltammetry with linear scan (EVLS), I suggest the term elimination procedure (EP) because the elimination principle can be used not only in linear sweep voltammetry but also in square wave voltammetry. Based on the different dependence of the particular currents of which the total voltammetric current is composed (i.e. diffusion, charging, kinetics, etc.) on scan rate, the EP is capable of eliminating or conserving some chosen current components. The voltammetric results are improved in both aspects, the sensitivity increase and the selectivity improvement. Successful applications of EP are presented on the electroanalysis of oligonucleotides and their components at unmodified and modified carbon electrodes by metallic nanoparticles. EP is a highly sensitive technique for the analysis of electroactive substances which are adsorbed on the electrode surface and for the analysis of electrode surfaces. The advantages of EP consist in the ability: (a) to detect the processes hidden in the predominant current, such as the discharge of the supporting electrolyte, (b) to increase the current sensitivity by at least one order of magnitude, (c) to determine the charge transfer coefficient, and (d) to detect the chemical reaction preceding the electron transfer. Thus, the EP offers a new tool contributing to a better understanding of basic electrochemical processes on the electrode surface, and one which is capable of markedly improving the sensitivity of voltammetric assays.

Acknowledgement

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Protein Electrochemistry Based on Amino Acid Residues: Theory and Medical Application

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Proteins have been the subject of intense interest from the very first steps of the electrochemistry and continue to be one of the favorite molecules of electrochemists until now. In 1980 two independent groups, of V. Bradec [1] and of J. A. Reynaud [2], demonstrated for the first time direct oxidation of proteins on solid electrodes as generated by their amino acid residues. At present there are lot of papers about amino acid redox activity on different electrode materials, however protein electrochemistry was not demonstrated in the majority of cases in the same conditions. Electrooxidation of proteins due to Tyr, Trp, Cys amino acid residues was shown on carbon screen printed electrodes (SPE). It is irreversible pH-dependent process. It was found based on 3D-models of protein molecules that protein electrochemical signal is proportional to the surface density of Tyr, Trp and Cys residues, but not to the amount of Tyr, Trp and Cys in the amino acid sequence. Also, it is possible to suggest that (i) proteins would not undergo denaturation in the course of electrochemical experiments at neutral pH and (ii) proper oriented surface amino acid residues take the major part in the protein oxidation signal. Linear calibration curves for amino acids and proteins were obtained in the different coordinates: of current-amino acid molar concentration and of current-logarithm of protein molar concentration. [3] The electrochemical activity of several commercially available and most-used proteins was examined on carbon SPE to find the quantitative relationships between electrochemical signal and protein structure for further biomedical application. The Alzheimer's disease neuropeptide amyloid-beta contained one Tyr residue was used as a model for study of protein-metal ion complexing and protein aggregation. Therefore, the electrochemical method may serve as a simple, rapid, label-free approach for protein analysis, for the study of protein-protein and protein-ligand interactions as well as for registration of post-translational modification. Amino acid electrochemistry opens up new possibilities to biosensor constructions and to the monitoring of life processes.

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Impurity effects on the oxygen reduction reaction (ORR)

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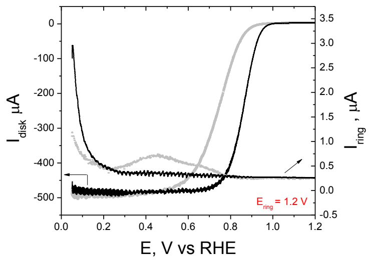
The oxygen reduction reaction (ORR) is one of the most important electrochemical processes because of its role in fuel cells[1] and metal-air batteries[2]. The mechanism of the ORR has been found to be sensitive not only to the nature of the electrocatalyst and its microstructure, but also to the presence of adsorbed species on the surface[3, 4]. In particular, trace amounts of halides can interfere with the 4-electron reduction of O_2, and promote instead, the 2-electron reduction to peroxide. This phenomenon is illustrated in Fig. 1, which shows polarization curves recorded in O_2 saturated 0.1 M $HClO_4$ solutions either neat (black) or containing 10 μM NaCl (grey). This contribution will describe a new method to determine quantitative correlations between the extent of chloride adsorption, the applied potential and the fraction of the total current associated with hydrogen peroxide generation. More specifically, experiments are performed by stepping the potential of the disk of a rotating ring-disk electrode from a value at which no halide adsorption occurs to a value at which the latter will proceed under strict diffusion control, while monitoring the currents associated with O_2 reduction at the disk and peroxide oxidation at the ring. Hence, assuming no kinetic hindrances the coverage of the halide well before saturation becomes proportional to time. An illustration of the type of data generated by this approach is displayed in Fig. 2.



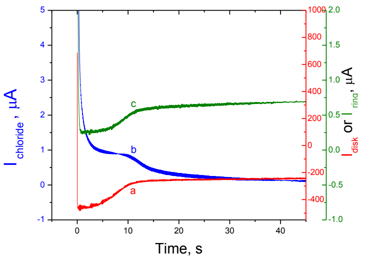


Fig.1.A Polarization curves recorded at a scan rate ν = 10 mV/s, a rotation rate ω = 400 for a Pt disk electrode in oxygen saturated 0.1 M $HClO_4$ in the absence (black) and in the presence of 10 μM (gray) NaCl. The corresponding ring currents when the ring was polarized at E_{ring}= 1.2 V are shown in the right ordinate.

Fig.1.B. Chronoamperograms recorded in 0.1 M $HClO_4$ with 10μM NaCl at ω= 400 rpm starting from E_{ini}= 0.05 V to 0.7, in the presence (a) and absence (b) of oxygen. The curve "c" is the ring current at E_{ring}= 1.2 V.

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Determining Particle Size Effect on Electrochemical Behavior of Nanoparticle Arrays Prepared by Laser Dewetting

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Many methods currently exist for the formation of metallic nanoparticles of well-defined size. However, the formation of ordered arrays of nanoparticles (with well-defined spacing on a suitable template) on large scales (cm^2) is still a key challenge in nanotechnology.[1] To obtain ordered nanoparticle arrays, "top down" approaches, such as lithography, are typically used. However, these approaches are very time consuming and require costly and specialized instrumentation. In recent work, highly ordered "dimpled" Ta templates, formed by the electrochemical anodization of Ta, were used to form ordered arrays of Au nanoparticles via sputter deposition and thermal dewetting.[2] Although uniform arrays (total size ~1 cm^2) of Au nanoparticles were obtained using this method, thermal deformation of the Ta template when heated above ~700 °C limits the application of this technique to low melting point metals (such as Au and Ag, which will dewet the Ta surface when heated to 500 °C).

To obtain nanoparticle arrays of higher melting point metals, such as Pt, Pd and Ir, pulsed laser-induced dewetting (PLiD) was investigated, initially using Au to compare with thermal dewetting as a method of forming nanoparticle arrays. PLiD, which causes only local heating, confined to the surface of the metal film/Ta substrate, was performed under high vacuum to further avoid deformation/oxidation of the Ta substrate. This approach resulted in excellent control of the size of the Au nanoparticles, which were more than an order of magnitude smaller than other studies using PLiD on pre-patterned templates.[3,4]

The Au nanoparticles arrays formed using both of these methods were found to be electrochemically addressable during cyclic voltammetry (CV) experiments in 0.5 M H_2SO_4. The electrochemical characteristics (e.g., activity, stability) of these nanoparticles, as a function of their size and preparation method, will thus be presented.

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Diamond-based Biosensors for Monitoring Neurosecretion in Chromaffin Cells

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Exocytosis is an essential step for neurotransmission, allowing the synaptic vesicle content to be released into the extracellular space. Time course of vesicle fusion and quantal release of oxidizable neurotransmitter molecules are commonly detected by polarized carbon fiber electrodes (CFE), whose electrochemically active surface originates a transient oxidation current (amperometric spike, lasting tens of ms, hundreds pA). Taking advantage of diamond high-electrochemical activity, optical features and biocompatibility, we developed newly designed diamond-based biosensors to monitor catecholamine release with subcellular resolution (high-density arrays) or detect exocytosis from several cells simultaneously (low-density arrays). To this purpose, conductive diamond arrays were fabricated following two different approaches: *i)* growing synthetic thin-films of boron-doped diamond on insulating substrates (NCD-MEA) [1-3] or, *ii)* drawing sub-superficial conductive micro-paths in a synthetic single crystal, using deep ion beam lithography (μG-SCD) [4]. The most significant results achieved and future perspectives are presented.

With the aim of detecting quantal exocytotic events with subcellular resolution, a high-density array of boron-doped nanocrystalline diamond electrodes (NCD) was designed. Nine electrodes, arranged into a circular hole of 20 μm diameter, were grown by CVD on a sapphire substrate and then patterned by e-beam lithography and reactive ion etching [1, 5]. We found that the 9-Ch NCD-UMEA could adequately resolve amperometric spikes from subcellular areas as small as 12 μm^2 of a single chromaffin cell. We could identify subcellular zones of variable secretory activity associated to different frequency of release, while temporal and quantitative spike parameters were comparable among the secreting areas. Using the same NCD-on–Sapphire technology, we also fabricated and tested different low-density boron-doped NCD arrays (up to 16 electrodes of 20 μm diameter), targeted to detect secretory events from more cells simultaneously. Quantal release of catecholamines from different cells could be detected as well using a prototype microfabricated in single-crystal CVD diamond with an ion-beam lithographic process. The device is based on sub-superficial highly conductive graphitic micro-channels (resistivity ~mΩ·cm) embedded in the insulating diamond matrix.

Our results show unequivocally that diamond-based biosensors (NCD-MEA and μG-SCD) can resolve quantal secretory events from living chromaffin cells with excellent time resolution and sensitivity. New prototypes of increased spatial resolution and number of recording sites are under construction. Significant effort is made to improve the device transparency in order to use the microchips under confocal and TIRF microscopy.

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Spectroelectrochemical Synthesis of Gold Nanoparticles on Single Walled Carbon Nanotubes-Optically Transparent Electrodes

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Gold nanoparticles (AuNPs) have attracted great interest in chemistry due to their special and unique optical, electrical, chemical and catalytic properties. Moreover, the properties of AuNPs depend on their size and shape being very important to have a fine control on the synthesis of NPs [1].

For AuNPs synthesis, the chemical route have been widely studied, and controlling the ratio between the salt of gold, the reductive agent and the protective agent is relatively easy to obtain NPs with a fixed size and shape. Electrochemistry allows controlling the kind of NP electrosynthetized, by modulation of variables such as current/potential applied, electrodeposition time, and protective agent or gold concentration.

UV/Vis spectroelectrochemistry is a multiresponse analytical technique that combines the spectroscopy with the electrochemistry. Spectroelectrochemistry in normal configuration needs to use optically transparent electrodes (OTEs), allowing us to study the process that are taking place on the electrode surface. Our research group has developed new OTEs based on single-walled carbon nanotubes (SWCNT) [2].

Spectroelectrochemistry is useful for the electrosynthesis of AuNPs due to the special properties for these NPs, like the presence of the plasmon band [3].

In this work, AuNPs have been electrodeposited on these new SWCNT-OTEs, using galvanostatic and potentiostatic techniques. Spectroelectrochemistry has permitted us to control AuNP growth, obtaining *in-situ* information on the process. Thus, we have observed that plasmon band of the electrodeposited AuNPs depends strongly on the experimental conditions.

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Engendering Anion Resistance in Electrocatalysts and its Implications

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Enabling anion resistance for most supported metal catalysts, especially on noble metal nano-particles in acidic pH has been a subject of significant challenge in diverse fields such as phosphoric acid fuel cells, oxygen depolarized cathodes based electrolyzers in the context of HCl recovery (for chlorine generation) and regenerative electrodes (such as H_2) in energy storage (such as in H_2/Br_2 batteries). Tweaking noble metal nano-particles (such as Pt) by alloying or surface modifications for enabling greater selectivity have typically resulted in limited improvements in anion resistance. This presentation will showcase some recent improvements in designing active sites using transition metal nitrogen coordinated systems and multi-phase chalcogenides wherein complete selective (i.e., immunity towards anion poisoning) for associated charge transfer is rendered. Detailed electrochemical comparison with conventional supported noble metal nano-particles will be made to highlight selectivity. In addition to electrochemical data, spectroscopic evidence will be presented. The latter in particular will be presented using in situ synchrotron x-ray absorption spectroscopy (XAS). Here the conventional bulk averaged XANES and EXAFS spectroscopy will be further embellished by unique use of subtractive method referred to as 'Δ μ technique'. This specially designed subtractive technique using the near edge part of the spectra (x-ray absorption near edge spectra, XANES) possesses unprecedented ability to elucidate natured of adsorbed species on transition metals. Taking advantage of unique element specificity and the in situ and operando capability of the spectra, correlation to electrochemical data will be presented to highlight steady state electrocatalytic pathways as a function of various operating conditions and associated applications. Unique structural features of the active sites determined in situ using the extended part of the spectra (i.e., extended x-ray absorption spectra, EXAFS) will be shown to explain the complex nature of the rendered immunity towards anion adsorption.

Key anions highlighted in this presentation will cover di-hydrogen phosphate and halides (such as chlorides). Implications of such selectivity will be highlighted in selective cases with actual device based operational data.

Influences of the charge balance issue on the performances of asymmetric supercapacitors with a battery electrode: the $Ni(OH)_2$-activated carbon system

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Recently, a lot of investigations focus on extending the cell voltage in order to enlarge the specific energy of asymmetric supercapacitors. However, finding the suitable operation condition of this type supercapacitors especially for the system consisting of one battery-like electrode, which is vital for the long-term usage and safety concern, is still few [1,2]. Moreover, the enhanced specific energy of such a "capattery" has been found to come with the tradeoff in the specific power and cycle life [3]. Therefore, how to improve the capacitive performances of asymmetric supercapacitors with one battery-like electrode is of both practical and academic interests. Herein, we employ nickel hydroxide (denoted as $Ni(OH)_2$) and activated carbon (denoted as AC), two typical electrode materials widely investigated for the asymmetric supercapacitors but very different in electrochemical reversibility and capacitance rate-retention, as the typical example for testing our idea. Because of the significant difference in the electrochemical reversibility and capacitance rate-retention between $Ni(OH)_2$ and AC, it is not easy to achieve the charge-balanced condition between these two electrode materials at any charge-discharge rates. In this work, we try to figure out the important influences of cell voltage and current density in evaluating the individual charge of $Ni(OH)_2$ and AC on the capacitive performances (e.g., specific energy, specific power, and energy efficiency) of asymmetric capacitors.

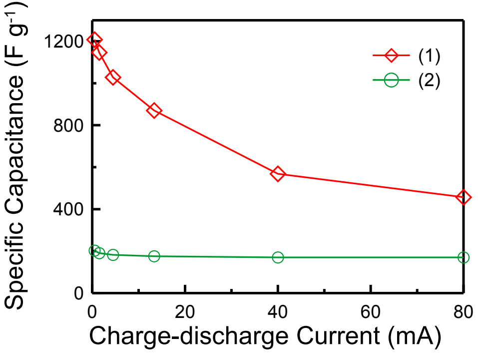

Fig. 1 The specific capacitance vs. the current density of charge-discharge for (1) $Ni(OH)_2$ and (2) AC in 6 M KOH.

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Dynamics of Sulfur/Polysulfides Dissolution and Re-deposition in Li-S Battery Revealed by In-Operando Transmission X-ray Microscopy

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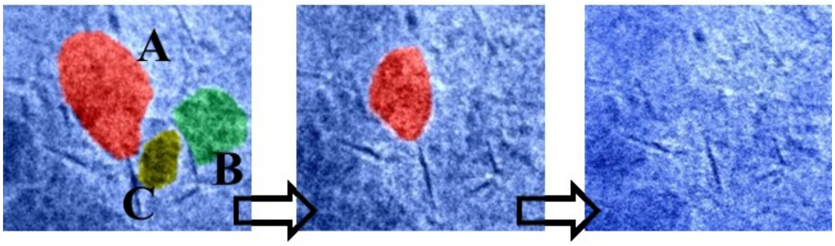
Lithium-sulfur (Li-S) battery is a promising rechargeable battery system that has both high theoretical capacity and energy density. Moreover, sulfur (S) is inexpensive and nontoxic, making Li-S suitable for large-scale energy storage applications. Sulfur (S_8) lithiation during the operation of Li-S battery is a multi-step electrochemical process that involves different lithium polysulfide (Li_2S_n, $1 \leqq n \leqq 8$) intermediates. The long-chain polysulfides (PSs) are highly soluble in the aprotic organic electrolyte. There has been a broad consensus that polysulfide dissolution is strongly linked to the key performance indexes, such as columbic efficiency, self-discharge, capacity fading and etc., of Li-S batteries. Re-deposition of S/PS takes place during de-lithaition, which has never been investigated in the literature but is believed to play equally important part as the dissolution process in affecting the cycle stability of the S electrode.

We carry out in this work in-operando transmission X-ray microscopy (TXM) studies on the dissolution and re-deposition processes of polysulfide/S particles during the operation of Li-S batteries under different conditions. The dynamics of the S/PS dissolution and re-deposition was revealed based on the dimensional variation of the S-containing active particles during lithiation/de-lithiation cycles. Studies have been conducted on bare and Nafion coated S particles in electrolyte (solution of lithium bis(trifuoromethanesulfonyl)imide in 1,3-dioxolane and 1,2-dimethoxyethane (volume ratio 1:1)) of different concentrations ranging from 1 M to 7 M. For bare S-particle electrode, extensive dimensional variations of S particles have been observed to result from PS dissolution/re-deposition. The kinetics of both dissolution and re-deposition are found to follow classical dissolution theory where the rate constants in both processes exhibit strong dependence on particle size, potential and electrochemical operation mode. PS re-deposition is nucleation-limited, leading to considerable aggregation of the S-containing active mass. The TXM results are correlated with the performance of practical Li-S cells containing C/S composite cathode.



Polyaniline Self-Doping via Complexation of Boronic Acid Substituent with Polyols: Towards Microbial Sensor

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Detection of microorganisms can be achieved by recognition of carbohydrate and hydroxy acids (mainly, sialic acid) commponents of their cells walls. Undoubtedly the most receptor for this purpose is the phenylboronic acid [1] able to bind polyols even being incorporated in a polymer chain [2].

We investigated conductivity of boronic acid substituted polyaniline by means of impedance spectroscopy. With the samples obtained after thorough optimization of 3-aminophenylboronic acid electropolymerization process we succeeded to observe an increase in the polymer conductivity as a result of injection of polyols in the working electrode medium. We note that in all previous reports the only conductivity decrease of boronic acid substituted polymers was registered under similar conditions. However, regular conductive and electroactive polymers (including unsubstituted polyaniline) also display a decrease in conductivity after injection of saccharides. This makes hardly possible to distinguish a specific signal versus an unspecific one.

The great advantage of the proposed system is, that the specific signal resulting in conductivity increase, is generated in the opposite direction to the unspecific one.

We confirmed that the impedimetric response resulted in conductivity increase is indeed due to complexation with polyols, by calculating from this effect binding constants with saccharides (glucose, fructose, galactose) and hydroxy acids (lactic and sialic acids), with characteristic trend in their relative values and characteristic shape of pH-profiles indicating a decreased pK_a for polymeric phenylboronic acid.

A tentative mechanism for the conductivity increase involves phenylboronic acid complexation with polyols converting neutral acid groups into negatively charged esters. As known, polyaniline conductivity is decreased as solution pH is increased. However, negatively charged substituents in polymer chain are known to prolong polyaniline electroactivity to neutral solutions, the corresponding polymers are referred to as 'self-doped' ones [3,4]. Accordingly, complexation of boronic acid substituents with polyols can be considered as polyaniline self-doping obviously resulting in increase of polymer conductivity.

An impedimetric response of boronic acid substituted polyaniline towards microorganisms allowed up to achieve of the lowest detection limits reported for such analytes.

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Voltammetry of Ion Transfer across the Polarized Liquid Membrane

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A polarized liquid membrane (PLM) can be defined as the thin layer of an electrolyte solution in organic solvent immiscible with water, which separates two aqueous electrolyte solutions [1]. There are three arrangements for such PLM [1]: (a) unsupported liquid phase [2], (b) liquid phase soaked in a porous material (supported liquid membrane) [2], and (c) liquid phase as a plasticizer of a polymeric film [3]. The alternative systems consisting of a thin layer of organic liquid [4], or aqueous electrolyte drop [5,6], supported on solid graphite or metallic electrode, respectively, have also received considerable attention. Hydrophobic electrolyte solution can be replaced by a hydrophobic room-temperature ionic liquid (RTIL) [7]. The principal quantities measured in studies of PLMs include (a) the equilibrium (zero-current) trans-membrane potential difference, and (b) the dependence of the trans-membrane electric current on the voltage externally imposed across PLM. Polarization phenomena in PLMs, which have been investigated mostly by voltammetric methods, can be understood in terms of the individual ion or electron transfer processes occurring at the two liquid-liquid interfaces [2]. This processes are coupled by virtue of the same intensity of the electric current flowing through both interfaces [2,7]. Theory of voltammetry of ion transfer across PLM in two- and single-interface polarized membrane configurations [6-9], and in the absence and presence of a supporting electrolyte [10], has been developed. The aim of this contribution is to provide a brief account of theoretical and experimental achievements in voltammetry of ion transfer across PLM including the applied topics, such as amperometric ion and polyion sensing.

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Force Spectroscopy Investigation of Ionic Liquid Structure at Carbon Interface

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Ionic liquids are attractive electrolytes for electrochemical capacitors due to the large operational voltage windows thereby providing an increased energy density in these systems. The charge storage mechanism and structure of ionic liquids within the electrical double layer at carbon interfaces is still poorly understood. Atomic force microscopy (AFM) force spectroscopy is capable of probing the layered structure of ionic liquids at the electrode interface. Figure 1 shows a histogram of 50 force distance curves on a highly oriented pyrolytic graphite (HOPG) surface in the ionic liquid 1-ethyl-3methyl-imidazolium bis(trifluoromethanesulfonyl)imide ($Emim^+Tf_2N^-$). Distinct steps are observed during the approach of the AFM tip due to interaction with the ion layers present at the interface. By combining this technique with insights from molecular dynamics simulations the effect of applied potential on the structure of the ionic liquid within the electrical double layer is investigated and we are able to observe reconstruction of ions in response to an applied bias.

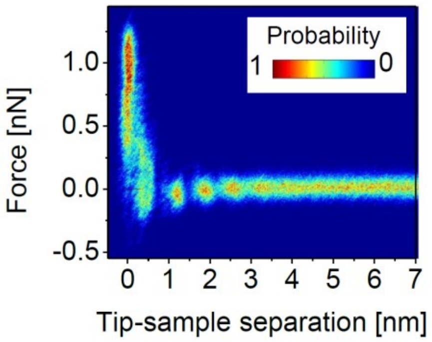

Figure 1: Histogram of 50 force distance approach curves on HOPG in $Emim^+$ Tf_2N^- ionic liquid.

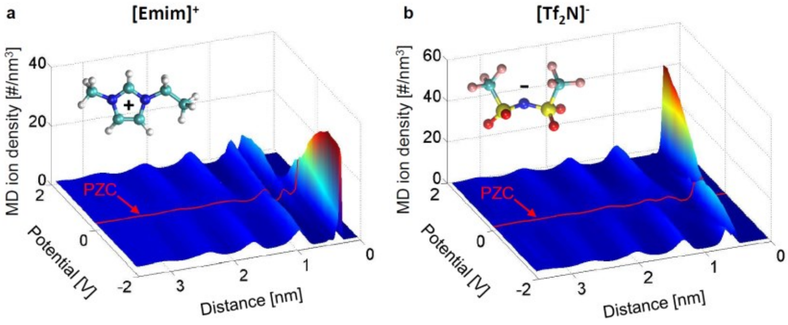

Figure 2: Molecular dynamics simulation of $Emim^+$(a) and Tf_2N^-(b) ion density as a function of potential and distance from a carbon surface.

Challenges and Opportunities for Brain Electrochemistry

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Approximately 40 years ago Ralph Adams proposed that voltammetric sensors could be implanted in the brain to measure neurotransmitters. Many electrochemists were sceptical that anything useful would arise from such experiments. Some predicted the electrodes would be fouled by the brain environment. Others suggested that the implanted electrodes would cause severe damage. Yet another group suggested that one would not be able to identify which neurotransmitters were being measured or that the electrodes would not have the desired sensitivity. This symposium on Brain Electrochemistry clearly shows that the nay-sayers were wrong, and that these probes can provide important new information.

What will happen in the next 40 years? In my talk I will speculate about this and indicate several new directions that I see as important.

Application of *in situ* X-Ray Diffraction and Electrochemical Impedance Spectroscopy to Lithium/Sulfur Batteries

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Lithium/Sulfur batteries, due to their high theoretical energy density values (2500 Wh.kg^{-1}) became one of the most popular candidates for next-generation energy storage system[1]. However, their practical discharge capacity and cycle life are still below expectation. The main focus of this work is a deeper insight into working mechanism of Li/S cells, which is an indispensable way to follow in order to improve the electrochemical performances. In our studies we combined two techniques: X-Ray Diffraction and Electrochemical Impedance Spectroscopy both applied *via* an *in situ* and *operando* mode. The use of nonwoven carbon tissue as a current collector for sulfur electrode allowed us to obtain highly loaded sulfur electrodes (5-7 mg$_{\text{Sulfur}}$/cm^2) without sacrificing good cyclability and practical capacity (initially 1100 mAh/g).

XRD could be successfully applied to Li/S system, since the active material is changing its form upon cycling between solid (S_8 and Li_2S/Li_2S_2) and liquid (lithium polysulfides: Li_2S_n, $2 < n \leq 8$) phases[2]. Thanks to the high quality and large number of recorded diffractograms we were able to precisely indicate the moments of solid phases appearance/disappearance. We also, for the first time in the domain of Li/S system, reported about unusual formation of monoclinic β-S_8[3]. Influence of cycling rate (C/20 and C/8) was taken into consideration. Moreover, further cycles (and not only the initial one, which is very often the case of *in situ* studies) were monitored as well.

By applying EIS measurements in Li/S system, other important information concerning the transfer reactions, the electrolyte conductivity evolution, the electrode morphology and the passivation layer formation (Li_2S and S_8) could be obtained. The impedance results of complete Li/S cell (CR2032 coin cells) as a function of both state of charge and the cycle number will be presented.

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Potential-resolved dissolution of Pt-Cu thin-film alloys

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Pt-alloys with other transition metals are prospective candidates to be used as catalysts for the oxygen reduction reaction (ORR). They provide an improved specific activity in comparison to pure Pt and a high Pt utilization [1,2]. However, their stability under operation conditions is still a matter of concern, and the exact dissolution processes are still unclear [3].

To address this issue, we utilize an electrochemical scanning flow cell (SFC) connected to an inductively coupled plasma mass-spectrometer (ICP-MS) to investigate the dissolution processes in parallel to the electrochemical treatment [4–6]. The dissolution of both alloy components can therefore be linked to the applied potential and to the respective electrochemical surface processes. As a sample we utilize a Pt-Cu thin-film material library with a composition gradient from 0 at% up to 60 at% Cu. This enables a fast, potential-resolved quantification of dissolution in dependence of the material composition, and consequently based on this unique data fundamental insights into the dissolution processes [7].

Our results show that although the onset of the Cu dissolution is well below the dissolution potential of Pt, the two dissolution processes are inherently linked to each other. For alloy compositions ≤ 50 at% Cu the surface is mainly passivated by the Pt-oxide. However, above this composition alloys show a critical potential, where the passivation of the surface breaks down, and a porous structure forms due to massive Cu dissolution. The absolute activity of this porous alloy increases due to the high surface area, but the specific activity was found to decrease to almost that of pure Pt.

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20 years experience of developing DSSC modules – from Ekologisk Energi to Dyenamo

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Abstract to be submitted

Electrochemical Behavior of Sequential Programmed Hetero-layer Films based on Dinuclear Ru Complexes on ITO Electrode

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Surface-confined molecular assembly of redox-active metal complexes has attracted considerable interest because of a promising platform toward molecular electronic devices. Recently, two Ru complexes having different bridging ligand of 2,3,5,6-tetra(2-pyridyl)pyrazine (tppz) or 1,2,4,5-tetra(2-pyridyl)benzene (tpb) were used, which show two one-electron redox processes at +0.84 and +1.06 V vs $Fc^{0/+}$ for the tppz-bridged complex (Ru-N), and -0.40 and 0.07 V for the tpb-bridged one (Ru-C), respectively (Fig. 1). [1] Sequential programmed layer structure was constructed by the layer-by-layer (LbL) growth method by use of Ru complexes bearing tetrapod phosphonate groups with Zr(IV) ion on an ITO electrode:[2] *i.e.,* the tested sequences were (**i**) ITO|only (Ru-C)m or (Ru-N)m, (**ii**) ITO|(Ru-N)m|(Ru-C)n, and (**iii**) ITO|(Ru-C)m|(Ru-N)n, where 'm' and 'n' stand for the number of layer, and their electrochemical behaviors have been examined in CH_3CN with 0.1 M $HClO_4$. For the sequence (**i**), the current increased linearly with increasing the number of m for both Ru-N and Ru-C complexes. For the sequence (**ii**), the cyclic voltammograms (CVs) strongly depend on the combination of the number of layers, (m, n). Fig. 2 shows the CVs of hetero-layer films for sequence (**ii**) with the combination of (m, n) = (1,1) and (2,2). In the case of the (1,1) film, redox waves from both Ru-N and Ru-C complexes were observed. The (2,2) film showed two waves only from the Ru-N complex but no waves from Ru-C ones. However, the prewave (Ec), which corresponds to the catalytic wave of Ru-C by electron mediation of inner Ru-N layer, was observed. On the other hand, upon changing the layer sequence from (**ii**) to (**iii**), another electron mediation pathway through Ru(III/IV) around +1.15 V in the Ru-C complex was opened. Therefore, molecular rectification in the hetero-layer

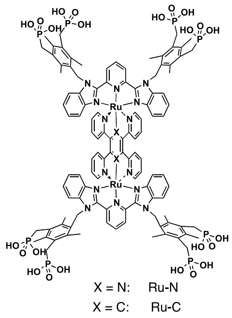

Fig. 1. Chemical structures of Ru-N and Ru-C complexes

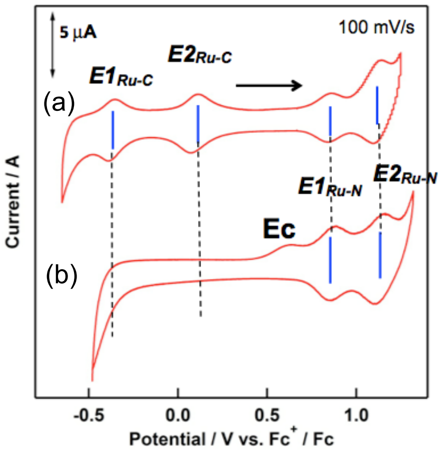

Fig. 2. CVs of heterolayer films with the sequence of ITO|(Ru-N)m|(Ru-C)n: (a) (m,n) =(1,1) and (b) (2,2) in CH_3CN .

films strongly relied on not only Ru(II/III) but also Ru(III /IV) redox levels of the Ru components, which affected the electron transfer mediation pathway.

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Microbial Fuel Cells for Treatment of Olive Oil Mills and Municipal Waste Water

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Microbial Fuel Cells (MFCs) use bacteria to convert organic waste material into electrical energy. MFC is considerably a new technology in wastewater treatment. Although MFCs generate less energy than hydrogen fuel cells, the combination of both electricity production and wastewater treatment effectively reduces the cost of primary effluent treatment.

We present here the development of an energy efficient wastewater treatment processes for industries with phenolic wastes based on microbial fuel cells, that inactivate and degrade toxic compounds. We constructed eight single chamber air-cathode MFCs working in parallel. Each MFC contained reticulated vitreous graphite (RVG) anode immersed in the treated effluent and a carbon cloth cathode exposed to air. The MFCs were inoculated with olive oil mill wastewaters (OMW) or municipal waste water (MWW) and performances (cell voltage, power density, COD removal, toxicant removal) were monitored. We found a reduction of 73-87% in tyrosol a main phenolic compound in OMW after one week. Toxicants removal has beneficial environmental implication and the toxicity of OMW is attributed mainly to phenolic compounds. In addition to decrease in toxicity, electric power was generated by the MFCs, which, might lead to a self-operating cleansing device in the environment. Moreover, microbial population analysis was performed to evaluate the changes in the microbial community of the biofilm formed on the anode. There was a shift from the initial OMW community to the anode community after the MFC operation. While the initial OMW community consist mostly fermentative aerobic bacteria, the anode community consisted mostly of sulfur and metal reducing anaerobic bacteria (anodic respiration).

BIREDOX IONIC LIQUIDS: NEW OPPORTUNITIES TO DEVELOP HIGH PERFORMANCE ELECTROCHEMICAL DEVICES

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The design of ionic liquids (ILs) comprising the target ion or imidazolium cations bearing a functional group adapted to the specific application permits to overcome the issues associated to the use of mixtures, including the presence of useless ions. Redox ILs belong to this type of so-called task-specific ILs.[1] The idea that motivated the present work was that the use of biredox ionic liquids, in which both the cation and the anion would bear redox moieties, should maximize the advantages of electroactive electrolytes in a large range of applications. The clear advantage is that to have all-in-one electrolyte components, where the concentration of both ions and redox species is maximized. Accordingly, we report here the synthesis and electrochemical properties of an original biredox IL electrolyte in which the anion and the cation are functionalized with anthraquinone and TEMPO moieties, respectively. The electrochemistry investigation (CVs, SECM) shows fast kinetics and high reversibility, encouraging the building of electrochemical double layer capacitor.

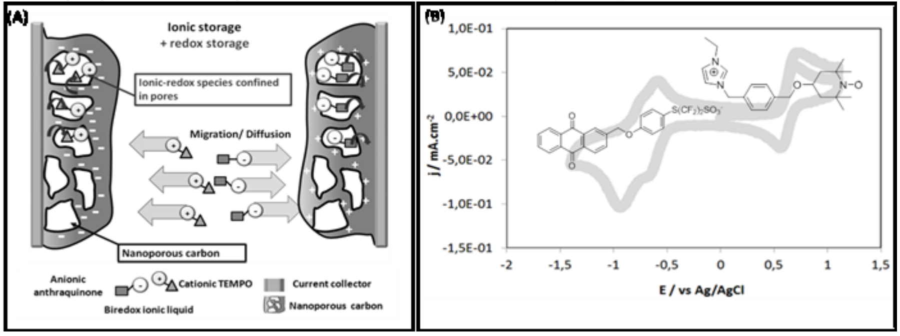

Figure 1: (A) General scheme of device using biredox ionic liquid and (B) cyclic voltammetry on macroelectroelectrode of biredox (10^{-3} M) in acetonitrile and $LiClO_4$ (0.5 M).

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Electrodeposition of Nanostructured Electrode Materials for Li-ion Batteries

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Rechargeable lithium-ion (Li-ion) batteries exhibit high energy and power densities and are hence the primary choice for application in consumer electronics. While new electrode materials for Li-ion batteries are developed continuously, relative little attention has so far been paid to the use of electrodeposition methods. In the field of microbatteries, electrodeposition has, however, become one of the main techniques employed for the manufacturing of current collectors, electrode materials and electrolytes [1,2]. Although several groups have described electrodeposition of nanostructured anode materials, there is still a need for a corresponding development of suitable approaches for cathodes and electrolytes [1,2]. As cathode materials mainly include intercalation compounds requiring well defined lattice planes to enable reversible lithium ion transport within the structures, electrodeposition of cathode materials is generally more challenging than that of anode materials [1]. More attention also needs to be paid to the electrodeposition of active films directly on metals such as copper and aluminium, as well as the possibility to electrochemically develop free-standing nanostructured electrodes with large surface areas.

This presentation will focus on our work aiming at the development of electrochemical approaches for the manufacturing of nanostructured electrode materials for Li-ion batteries. It will be shown that electrodeposition can be used for the manufacturing of 3-D copper [1,2] and aluminium [3,4] current collectors as well as the coating of these with thin layers of anode or cathode materials. Electrodeposition of materials such as Sb, Sb_2O_3, Cu_2Sb, Sn, SnO_2, Al_2O_3 and MnO_x will be discussed as well as the manufacturing of electrodes composed of free-standing TiO_2 nanotubes [5]. A novel strategy for electrodeposition of cathode materials directly on Al current collectors will likewise be described.

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Theory-Guided Design of Electrodeposition Systems: Applications in Semiconductor Processing and Advanced Energy Storage Devices

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Electrodeposition of metals and alloys is critical in a variety of applications, including semiconductor device fabrication, metal finishing, thin-film photovoltaics, advanced battery technology as well as metal extraction technologies. In these applications, the electrodeposition chemistry is tailored to achieve specific surface morphology or deposit property. The present talk will focus on electrodeposition chemistry development for two specific applications: (*i*) Complexed-Cu electrolytes for achieving nucleation, bottom-up plating and alloy (Cu-Mn and Cu_3Ge) deposition for use in future-generation semiconductor metallization; and (*ii*) Electrolyte additives for suppressing dendrite formation in zinc and lithium electrodeposition for large-scale as well as portable energy storage solutions.

Interconnect metallization in future-generation semiconductor devices will require a versatile metallization process capable of nucleating Cu on resistive substrates (e.g., Ru), generating bottom-up growth for void-free fill, and depositing complex materials such as Cu-Mn or Cu_3Ge with tailored electrical or electromigration properties. We have recently developed an alkaline plating electrolyte that addresses all the above requirements. This novel complexed-Cu electrolyte provides Cu nucleation density exceeding $10^{11}/cm^2$, generates bottom-up Cu fill in sub-micron geometries, and is capable of electrodepositing compositionally-controlled, adherent and smooth alloy (Cu-Mn) or compound (Cu_3Ge) deposits.

Advanced energy storage devices, such as Zn-based flow batteries and Li-metal batteries, require stable, cycleable, and reversible anodes. A common problem encountered in these batteries is dendrite formation during battery charging. In this talk, mechanisms underlying the development of dendritic morphology during Li and Zn electrodeposition will be discussed. Mechanistic effects associated with electrolyte components (additives and solvents) will be elucidated through in situ 'live' monitoring of the dendrite evolution process. Performance of a variety of additives (polymers, carbonates) and salt-solvent mixtures in the Li and Zn system will be discussed. In situ dendrite propagation studies will be complemented with electroanalytical studies such as polarization measurements on a rotating disc electrode. Knowledge of surface polarization enables quantitative modeling of the dendrite growth propensity and the additives-assisted dendrite suppression efficacy. A combination of theory and experiment allows development of a comprehensive framework for characterizing the surface chemistry responsible for the dendritic morphology.

Towards a Rational Design of the Electrochemical Interface for Efficient Electrocatalysis

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The catalytic properties of electrodes are primarily determined by the electronic structure of the surface, which, in turn, influences the adsorption and desorption of reaction intermediates. The strength of the binding of an adsorbed species to the electrode surface has been shown to play a key role in the activity of the electrocatalysts, as activation energies for elementary surface reactions are strongly correlated with the adsorption energies. In many cases, it is possible to optimize the binding energies of the adsorbed intermediates by changing the electrode composition (and/or structure) at the surface. An important aspect of electrocatalysis, therefore, is to tune the properties of the surface for a particular reaction. On the other hand, electrolyte composition also largely influences the performance of the active sites.

Tuning of the catalytic properties of metal electrodes can be achieved with relative ease through modification of the surface using bulk alloys, with monolayer amounts of other metals or non-metals or by introducing surface defects. Electrochemistry provides a number of tools for a controllable modification. One of them is e.g. the application of underpotential deposition (UPD). As well as forming active catalyst surfaces, UPD formed monolayers can also act as the foundation for surface modification to tune the electrode surface, either by further UPD of a third metal, or with the formation of surface alloys and sub-surface alloys. On the other hand, using non-covalent interactions between cations, anions and the surface, it is in some cases possible to optimize the electrolyte composition, further improving the performance of active sites. In the presentation, new examples will be given where the above mentioned approaches were used to develop electrocatalytic systems active towards some model reactions such as the oxygen reduction, hydrogen evolution and oxidation and electro-oxidation of CO molecules.

Tailored Design of Multi-functionalized Suppressor Additive for Copper Electroplating

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A multi-functionalized suppressor additive (IPEG) for copper electroplating was synthesized by the copolymerization of imidazole and poly(alkylene glycol) diglycidyl ether (Fig. 1a) [1]. This suppressor polymer contains the typical functional groups of both PAG (poly(alkylene glycol) polymer – a typical suppressor for Damascene applications, and IMEP (polymerizate of imidazole and epichlorohydrin) polymer – a state-of-the-art leveler for Damascene applications. Electrochemical studies reveal a variety interactions between of IPEG polymer with the SPS (bis (sodium sulfopropyl) disulfide): i) the poly(ethylene glycol) part of the polymer interacts antagonistically with SPS as typical PAGs polymers, and ii) the IMEP-like part of the polymer interacts antagonistically and synergistically with SPS similar to IMEP polymer. It is the synergistic suppression effect of these functional groups in copper plating that leads to a significantly higher total suppressing effect of the IPEG polymer over that of conventional suppressors and levelers. Overall, this polymer acts as an efficient suppressor additive. The fill-experiment (Fig. 1b-c) on Damascene test features demonstrate a successful fill. Furthermore, the SIMS (secondary ion mass spectroscopy) experiments indicate a copper deposit with a low contamination level.

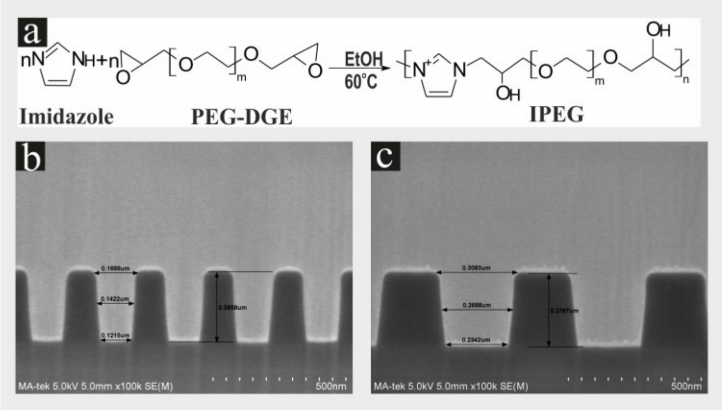

Fig.1. a) The synthetic route of IPEG from imidazole and poly(ethylene glycol) diglycidyl ether; c)-d) Cross-sectional FIB-SEM images indicating successful superfill of test structures using the new IPEG suppressor additives, c) 0.13 µm; d) 0.25 µm.

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Electrochemical Deposition of Pt-(Fe, Co, Ni) Alloys: Self-terminated growth to underpotential co-deposition

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Electrodeposition of Pt alloy films is examined and compared to the characteristics of the constituent elements. Pt deposition at negative potentials revealed an unanticipated self-terminating characteristic that enables controlled deposition of Pt monolayer films from a K_2PtCl_4-NaCl electrolyte.[1] Despite the deposition overpotential being in excess of -1 V, Pt deposition is quenched at potentials just negative of proton reduction by alteration of the double layer structure induced by a saturated surface coverage of underpotential deposited hydrogen, (H_{upd}).[1] The surface may be reactivated for Pt deposition by stepping the potential to more positive values where H_{upd} is oxidized and fresh sites for adsorption of $PtCl_4^{2-}$ become available. Periodic pulsing of the potential enables sequential deposition of two dimensional (2-D) Pt layers to fabricate films of desired thickness relevant to a range of advanced technologies in a manner that is tantamount to wet atomic layer deposition (ALD). In the presence of iron group metals, the H_{upd} induced suppression is lifted by underpotential deposition of the iron group metal as revealed in voltammetric studies of singular surfaces and thin film deposition studies of binary $Pt_{100-x}Ni_x$ and $Pt_{100-x}Co_x$ alloys.[2,3] Bulk alloy formation is facilitated by ongoing Pt deposition that incorporates the iron group metal in accord with the excess enthalpy of alloy formation. The application of these materials as electrocatalysts will also be briefly detailed

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Electrodeposition of Nano-objects

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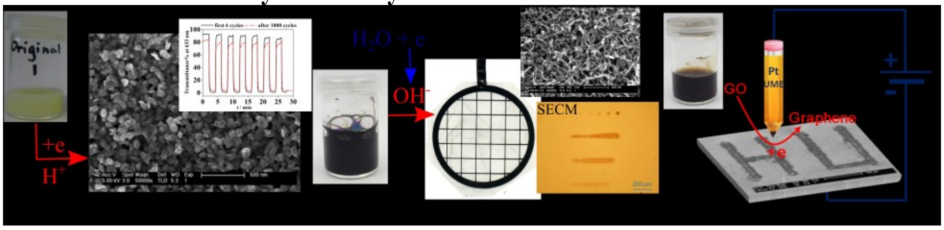
The dimension of nano-objects, *e.g.* nanoparticles, nanotubes, nanosheets, can be well tuned by various synthesis approaches in liquid phase. This work shows the transferring of nano-objects with well-defined shape and structure from their dispersions to thin films by electrodeposition. The latter is well-known and widely applied, especially having merits in the ease of manipulation and coating complex shaped surfaces. Here, we present the **"nano to nano" electrodeposition** of typical nano-objects, *i.e.* WO_3 nanoparticles, carbon nanotubes (with silane), and graphene. Electrodeposition of WO_3 nanoparticles is based on the reduction of WO_3 in the dispersion to HWO_3, which is less dispersable forming film on the cathode. The obtained film consists of stacked nanoparticles, yielding excellent electrochromic performance (**92% contrast**). Electrodeposition of carbon nanotubes is achieved with a silane sol-gel binder. By electrochemically inducing local pH increase on the cathode via reduction of O_2 or H_2O, silane is electrodeposited and thereby acts as a binder for the deposition of CNTs. The obtained films have excellent anti-reflection and non-linear optical performance (**Specular reflection < 0.5%**). Electrodeposition of graphene is carried out via electrochemical reduction of graphene oxide from its water dispersion. Moreover, local electrodeposition of carbon nanotubes and graphene is carried out by **scanning electrochemical microscopy (SECM)** using the direct mode. In the latter, the current reflux is spatially restrained under the microelectrode tip which is positioned close to the surface, thus patterns of carbon nanotubes and graphene are generated with micrometer-scale resolution. **In general, this work shows typical cases of (local) electrodeposition of nano-objects with different shape through different mechanisms. With similar concepts, electrodeposition from "nano" to "nano" can be extended to a variety of other systems.**



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Electrodeposition of semiconductor thin films for photovoltaic devices

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Cu_2SnZnS_4-type compounds have attracted interest as low cost and high conversion efficiency solar cell devices, because of their appropriate band gap energies and absorption coefficients values. In the last years our group has developed an ongoing research aimed at the electrodeposition from aqueous solution of thin films of technological semiconductors. In this presentation, we exploited alternated electrodeposition of Cu, Sn, Zn and S by E-ALD (Electrochemical Atomic Layer Deposition) to obtain sulfide thin films, controlling the growth of the structures at the nanometric level. The presentation included the analysis of the electrochemical behavior of the solution containing the single elements, to assess the most efficient deposition of controlled amounts of material. By alternating deposition of the elements, growth of thin films has been obtained. Band gaps of the deposited materials exhibit modulation with sample composition and thickness. Structural characterization of thin films is generally a rather complex task as it requires high brilliance x-ray sources given the small thickness of the film. Nevertheless synchrotron light sources can provide such an high photon flux to perform this kind of experiment. Surface X-ray diffraction was used to identify the crystallographic structure and to investigate the order on the surface. The results confirm that E-ALD is an effective method to grow crystalline films with high level of order.

Microstructure Matters: Matching Electrodeposited Precursors to Annealing Routines for Thin Film Photovoltaics

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Thin film photovoltaic devices require less energy to produce than their silicon counter-parts and hence are attractive for future energy generation. They are fabricated from approximately eight different layers using a mixture of vacuum assisted deposition steps. If some or all of these steps can be replaced with non-vacuum, low energy deposition processes, the energy cost of producing thin film photovoltaics could be further reduced.

At the heart of these solar cells lies an absorber layer consisting of a semiconductor chalcogenide layer, several microns thick, such as CdTe, Cu(In,Ga)Se_2 or $Cu_2ZnSnSe_4$. One low energy approach to producing these absorber layers is the electrodeposition of a precursor layer followed by an annealing step. The precursor should consist of at least all the metal elements, and may optionally contain the chalcogen as well. The annealing process must convert the metallic inhomogeneous amorphous / nanocrystalline precursor into a homogeneous microcrystalline semiconductor.

Here we demonstrate that the quality of the semiconductor produced using a two step precursor – annealing routine heavily depends on the annealing routine *and* the microstructure of the precursor. For example to form $CuInSe_2$, a relatively homogenous $CuInSe_2$ precursor is compared to a bi-layered Cu_xSe_y/In_2Se_3 precursor. The homogenous precursor is suitable for ultra high speed laser annealing but not for normal furnace annealing, whilst the converse is true for the bi-layered precursor. A further example can be found for $Cu_2ZnSnSe_4$. Annealing a layered metallic precursor leads to no working device, whilst a columnar metallic structure leads to a power conversion efficiency of 6 %.

In order to use a two step, low energy cost approach for synthesizing these compound semiconductors, understanding the thermodynamics and kinetics of annealing is key. The challenge is to be able to electrodeposit suitable precursor structures over large areas that will suitably react to form the desired high quality semiconductor.

An Environmentally Friendly Solution Processing of Earth-Abundant and Non-Toxic Materials for Photovoltaics

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Photovoltaics have received widespread research attention as an alternative to finite and greenhouse-emitting fossil fuels. From the various photovoltaic materials, CZTS (Cu, Zn, Sn, and S) is promising as it consists of earth-abundant and non-toxic elements. This is in contrast to Cu(In,Ga)Se and CdTe, which contains rare indium and toxic cadmium respectively. Since the first reported efficiency of 0.489% in 1997 [1], photovoltaics based on CZTS have developed rapidly with an efficiency of 12.6% by the end of 2013 [2]. CZTS can be fabricated by both vacuum and non-vacuum techniques. Among these techniques, electrochemical and electrophoretic deposition provides a cost-effective deposition method [3, 4]. However, current techniques use toxic H_2S to incorporate sulphur. In this study, we propose three differing approaches for an environmentally friendly deposition of CZTS films without H_2S use. They are: 1) hybrid electrochemical and electrophoretic deposition; 2) electrophoretic deposition of metal sulfides; 3) electrophoretic deposition of CZTS nanoparticles. In each of these studies, deposition parameters such as deposition potential and bath composition were varied, and their effects on film morphology and electrical properties investigated. To our knowledge, this study is the first to compare electrochemical and electrophoretic deposition for deposition of earth-abundant and non-toxic CZTS, and furthers the understanding of electrophoretic deposition of multiple particle systems.

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Photoelectrochemical water oxidation on an electrodeposited n-Si/SiO$_x$/Co/CoOOH heterojunction

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We have previously explored the catalytic activity of electrodeposited films of Co_3O_4, $Co(OH)_2$, and CoOOH for the oxygen evolution reaction (OER). The materials all have very similar activity for the OER. Here, we discuss the photoelectrochemical oxidation of water on an electrodeposited n-Si/SiO$_x$/Co/CoOOH photoanode. Our emphasis in this study was to understand the effect of the catalyst on the interface energetics. That is, how does the catalyst influence the band bending in the semiconductor? The photoanode was produced by electrodepositing a very thin layer of Co metal directly onto n-Si. The Co was then electrochemically oxidized in alkaline solution to produce the n-Si/SiO$_x$/Co/CoOOH photoanode. The photoanode generated a photocurrent of 35 mA/cm^2 at 0.5 V vs. Ag/AgCl in a 1.0 M NaOH solution under 100 mW/cm^2 AM 1.5 irradiation. The measurements show a photovoltage of over 0.45 V, which is considerably larger than would be expected for an n-Si/Co Schottky barrier. Photoelectrochemical and solid-state measurements show that the photoanode acts like an MIS solid-state photovoltaic cell in series with an electrochemical cell. The diode quality factor is 1.1 and the barrier height is 0.91 eV. The expected barrier height for an n-Si/Co Schottky barrier is 0.71 eV. The barrier height was determined by the n-Si/SiO$_x$/Co heterojunction, and was independent of solution potential.

Coupling of Hydrogen and Oxygen Evolving Electrocatalysts to Metal Oxide Photoelectrodes for Solar Fuel Production

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The efficient and inexpensive conversion of solar energy into chemicals is a promising alternative for the production of carbon-free fuels and the storage of energy. Photoelectrochemical (PEC) water splitting using metal oxide photoelectrodes offers an exciting solution for the production of hydrogen fuel as it integrates in the same device sunlight collection and water electrolysis. Just as in electrolyzers, a PEC water splitting device requires efficient electrocatalysts for the hydrogen evolution reaction (HER) and the oxygen evolution reaction (OER). However, in addition to high electrochemical performance and stability, electrocatalyst for PEC water splitting should be optically transparent to allow illumination of the top and bottom photoelectrodes in a tandem device and form a stable electrical contact with the underlying photoabsorbing material. Coupling of optically transparent HER and OER electrocatalyst with metal oxide photoabsorbers remains challenging and few examples of efficient earth-abundant electrocatalysts have been reported to date.

We have recently reported on the photoelectrochemical deposition of amorphous molybdenum sulphide films on a surface-protected cuprous oxide photoelectrode capable of driving currents as high as -5.7 mA cm^{-2} at 0 V versus the reversible hydrogen electrode (pH 1.0) under simulated AM 1.5 solar illumination [1]. In addition to the efficient extraction of electrons, the photocathode exhibits enhanced stability under acidic environments, whereas photocathodes with platinum nanoparticles as catalyst deactivate more rapidly under identical conditions.

Similarly, we have developed a general and simple method for the deposition of different OER catalyst on nanostructured cauliflower-type hematite photoanodes. Coupling of efficient electrocatalysts made of earth-abundant materials show an improvement of 300 mV in the onset potential compared to the bare hematite. We have extended the concept of optically transparent electrocatalysts to the construction of a tandem cell device capable of unassisted water splitting with high solar-to-hydrogen efficiencies.

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Passivation of Defects in TiO_2 Nanotubes by Li and H Doping

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Direct conversion of sunlight to fuels by photoelectrochemistry promises to be a potential route to overcoming the challenge of the transient nature of solar energy. TiO_2 nanotubes formed by anodization exhibit properties that make them an attractive system for this application: high surface area, 1D charge transport, and stability in solution and under irradiation. However, the presence of localized trap states in TiO_2 allows for possible losses to recombination, decreasing the photocurrent conversion efficiency of any TiO_2 NT based device. We have recently demonstrated with electrochemical impedance spectroscopy (Figure 1 (a)) that TiO_2 nanotubes formed in electrolytes containing a 2 vol% water have a 3x higher density of defect states compared to those anodized in a higher 11 vol% water electrolyte [1]. This implies that the nanotubes formed in the low water content electrolyte suffer from an accelerated trap-mediated recombination rate. Passivation of these defects by using Li and H doping [2] produced a twofold increase in the photocurrent under simulated sunlight at 1.0 V_{SCE} (Figure 1(b)). Defect passivation was confirmed by photocurrent onset transients and impedance spectroscopy.

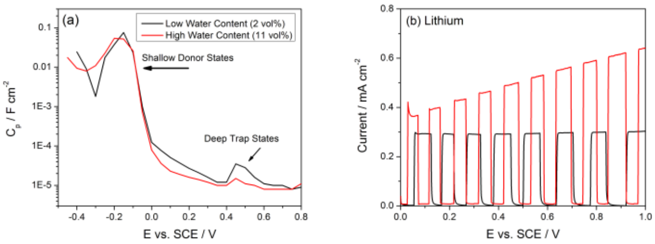

Figure 1. (a) Low frequency capacitance of TiO_2 NTs anodized in a low water content electrolyte exhibit a larger peak corresponding to deep level trap states. (b) Photocurrent as a function potential of (black) as formed and (red) Li doped NTs.

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Nanoscale Views of Electrochemical Processes

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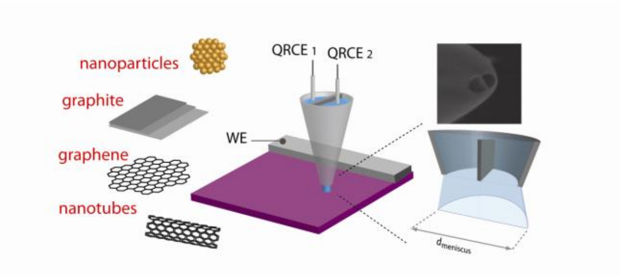
Electrochemistry is enjoying a major renaissance. It is increasingly seen as enabling not only in chemistry, but in the life sciences/medicine, materials science and chemical engineering. This interest has been catalysed by the rise of electrochemical energy technologies (batteries, fuel cells, solar cells), innovative sensor systems, and the revolution in nanoscience. However, while new materials and complex applications provide opportunities, they also bring considerable challenges for established electrochemical techniques. There is a great need to understand electrochemistry at the nanoscale, and to address this issue we have recently developed a suite of powerful imaging techniques, notably scanning electrochemical cell microscopy (SECCM) [1], that facilitate the study of individual nanomaterials (below), such as nanoparticles [2], carbon nanotubes [3] and graphene [4]. Through the use of complementary microscopy and spectroscopy techniques, structure and activity can be linked directly at the nanoscale, in a ***multimicroscopy*** approach that opens up major new vistas on electrochemical processes.



Electrochemical imaging also reveals nanoscopic views of the intrinsic activity of macroscopic electrodes, providing new models for graphite [5], conducting diamond [6] and polycrystalline noble metal electrodes [7], and facilitating local functionalisation, patterning and printing [8]. In this contribution, I shall describe the principles and applications of nanoscale electrochemical imaging, and will also highlight new frontiers in electrochemistry through the use of fast scan multifunctional imaging methods.

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Peculiarities of the interface ionic liquid(s) / electrode(s) and the possible influence of solutes/impurities

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Ionic liquids, formerly called room temperature molten salts, received a wider attention around the year 2000. Up to now ISI KNOWLEDGE counts 40.000 abstracts dealing with ionic liquids, and the "peak IL" has not yet arrived. Due to their wide electrochemical windows of up to ±3 V vs. NHE they are quite interesting for electrochemistry as they allow the electrodeposition of reactive elements like Aluminum, e.g. for surface finishing, and of elemental semiconductors like Si or Ge, which are interesting from a fundamental point of view but also for solar cells. Due to quite low vapour pressures ionic liquids do usually not evaporate, only under the conditions of a high vacuum at elevated temperature they can be distilled with low rates. The low vapour pressure and a thermal stability of up to +250 °C close the gap between molecular solvents and high(er) temperature molten salts, but also cause a problem: it is quite difficult to purify ionic liquids and the best strategy is to avoid any impurity already in the synthesis. Ionic liquids have a complicated surface behaviour: they form remarkably strongly adhering interfacial layers which vary with the liquid. Pyrrolidinium ions are usually more strongly adsorbed than imidazolium ions, which gives some information why nanocrystalline and microcrystalline deposits, respectively, can be obtained. Impurities play an important role for the interfacial structure, and LiCl, a common impurity, drastically changes the interfacial layers. Thus, care is needed when impedance or STM data shall be evaluated. The lecture will give an insight into the fascinating interfacial electrochemistry of ionic liquids.

Recent development on boron-doped diamond electrodes

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Boron-doped diamond (BDD) electrodes are very attractive material, because of their wide potential window, low background current, chemical inertness, and mechanical durability[1]. In these years, we have reported several examples for electrochemical sensor applications[2]. Here, we report some recent examples of electrochemical sensor application of BDD such as ozone [3], pH [4], *in vivo* detection of neurotransmitter in monkey brain [5], and *in vivo* detection of glutathione for assessment of cancerous tumors [6] using BDD microelectrodes. Furthermore, other applications such as organic synthesis [7], ozone generation, and CO_2 reduction [8] are also shown.

In vivo assessment of cancerous tumors[6]

The *in vivo* electrochemical detection of the reduced form of glutathione (GSH) using BDD microelectrode for potential application in the assessment of cancerous tumors is presented. *In vivo* GSH detection measurements have been performed in human cancer cells inoculated in immunodeficient mice. These measurements have shown that the difference of GSH level between cancerous and normal tissues can be detected.

Electrochemical production of formaldehyde from CO_2 and seawater [8]

The electrochemical reduction of CO_2 in seawater using a BDD electrode under ambient conditions to produce formaldehyde is presented. This method overcomes the usual limitation of the low yield of higher order products and also reduces the generation of H_2. In comparison with other electrode materials, BDD electrodes have a wide potential window and high electrochemical stability, and, moreover, exhibit very high Faradaic efficiencies (74 %) for the production of formaldehyde, using either methanol, aqueous NaCl, or seawater as the electrolyte. The high Faradaic efficiency is attributed to the sp^3-bonded carbon of the BDD. Our findings therefore have wide ranging implications for the efficient and cost-effective conversion of CO_2.

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Using Hybrid Bilayer Membrane Devices and Electrochemical Stress Measurements to Interrogate Processes at Electrode Surfaces

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This talk will report on our use of electrochemical strain methods to examine metal electrode surfaces. We further report on development of a proton coupled electron transfer switch involving a hybrid bilayer membrane construction which enables facile gating of proton transfer.

We use electrochemical strain methods to interrogate Sn electrode lithiation relevant to Li ion batteries. The electrochemical response from Sn electrodes depends on the degree of Sn oxidation. In the presence of oxide, strain methods show conversion of compressive to tensile strain concomitant with oxide conversion. However, in the absence of surface oxide, Sn lithiation yields compressive strain only, the magnitude of which is modified by materials properties associated with lithiation and delithiation of the Sn.

We also report on our development of the first electrochemical platform in which a proton transfer switch gates catalytic activity. By incorporating an alkyl phosphate in the lipid layer of a hybrid bilayer membrane (HBM), we regulate proton transport to a Cu-based molecular oxygen reduction reaction (ORR) catalyst. To construct this HBM system, we prepare the first example of a synthetic Cu ORR catalyst that forms a self-assembled monolayer (SAM) on Au surfaces. We then embed this Cu catalyst inside a HBM by depositing a monolayer of lipid on the SAM. We envision that this electrochemical system can give unique mechanistic insight not only to the ORR, but to proton-coupled electron transfer (PCET) in general.

Electrochemical Capacitor in Aqueous Electrolyte Reaching the Energy Density of Organic Systems

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Electrochemical capacitors are generally based on activated carbon (AC) electrodes. Due to the square dependence of their energy with voltage, most of the commercially available systems use organic electrolyte (Et_4NBF_4 in acetonitrile), although environmental unfriendly, with voltages of 2.7 - 2.8 V. AC/AC capacitors in conventional aqueous electrolytes (H_2SO_4 and KOH) exhibit higher capacitance and power, but they have a restricted voltage window of 0.7 - 0.8 V. Recently, good performance and high cycle life has been reported up to 1.6 - 2 V for AC/AC supercapacitors based on salt aqueous electrolytes. It has been also demonstrated that, by using aqueous iodide solutions, the capacitance can be dramatically enhanced through pseudocapacitive effects related with the $2I^-/I_2$ redox couple at the carbon/iodide interface. This contribution demonstrates that mixed aqueous alkali sulfate or nitrate and alkali iodide solutions allow advantages of high voltage and high capacitance to be combined, while using stainless steel current collectors.

For example, capacitance values of 366 $F.g^{-1}$ and 378 $F.g^{-1}$ have been measured by galvanostatic cycling up to 1.6 V of AC/AC capacitors in 1 $mol.L^{-1}$ Li_2SO_4 + 0.5 $mol.L^{-1}$ KI and 1 $mol.L^{-1}$ $NaNO_3$ + 0.5 $mol.L^{-1}$ KI, respectively, as compared to 192 $F.g^{-1}$ for 1 $mol.L^{-1}$ Li_2SO_4 and 159 $F.g^{-1}$ for 1 $mol.L^{-1}$ $NaNO_3$. Moreover, the system based on the Li_2SO_4+KI mixed electrolyte exhibits constant resistance and capacitance during potentiostatic floating at 1.6 V for 120 hours, while in pure Li_2SO_4 solution the resistance increased from 1.52 Ω to 2.78 Ω and capacitance decreased from 188 $F.g^{-1}$ to 129 $F.g^{-1}$. Overall, the AC/AC electrochemical capacitor in mixed aqueous electrolyte is able to operate up to 1.6 V, exhibiting energy density as high as 30 $Wh.kg^{-1}$, which is comparable to the value obtained in organic electrolyte using the same AC material. Hence, this new generation of environment friendly supercapacitors is extremely promising for both stationary and mobile applications.

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Spectroelectrochemical and Theoretical Study of Redox Properties of Galactose Oxidase Models

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The interplay between redox-active transition metal ions and redox-active ligands in metalloenzyme sites is an area of considerable research interest. Galactose oxidase is the archetypical example, catalyzing the aerobic oxidation of primary alcohols to aldehydes via two one-electron cofactors: copper atom and a cystein-modified tyrosine residue.[1] The electronic structure of the oxidized form of the enzyme can be investigated extensively through small molecule analogs including phenoxyl radical. In this work the redox properties of metalocomplexes containing Cu(II) or Ni(II) central atom and variously substituted tetradentate ligand (S-methyl group or S-phenyl group) were studied by cyclic voltammetry and EPR-UV/Vis/NIR spectroelectrochemistry. The aim was to get insights into the electron transfer mechanism and the stability of the formed charged states within the investigated metalocomplexes containing π-conjugated ligand backbone. Marked stabilization of positively charged form was observed by replacing the tert-buthyl group with the S-phenyl group in orto- position to phenolic oxygen.[2,3]

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Elucidating kinetic processes and chemo-mechanical couplings in electrode materials from first principles

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Kinetic processes within the electrodes of energy storage devices remain poorly understood and characterized. Lithium insertion and removal from electrode materials, for example, requires solid-state diffusion at non-dilute concentrations and is often also accompanied by a sequence of diffusional and structural phase transitions. Since these phase transformations happen rapidly at room temperature, they are difficult to characterize experimentally. First-principles statistical mechanical approaches are now capable of predicting key electronic, thermodynamic and kinetic properties of electrode and electrolyte materials. They have been especially useful in elucidating the role of chemistry and crystal structure on ionic mobility as a function of concentration in intercalation compounds. By relying on effective Hamiltonians and kinetic Monte Carlo simulations to evaluate Kubo-Green expressions, it is possible to predict diffusion coefficients in arbitrarily complex crystal structures and at non-dilute concentrations. Electrode materials used in energy storage devices are also affected by a strong coupling between chemistry and mechanics. Charging and discharging of electrode materials can produce local stress intensities due to concentration gradients and misfit strain across migrating interfaces. First-principles electronic structure calculations have demonstrated that fracture properties can depend strongly on the local chemistry, making the susceptibility of electrode materials to fracture very sensitive to the state of charge.

High Voltage Perovskite Cells

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One of the important characteristics of perovskite solar cells is the unusually high open circuit voltage (V_{OC}) relative to the bandgap that can be obtained from these cells, approaching cells made with III-V semiconductors. This makes the perovskites highly suitable for a high voltage cells to be used as a top cell in a tandem cell stack or employing spectral splitting and potentially for high-energy photochemical reactions (including water splitting) if the rather labile perovskite can be surface-protected. This would provide a cheap alternative to the highly-expensive $GaInP_2$ which is the only commercial and presently available high voltage cell.

We have been investigating high-voltage cells using the Br-based lead perovskite (Eg=2.3 eV) instead of the much more commonly investigated I-based perovskite. In early work, we demonstrated a V_{OC} of 1.3 V using $CH_3NH_3PbBr_3$ on an alumina scaffold and matched with a perylene diimide (PDI) hole conductor [1]. While this was considered a very high value at that time, it was clear that the perovskite/PDI valence band offset of about 0.7 V was responsible for most of the difference between the bandgap and the V_{OC}. Choosing a hole conductor with an even deeper valence band (4,4′-bis(N-carbazolyl)-1,1′ -biphenyl, CBP) resulted in a V_{OC} up to 1.57 V under simulated 100 mW/cm^2 irradiation [2]. In addition, the low I_{SC} (ca. 1 mA/cm^2) obtained in our previous study was quadrupled by a combination of better doping of the CBP compared to the PDI as well as improvement in the perovskite by adding some Cl to the $CH_3NH_3PbBr_3$. Addition of Cl to the iodide perovskite had been shown to increase the charge carrier diffusion lengths [3,4]. For the Br perovskite, while we have not yet measured charge diffusion lengths, we suspect the improvement in performance with added Cl, whether or not due to increased charge diffusion lengths, may be connected with changes in the morphology of the perovskite films.

We have shown that, for the iodide and iodide/chloride perovskites, the cells behave as p-i-n cells, where the perovskite is the ‘intrinsic’ semiconductor sandwiched between the electron conductor (mostly TiO_2, even where an alumina mesoscopic scaffold has been used, since there is almost always a dense underlying TiO_2 blocking layer) and hole conductor [5]. This configuration is ideal for obtaining high V_{OC} since the total space charge layer is the sum of the two heterojunctions in the perovskite and can explain the high values of V_{OC} obtained by judicious choice of the other components in the cells.

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In Vivo Fast-scan Cyclic Voltammetry of Dopamine Domains in the Central Nervous System

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Fast-scan cyclic voltammetry in conjunction with carbon fiber microelectrodes offer very high, in fact unprecedented, levels of spatial and temporal resolution for the measurement of dopamine, a highly significant neurotransmitter, in the brain of living laboratory rodents. Capitalizing on the analytical merits of FSCV with CFEs, our laboratory has identified a previously unknown patchwork of distinct dopamine kinetic domains in two key brain regions, the dorsal striatum and nucleus accumbens. As a consequence, we begin to understand that the brain exhibits a fascinatingly rich repertoire of kinetic dynamics. It remains to be seen exactly what the functional consequences of these domains are but their existence comports extremely well with the recognized diversity and complexity of dopamine function in terms of both normal and disease states. In addition, the kinetic diversity demands refined mathematical modelling because existing models do not capture the full diversity of evoked responses that we have observed. Restricted diffusion is a novel concept that we hypothesize plays a significant role in maintaining the kinetic distinctions between dopamine's various domains, which appear to be closely adjacent to one another. If dopamine molecules were able to freely diffuse between them, the distinctions between the domains would be physically impossible. A new mathematical model cast to incorporate a generic description of restricted diffusion of dopamine in the extracellular space provides an excellent fit to many of the domain and region specific dopamine profiles we observe. This model supports the plausibility of the restricted diffusion mechanism but we must acknowledge that the model does not exclude other potential mechanisms for the domains.

Electrogenerated radical species produced at BDD electrodes: identification and reactivity

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Electrogeneration of reactive radical species at electrodes is very important for industrial applications. It is especially true considering the reactive oxygen species produced in aqueous media. One of the most interesting cases is the production of hydroxyl radical at boron-doped diamond (BDD) electrodes [1].

It is difficult to understand their reactivity due to the lack of specific and sensitive methods for characterizing such species. Electrogenerated radical species in aqueous solutions are often very reactive and vanish immediately after their production. A new experimental method that is easy to use is therefore needed for investigations of intermediate species formed on several electrode materials. The challenge is to detect species with high reactivities and short lifetimes, such as superoxide and hydroxyl radicals. In general, their presence or absence can only be confirmed by indirect complex methods. Among these methods, electron paramagnetic resonance (EPR) spin trapping is the most popular. Other methods suffer from high costs, low selectivity or poor detection limits.

An original selective and quantitative detection method for direct access to reactive oxygen species (ROS) called SECL for Selective Electrogenerated Chemiluminescence [2]. The method was validated on several electrocatalytic materials known to exhibit different behaviours toward the oxygen reduction reaction (ORR). The complementary nature of the information about the mechanistic path of the ongoing mechanism of ORR and the electrochemical response allowed us to understand the electrochemical reactivity based on the identified reactive intermediates in relation to the electrocatalytic activity of the electrode materials. It is based on the systematic use of several selective chemiluminescent probes and simultaneous amperometric recording. It is a powerful complementary tool for the classical characterization of electrocatalyst performance because it provides direct access to a quantitative detection of the specifically targeted intermediates that are produced during the ORR process. Such a methodological approach allows the design of new electrocatalysts through analysis of the effect of each component and each synthesis step at electrodes. Depending on the application, the pathway can be specifically oriented toward the four-electron pathway for fuel-cell processes on platinum electrodes and toward the two-electron pathway for industrial production of H_2O_2 with BDD electrodes.

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Organic "donor-free" dye with enhanced open circuit voltage in solid-state sensitized solar cells

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The predominant recent trend in designing new organic dyes for sensitized solar cells has been to combine an electron-withdrawing group (acceptor, A) on one side of a conjugated π-spacer and one or more electron-donating groups (donor, D) on the other side, which generate a donor-pi-acceptor (D-π-A) dye. Here, we reported solid-state cells sensitized with cyanoacrylic end-functionalized oligo(3-hexylthiophene) as a "donor-free" dye (π-A) with power conversion efficiency competitive with the state-of-the-art D-π-A dyes. We show that without an electron donor group a significantly higher open circuit voltage (V_{oc}) is achieved, while maintaining short circuit current. By combining experimental and theoretical investigation, we conclude that improved V_{oc} is due to higher steady-state concentration of oxidized dye, which increases the potential offset across the TiO_2-hole transporter heterojunction. This work questions the basic premise of the operating principles of solid-state dye-sensitized solar cells and opens a new direction for organic dye-sensitizer design strategy.

Electron Transfer and Spectroelectrochemistry of Carbon Nanostructured Systems

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The electrochemistry combined with spectroscopy techniques has been widely used in different contexts both to complement physical chemical information or gain new data, otherwise not so easily obtainable.

Thus, spectroelectrochemistry techniques, mainly UV-Vis, since the development in the 60's of the last century have allowed to investigate the electron transfer processes in molecular systems, with an increasing structure complexity as well as the electronic interactions among the various moieties in supramolecular species.[1] The appearance of low-dimensional carbon nanostructures, such as nanotubes and graphenes, which represent a very promising class of new materials in the field of nanotechnology, has seen an even more frequent recourse to spectroelectrochemical investigations.[2]

In this communication the interesting redox and photophysical properties of nanostructured carbon systems (single walled carbon nanotube – SWNT, graphene, planar and curved polycyclic hydrocarbons[3]) will be discussed together with the fundamental data obtained from the spectroelectrochemical investigations.

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Interface Electrochemistry in Li-Materials: A First Step towards Multiscale Modeling

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Li-Ion batteries have become indispensable in the field of portable electronics and hybrid electric vehicles. If their high energy density is a major asset, their life and reliability are still inadequate to address favorably industrial specifications. Understanding the degradation modes of the different elements of a Li-Ion battery is now one of the major objectives of the scientific community involved in this field. To achieve this, one possible strategy is to identify the indicators of failure in order to prevent degradation of our batteries and, hopefully, propose alternatives to this degradation. For the most part, the aging/degradation phenomena of a battery arise from the electrochemical reactivity at interfaces and from side reactions occurring between the different elements of the battery (electrode/electrode, electrode/electrolyte). These reactions occur, for example, when the redox mechanisms at the origin of the device performance are modified by a change in texture or morphology of the electrode during the charge/discharge. An essential step in the understanding and treatment of these phenomena is to define, in a systematic way the mechanical, electronic, chemical, electrical and ionic factors that are most relevant to describe the device as a whole. Understanding these parameters is a challenge for computational chemists, in particular at the atomistic level using first-principles methods. This presupposes to calculate, independently and without prejudging their impact on battery performance, a set of elementary reactions occurring in the bulk, at the surfaces and at the interfaces of the electrode, and to inject the as-obtained *ab initio* parameters in a model of higher scale to determine which of these elementary processes is dominant in the degradation mechanism. With these calculations, it is then possible to translate, at a macroscopic level, all the basic mechanisms occurring at the atomic scale, in order to identify factors causing degradation phenomena of Li-Ion batteries. The methodology we developed [1,2] to investigate this first-step study towards multi-scale modeling will be presented for a set of Li-based materials, the so-called conversion materials.[3]

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Electroosmotic Flow in Brain Tissue. Implications for Measurements.

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We determine several years ago that cultured hippocampal slices, so-called organotypic hippocampal slice cultures (OHSCs), have a significant ζ-potential. Its value is about –22 mV. While this may play a role in normal physiology, we have concentrated on the beneficial application of electroosmotic flow on OHSCs to make measurements of extracellular concentrations and enzyme activity. In particular, we have focused on the determination of the activity of membrane-bound, outward facing enzyme activity. Such enzymes, called ectoenzymes, are important in purine signalling as well as in neuropeptide activity.

Experiments are involve either a single collection capillary drawing fluid through an OHSC and collecting the perfusate or a pair of capillaries, one pulled to a tip and inserted in the tissue and supplying electrolyte solution and the other collecting as in the single-capillary experiment. The OHSCs are about 160 μm thick and 2-3 mm in length and width. Notably, the hippocampus has an impressive architecture which is preserved in the cultures. For measurements of peptides, we use capillary liquid chromatography with electrochemical or UV detection. For measurements of thiols we use microfluidic capillary electrophoresis and laser-induced fluorescence.

With these systems, we have determined the identity of an ectopeptidase removing the N-terminal tyrosine from the peptide leu-enkephalin. We were able to characterize the enzyme in the living, intact tissue by determination of a Michaelis constant. Another peptide of interest is the 29-amino acid galanin. The spatial resolution of our approach has permitted us to distinguish differences in the extracellular processing of galanin among different regions of the hippocampus. Finally, we have determined for the first time the endogenous concentration of cysteamine. Using the cysteamine measurement we have also been able to study certain drug metabolisms as well as the catabolism of coenzyme A. All of our work is buttressed by numerical calculations using Comsol.

Signal Amplification for Electrochemical Analysis of Nucleic Acids and Proteins

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Owing to the inherent background signals of various instrumental analytical technologies and the limitation of the classical analytical methodologies, the detection of biomolecules with low abundance and the acquisition of ultra weak biological signals have become a bottleneck of life science research. To dissolve the bottleneck problem, our group brings nanotechnology and biotechnology into the development of analytical methodologies, and has designed a series of signal amplification strategies based on nano and molecular biological technologies for sensitive electrochemical detection of nucleic acid and proteins.

Firstly nanomaterials can accelerate the electron transfer. The catalytic and enzyme mimetic functions of the nanomaterials lead to sensitive electrochemical signals. By using the nanomaterials as tag molecules some electrochemical detection methods have been proposed. Nanomaterials can also be used as the carriers of signaling molecules. These signal amplification strategies have been used in electrochemical detections such as voltammetric analysis, impedance analysis, capacitance analysis, electrochemiluminescent analysis, photoelectrochemical analysis, and scanning electrochemical microscopy imaging. The established methods can conveniently be used in the detections of DNA, proteins, cells and carbohydrate sites on cell surfaces.

The molecular biological technologies for signal amplification are to use PCR, rolling circle amplification (RCA), target-induced repeated primer extension, hybridization chain reaction, loop-mediated amplification and target DNA recycling amplification including endonuclease-, exonuclease- and polymerase-based circular strand-replacement polymerization to amplify the electrochemical signals. These strategies bring the opportunity of vigorous development of electrochemical bioanalysis, which makes it possible to detect undetectable targets by traditional methods, such as some disease markers, biological threat agents and pathogens.

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Utilization of Poly(vinylpyridine) as an Oxidant-capture for Iodine-based Redox Capacitors

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Electrochemical capacitors utilizing pseudo-capacitance based on redox reactions in electrolyte solution phases have potential advantages such as higher rate-capability and higher energy density than those of conventional electric double-layer capacitors (EDLCs). However, as the charged redox species in the solution tend to diffuse and compensate the stored charges between positive and negative electrodes (*Shuttle-effect*), the capacitance loss under the rest conditions after the charge (so-called self-discharge) is higher than that of EDLC.

In the present work, we have examined the effects of an electron-donor compound in the electrode on the voltage retention of an electrochemical capacitor utilizing pseudo-capacitance of an iodide/tri-iodide redox couple. It is well-know that Poly(4-vinylpyridine) (PVP) forms a charge-transfer complex with iodine (I_2) or tri-iodide (I_3^-), as shown in Fig. 1 [1].

The present capacitor system consists of high surface area carbon electrodes with organic electrolyte solution. The carbon electrode was prepared from powdered carbon black (BP2000) with and without PVP. The organic electrolyte was 1 M $EMIBF_4$ with and without 0.01 M EMII (EMI: 1-ethyl-3methylimidazolium) dissolved in propylene carbonate (PC). The cell containing EMII in the electrolyte showed higher specific capacitance than that without the iodide, due to the contribution of pseudo-capacitance from I^-/I_3^- redox reaction in the solution. In Fig. 2, OCV profile of the cell using PVP in the positive electrode is compared with that of the cell without PVP. In the cell without PVP, the OCV significantly decreased with the storage time because of the *shuttle effect* of the oxidized species. However, better voltage retention was observed for the cell using PVP, which would trap the oxidized species (I_2/I_3^-) at the positive electrode.

Fig. 1 Charge-transfer complex formation between PVP and I_2 (or I_3^-).

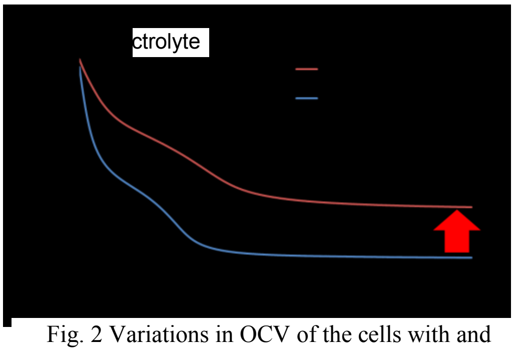

Fig. 2 Variations in OCV of the cells with and without PVP in the positive electrode, as a function of storage time after constant-voltage charging at 2.5 V.

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Polyelectrochromism in Diruthenium Complexes with Redox-Active Ligands

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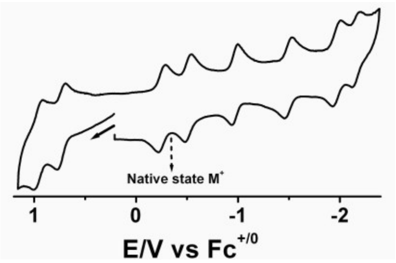
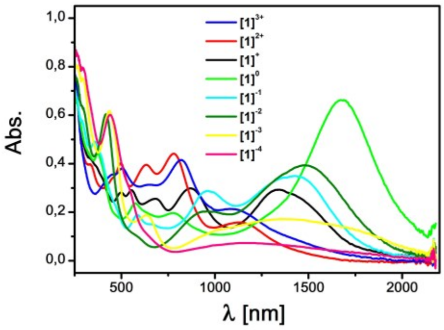
Electrochromic materials are promising substance classes for applications in the opto-electronic industry.[1] A convenient way of generating electrochromic dyes for the visible as well as the NIR region is the combination of transition metal centers with redox-active ligands that contain frontier orbitals which are comparable in energy.[2] Using this concept, we have reported on three-center redox-systems that display such properties.[3] In this contribution we would like to present a novel five-center redox system that combines three redox-active ligands with two redox-active ruthenium centers. This complex that displays eight reversible one-electron transfer steps (see Figure) has been investigated with cyclic voltammetry and differential pulse voltammetry. We will show that such molecules are capable of exhibiting polyelectrochromism in the visible and the NIR region, where the absorption features can be controlled by well-defined one-electron transfer steps at mild potentials. In addition, we will discuss the powerful methods of UV-vis-NIR and EPR spectroelectrochemistry, together with DFT calculations for characterizing these substances and gaining insights into such polyelectrochromic behaviour.





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High Purity Silicon Materials Prepared Through Wet-chemical And Electrochemical Approaches

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Si material has highly increasing demand for various applications such as solar cells, photonic devices, semiconductor devices, MEMS and related functional micro/nano structures, etc. In particular, the solar cell industry needs huge amount of high-purity Si at lower cost. Since the conventional process bases on substantial energy consumption for purification and machining (slicing/polishing etc.), alternative approach has to be examined. For this, we have been investigating a new approach to form the Si materials using wet-chemical purification and electrochemical reduction processes, as well as electrodeposition process to form Si layers. In this paper, we will describe our attempts on developing these processes, mainly focusing upon the electrodeposition of Si layers and microstructures.

For the resource of producing high purity Si, diatomaceous earth is chosen, which is earth-abundant material consisting of porous silica with relatively high purity. After wet treatment with acid solution, most of the impurities except light elements such as B, could be removed [1]. In order to achieve further purification to eliminate the light element, we employed solvent extraction using channel-flow type reactors, and it turned out to work quite effectively [2].

Silica with high purity was then reduced by direct electrochemical reduction process using $CaCl_2$ molten salt as electrolyte [3], and crystalline Si was successfully obtained. We attempted to develop the continuous reaction system by feeding silica powder [4], and confirmed that the reduction proceeded steadily to reduce silica. We also attempted to apply ionic liquid as an electrolyte, and developed the process to form continuous Si layers as well as arrayed patterns [5, 6].

The authors would like to thank Drs. J. Komadina, M. Kunimoto, K.Yasuda, X.Yang, and Mr. T. Nishida for their experimental help and valuable discussion.

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Design of Boron-doped Diamond with *sp*^{2}-bonded Carbon Impurities According to the Electrochemical Applications

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Table 1. Specimen characteristics

Electrode	[B] / cm^{-3}	Resistivity / Ω cm	sp^2-C (*)
BDD-A	1.3×10^{20}	0.47	Absence
BDD-B	1.9×10^{20}	0.28	Presence
BDD-C	1.7×10^{21}	3.1×10^{-3}	Absence
BDD-D	6.2×10^{21}	1.3×10^{-3}	Presence

(*) Judged from G-band in Raman spectra

Much attention has been drawn to conducting boron-doped diamond (BDD) as an electrode material for electrochemical sensors, water treatment and ozone production because of low background current, wide potential window and intrinsic durability. However, each application does not necessarily require the same properties. Consequently, the electrode design appropriate for each application is important. The electrochemical properties of diamond can be substantially affected by the boron concentration, surface termination and *sp*^{2}-bonded carbon impurities. In this study, the effect of *sp*^{2}-bonded carbon impurities on the electrochemical properties were investigated in case of heavily and moderately boron-doped diamond. Additionally, their capabilities for the each application were evaluated. Four types of BDD electrodes were prepared for the electrochemical measurements (Table. 1). At a results sp^2-bonded carbon impurities can affect electrochemical properties on heavily boron doped diamond and the electrode (BDD-D) behaved as active electrode like carbon electrodes. The BDD-D showed poor capability of water treatment application compared to other BDD electrodes (Fig.1). On the other hand, the highest performance of O_3 production were obtained in using the BDD-D (Fig.2). These results suggest that electrode properties of BDD can be tailored with sp^2-bonded carbon impurities in heavily boron-doped diamond according to applications.

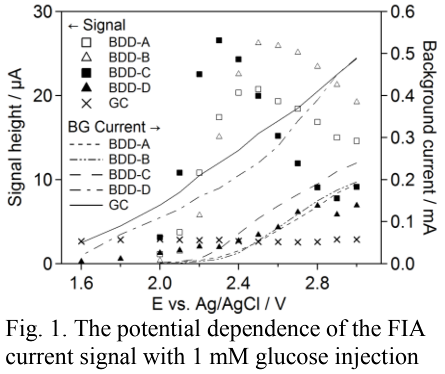

Fig. 1. The potential dependence of the FIA current signal with 1 mM glucose injection and the background current.

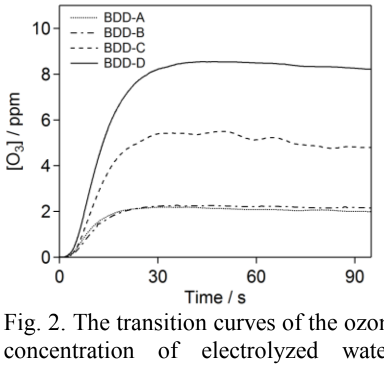

Fig. 2. The transition curves of the ozone concentration of electrolyzed water. Applied voltage: 11 V

Modeling of Lithium Stripping and Plating

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Lithium-metal anodes are plagued with the formation of surface structures like dendrites during battery cycling which reduce battery performance and safety. Replacing Lithium metal by graphite can prevent deposition of metal Lithium and formation of dendrites in a reasonably wide range of operating conditions, but at high charging rates especially at low temperatures, lithium can deposit on the graphite surface as metal instead of intercalating into the active particles. Although partially reversible, there remains always an irreversible capacity loss under cycleing.

Here, we approach the problem of metal deposition and dissolution from two directions. On the scale of lithium dendrites, we formulate a theory for the dissolution of nanostructures of lithium metal upon discharge. Our theory is based on phase field models for electrochemically-driven surface growth [2]. Experimentally it is observed that dissolution of lithium metal may lead to the formation of solid droplets if the initial structure are dendrites [1]. The same behavior is also observed in our theory. In addition, the theory reveals as origin for droplet formation the interaction between the lithium metal and the SEI, which is formed on the metallic lithium surface in contact with the electrolyte. This interaction is responsible for the nucleation of a Rayleigh-Jeans instability driven by the lithium metal surface energy [3].

On the cell level, we model lithium plating in a three-dimensional thermal transport and reaction model of the full battery cell. Our model accounts for consistent transport [4] and reaction kinetics [5] in electrolyte and electrode particles, which is necessary to predict consistently the inhomogeneous nucleation of lithium metal in a graphite anode and its influence on the battery performance as well as the feedback of already plated lithium on subsequent plating events.

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Ultrasensitive Electrochemical Detection of miRNA Biomarkers in Epilepsy

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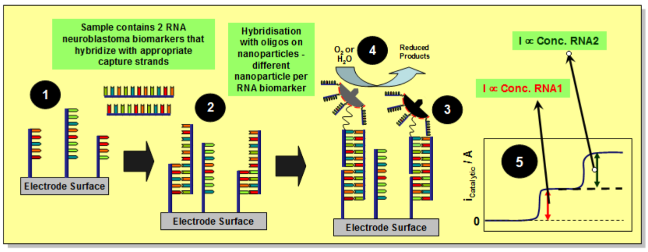
Epilepsy is a common serious neurological disorder characterized by recurring seizures[1]. Epileptogenesis, i.e., the transformation of a normal brain to one capable of generating epileptic seizures, involves alterations to synaptic function, channels and neurotransmitters, gliosis, inflammation, extracellular matrix, cell death and aberrant neurogenesis.

Henshall and co-workers have recently identified miRNA biomarkers in animal models and in children with refractory temporal lobe epilepsy[16-17]. However, the concentrations are extremely low requiring significant amplification by PCR before they can be detected. In this contribution, we describe the use of electrocatalytic nanoparticles and advanced imaging dyes that generate dramatically enhanced Faradaic current or fluorescence/Raman responses even when only a few copies of the miRNA target are present thus avoiding PCR based amplification of the target.



Our approach involves creating a nanoparticle label for probe strand DNA/miRNA on which the electrocatalytic detection and molecular recognition functions are physically separated. As shown in the figure above, in the presence of the target NA, the platinum nanoparticles become bound to the electrode surface and the concentration of the target can be determined by monitoring the current associated with the reduction of hydrogen peroxide. Calibration plots of the log[miRNA] vs. faradaic current are linear from 10 fM to 1 μM and fM concentrations can be detected without the need for amplification of the target. As well as a wide dynamic range, this detection strategy has an excellent ability to discriminate between miRNA targets.

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Quantum Dots-based Thin Film Solar Cells

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Oxidation of Organics via a Non-Faradaic Electrochemical Activation of Molecular Oxygen

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Electrochemical oxidation reactions in aqueous media can be divided in to two main classes: electron transfer reactions (ETR) and electrochemical oxygen transfer reactions (EOTR). Electron transfer reactions are in general simple reactions and involve proton and electron transfer. A typical example of ETR is the oxidation of phenolic compound to the corresponding phenoxy radical. Electrochemical Oxygen Transfer Reactions (EOTR) are more complex and in general involves water activation in order to transfer oxygen from water to the substrate. A typical example of the EOTR is the oxidation of CO to CO_2.

In this work, we demonstrated for the first time, using acetic acid as a model organic compound a new type of oxygen transfer reaction involving the non-faradaic electrochemical activation of oxygen/air at room temperature using BDD anodes.

The direct evidence of this process was obtained from differential electrochemical mass spectrometry (DEMS) measurements for the electro-oxidation of acetic acid in 1 M $HClO_4$ saturated with isotopically labeled $^{18}O_2$.

This non-faradaic electrochemical activation of oxygen is believed to be initiated by $HO^\bullet$ electro-generated on the BDD surface as is shown in the proposed reaction mechanism (Fig 1).

This new process opens new possibilities for the design of a less energy consuming electrochemical oxidation process in which current is applied mainly to initiate the formation of $HO^\bullet$ radicals, whereas oxidation of proceeds via reaction with molecular oxygen in aerated solutions

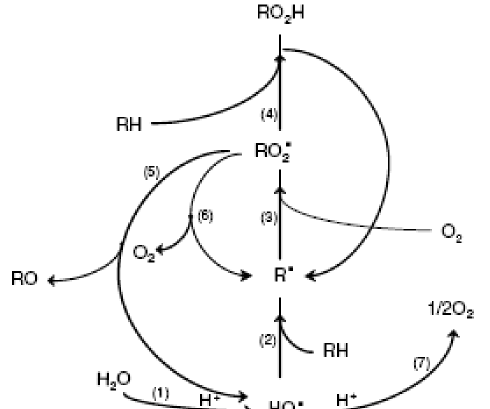

Fig.1. Proposed reaction mechanism for the induced oxidation of organics by O_2
(1) Electrogeneration of $HO^\cdot$; (2) Formation of organic radicals $R^\cdot$ by hydrogen abstraction via $HO^\cdot$; (3) Formation of organic peroxy radicals $RO_2^\cdot$ by addition of O_2 to $R^\cdot$; (4) Hydrogen abstraction from RH via $RO_2^\cdot$; (5) $RO_2^\cdot$ reaction leading to RO and regeneration of $HO^\cdot$; (6) Decomposition of $RO_2^\cdot$ to O_2 and $R^\cdot$; (7) oxygen evolution.

MODEL-BASED OPTIMAL EXPERIMENTAL DESIGN & STATISTICAL METHODS FOR ELECTROCHEMISTRY

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Keywords: Electrochemical Impedance Spectroscopy, Conductivity Relaxation, Ionic Exchange Depth Profiling, Statistical analysis, Optimal Experimental Design

Introduction

Mathematical models are ubiquitous in science and engineering and are used to interpret and predict the outcome of experiments and the behavior of devices or systems. Models with varying degree of complexity are found in the study of electro active materials and they have been used to explain the nature of electrochemical reactions both at kinetic and the quantum level, to determine defect chemistry and transport properties, to establish the processes that are rate limiting and to gain insight on reactions occurring at the nanoscale [1]. In this work, a statistical link between experimental date obtained widely used in solid state electrochemistry, such as Electrochemical impedance spectroscopy (EIS), Electrical Conductivity Relaxation (ECR) and Isotope Exchange Depth Profiling (IEDP), and mathematical model is made in order to increase the quality of the estimated parameters via Optimal Experimental Design (OED).

Approach and Results

The link between errors in the measurements and errors of the parameter set that constitute the underlying model are clarified analytically. Then, within the optimal experimental design setting, the controllable experimental variables are optimized so that the confidence on the parameters estimated parameters during the experiment are reduced. Subsequently synthetic experiments are performed to check the quality of the analytical estimators of the parameters errors.

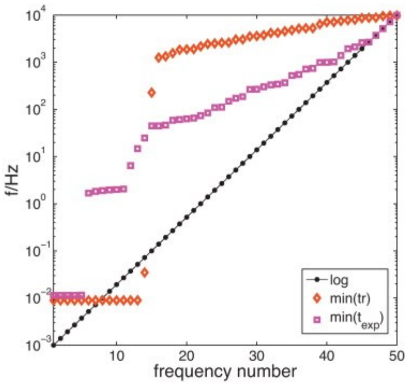

Figure 1 - Frequency distribution in the minimum trace, minimum time and log-spaced impedance spectra.

Concurrent minimization of the experimental time and of the quality of the parameters estimates is also considered and the result of this optimization procedure is the determination of experimental configurations that can improve the quality of the estimated parameters (up 90% relative error reduction) and drastically reduce (up 80%) the experimental time [2-3] leading to non-traditional sampled frequencies, see Fig. 1.

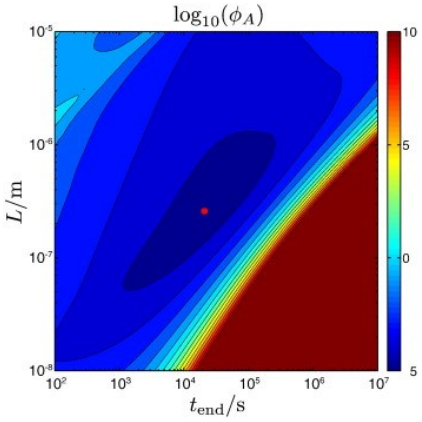

Figure 2 - Contour plots of the logarithm of the A-criterion objective function for IEDP versus sample thickness and annealing time.

Finally, guidelines for EIS [2-3], IEDP [4] and ECR [5] optimization are provided in a unified setting and the test results are compared to novel bootstrap analysis methods [6]. Freely available Matlab code is also introduced [7].

Conclusions

In this presentation, new tools that aim at enhancing the parameter estimation process in EIS, ECR and IEDP are introduced and OED, along with related statistical techniques, is shown to be useful for reducing experimental time and for establishing model parameters with increased accuracy and broader insight.

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STM Studies of Single Molecule Electrochemical and Chemical Gating

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Measurement of the electrical properties of single molecules sandwiched between metal contacts has become an experimental reality over the last decade. In recent years, we have exploited novel scanning-tunnelling-microscopy (STM) based methods for achieving this feat. This has included STM measurements of single molecule conductance under electrochemical potential control. The electrochemical potential can be used to control the redox state of single molecule bridges and switch the electrical conductance from low to higher values. This has been referred to as the "single molecule electrochemical transistor" configuration, with the electrochemical potential "gating" the molecular conductance in the STM nano-gap configuration. Recent results from our group on gating the conductance of single molecules will be discussed. Using the STM in a room temperature electrochemical ionic liquid environment has enabled us to view electrochemical redox processes of single molecules not observed in aqueous solutions. Our recent work on other redox active molecular wires studied using this in-situ electrochemical STM technique will also be discussed. Also new work on chemical gating, sensing to the single molecule level and effects of the solvent medium will be presented. New developments in single molecule measurements on electrochemically deposited ferromagnetic contacts will also be presented.

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Electrochemical studies of the lithium deposition on Au(111) from a piperidinium-based ionic liquid

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Two major problems of modern lithium ion batteries are the thermal stability of the electrolyte and internal short circuits due to the formation of lithium dendrites at constant current. Room-temperature ionic liquids (RTILs) provide wide electrochemical windows, good conductivity and high thermal stability [1,2] and are thus excellent candidates for next generation batteries and general electrochemical applications [3]. However, in order to understand and prevent the dendritic growth of lithium in ionic liquids, extensive fundamental studies regarding the initial stages of lithium deposition are required.

In this study lithium was electrodeposited on a Au(111) substrate from the solution of lithium bis(trifluoromethylsulfonyl)imide in the commercially available RTIL 1-methyl-1-propylpiperidinium bis(trifluoromethylsulfonyl)imide. Electrochemical investigations were carried out by means of cyclic voltammetry (CV) and the initial stages of metal deposition were followed by *in-situ* scanning tunnelling microscopy (STM). As additional and independent characterization method, Electrochemical Quartz Crystal Microbalance (EQCM) measurements were performed to determine the actual adsorbate species with high accuracy.

Three cathodic current peaks were found in the potential range of −0.5 to −2.5 V vs. a Pt pseudo-reference electrode. By means of the EQCM measurements it turned out that each peak is related to the deposition of lithium. This is also in accordance with the *in-situ* STM investigations, which confirm Li deposition in various morphologies within this potential range. Further, we found that the first cathodic peak coincides with the strand-like growth of lithium on top of the gold terraces. The second peak is due to the Li underpotential deposition and corresponds to the growth of lithium islands of one monolayer height in this potential region. Finally, at very negative potentials, *i.e.* in the order of the last cathodic peak, the lithium growth takes place in a three-dimensional manner.

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Rational Design of Electrode Materials Based on Chalcogen Elements for Li-Ion and Post Li-Ion Batteries

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With the increasing demand for efficient and economic energy storage, rechargeable alkali metal (Li, Na etc.)-chalcogen (O, S, Se, etc.) batteries, including Li-O_2, Li-S, Li-Se, and Na-S systems have become attractive candidates as post Li-ion systems for the next-generation high-energy batteries because of their high theoretical energy density and cost effectiveness.[1] As a crucial component, carbon substrates with appropriate porous structures are highly desired in developing superior chalcogen elements-based electrode materials for rechargeable batteries.[2] Here, we report a series of rational designs for chalcogen elements (S, Se, Te)-carbon composite electrode materials.[3-5] We discuss the electrochemistry of S cathodes with different sulfur allotropies, as well as the new designs of Li-S pouch cells (5~10 Ah).[6] Secondly, we report advanced Se-C cathodes for rechargeable Li-Se batteries, as well as the Se molecules evolution upon cycling.[7] The advanced Se/C nanocomposite not only can be used as a cathode material in Li-Se batteries, but also an anode material in Li-ion batteries.[8] Finally, through employing the confined chain-like sulfur molecules as the active cathode component for room-temperature Na-S batteries, a novel mechanism is proposed and verified for the batteries' electrochemistry, which bringing a tripled specific capacity and an increased specific energy compared to traditional high-temperature Na-S batteries.[9]

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Supercapacitor Electrode Materials from Abundant Lignocellulose Biomass: fine-tuning porosity to specific electrolytes

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The market prospects of supercapacitors depend greatly on the cost of electrode materials and the energy and power output, especially in volumetric terms [1].

Renewable natural precursors are abundantly generated in nature and are already known to be a source of nanoporous carbons with well-developed microporosity and low admixture content. Some biomass precursors like coconut shell have been extensively used for the fabrication of electrode materials for supercapacitors, while the others have never been used although the parameters of derived carbon materials are attractive for supercapacitor applications.

Therefore, extending the range of inexpensive natural sources for nanoporous carbon electrode materials is an evident option for the better affordability of supercapacitors. However, nanoporous carbons from each natural resource requires proper optimization of synthetic conditions before they can become practically applicable. This has stimulated the present work on alternative carbon precursors with a focus on the optimization of synthetic parameters, primarily targeting high volumetric capacitance and cost-related parameters such as an amount of activating agents and temperature.

Good control over textural properties was enabled through small variations in the synthesis parameters such as temperature and amounts of activating agent, resulting in a series of microporous carbons displaying gradual changes in pore size distribution within narrow limits. Cost-effective synthesis conditions (the minimum loading of an activating agent and the lowest synthesis temperature) were defined for each specific electrolyte to provide a volumetric capacitance as high as 150 $F.cm^{-3}$ per electrode in aqueous electrolyte and 60 $F.cm^{-3}$ in organic electrolyte with good rate capability (e.g., 90% capacitance retention at a current density of 9 $A.g^{-1}$ in organic electrolyte) and cycling characteristics. The whole data set generated in the course of refining the synthesis conditions can be used as a guidance for adjusting the porosity of the materials to novel electrolytes.

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Structural and Electronic Properties Featuring Ambipolar Transport in Methylammonium Lead Iodide Perovskite: A DFT Analysis

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Methylammonium (MA) lead iodide perovskite ($CH_3NH_3PbI_3$) plays an important role in light absorption and carrier transport in efficient organic−inorganic perovskite solar cells [1]. In my talk, the first theoretical estimation of effective masses of photocarriers and the role of MA cation in $CH_3NH_3PbI_3$ will be discussed.

Spin-polarized DFT calculations have been performed with the generalized gradient approximation. From the charge density of the two-fold degenerate states ((a) and (b)) of CBM and those ((c) and (d)) of VBM, one can see that photogenerated electrons around CBM and holes around VBM exist separately, results related to the ambipolar transport nature of the material. Effective masses of photogenerated electrons and holes are estimated to be me* =0.23m0 and mh* = 0.29m0, respectively, including spin−orbit coupling (SOC) effects. This result is consistent with the long-range ambipolar transport property and with the larger diffusion constant for electrons compared with that for holes in the perovskite, which enable efficient photovoltaic conversion [2].

We also have focused our attention on the MA cation and studied the role it plays in the electronic/optical features of the perovskite, paying attention mainly to the iodide compound.

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Micro-Electrode Array Biosensors for Neurotransmitter Detection in Behaving Animals

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The ability to make rapid, informed decisions about whether or not to seek out a reward, such as a palatable food, is essential for survival. Indeed, aberrant reward-related decision-making is a hallmark of addiction, obesity, and many other neuropsychiatric disorders. It is therefore imperative to elucidate the neural signals of decision making to understand, on a basic level, the mechanisms of desire, and on a disease level, how these signals may be altered to produce maladaptive reward-seeking behavior.

The power of in vivo electrochemistry to provide direct, rapid measurement of biogenic amine neuromodulators has been recognized for some time. Unfortunately, the major excitatory neurotransmitter, glutamate (Glut) is not readily oxidized at an electrode, but amperometric electroenzymatic methods for Glut detection have been developed in our laboratory and elsewhere, using electrodes modified with Glut oxidase (GlutOx), a flavoenzyme that uses O_2 as electron acceptor resulting in the production of H_2O_2, which can be detected by electrooxidation. Interference from both electroactive anions and cations is effectively excluded from the amperometric recordings, while still maintaining a 1 s response time, by application of Nafion and polypyrrole films to the electrode sites on a silicon wafer-based micro-electrode array before enzyme immobilization (Wassum et al., 2008). Incorporation of a non-enzyme-coated sentinel electrode on the microelectrode array, signals from which are subtracted from those of the enzyme-coated electrode, provides the noise reduction necessary to reveal rapid transient glutamate events in the rodent brain.

Taking advantage of these advances, we have made spatially discrete near-real-time extracellular recordings of glutamate, in the basolateral amygdala (BLA) region of the brain of rats performing a self-paced lever-pressing sequence task for sucrose reward. This has allowed us to detect rapid transient fluctuations in extracellular BLA glutamate time-locked to action performance. These glutamate transients tended to precede lever-pressing actions and were markedly increased in frequency when rats were engaged in such reward-seeking actions. Based on muscimol and tetrodotoxin microinfusions, these glutamate transients appeared to originate from the terminals of neurons with cell bodies in the orbital frontal cortex. Importantly, glutamate transient amplitude and frequency fluctuated with the value of the earned reward and positively predicted lever-pressing rate. Such novel rapid glutamate recordings during instrumental performance identify a role for glutamatergic signaling within the BLA in instrumental reward-seeking actions.

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Microfluidic based electrochemical sensors and biosensors for real-time neurochemical monitoring of the injured human brain.

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Traumatic brain injury is a major cause of death and disability in all age groups and the leading cause in working people. Deterioration of patients often occurs during the 5-10 day post injury while they are intensive care unit (ICU), and is due to 'secondary' brain injury. We have previously shown that complex phenomena such as the development of secondary brain injury can be detected on the ICU and potentially understood by combining data from a range of real-time measurements made in the brain tissue at risk from secondary injury (1,2). In this presentation we discuss the design, construction and first clincial data from a new electrochemical clinical instrument specifically targeted at the detection of pathological 'secondary insults' to at risk brain tissue.

At the heart of the system is neurochemical measurement. We sample the extracellular space using a CE marked microdialysis probe. The dialyse liquid stream (1–2 microlitre / min) is then carried to the bedside analysis unit in either continuous flow or, for greatly improved temporal response, using 30 nl droplets formed using FC40 fluorocarbon oil, giving digital microdialysis. Neurochemical analysis takes place at the patient bedside using electrochemical sensors and biosensors within a microfluidic analysis device. Potassium ion concentrations are measured using 300 micron diameter valinomycin based ion-selective electrodes. Glucose and lactate levels in the microdialysate are measured using biosensors based on a 320 micron integrated amperometric electrochemical cell. These biosensors use an electropolymerised non-conductive film of polyphenol as a selectivity layer combined with PEG based enzyme entrapment. The microfluidic chip / sensor combination is built into a microfluidic circuit-board that also has computer controlled valves and micro-syringe pumps (LabSmith). This allows routine 5 point autocalibation under computer control. Custom instrumentation and event detection software that highlights adverse changes o the clinical care team then completes the instrument.

The talk will highlight the challenges of carrying out electrochemistry on the ICU and show how electrochemical data can be combined with other real-time measurements to detect changing brain pathology.

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Durability of PEFC Cathode Catalysts: Challenges, New Concepts and Solutions

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Even after multiple years of R&D electrocatalysis in Polymer Electrolyte Fuel Cells (PEFCs) still represents a major field due to both kinetic limitation of the cathodic oxygen reduction reaction and limited intrinsic stability of the typically used carbon supported Pt-based electrocatalysts. The latter is imposing either major efforts on the stack and system design and its control strategies or requires new concepts for the material design in order to improve the catalyst's intrinsic corrosion stability. Pt nanoparticles supported on high surface area carbon supports suffer from both the instability of the active phase (Pt or its alloys) and the limited corrosion resistance of the carbon support. In order to overcome these stability limitations, several mitigation strategies on the materials level exist:

i) Instead of high surface carbon supports, transition metal oxide supports can be used which may not be further oxidized, i.e., metal oxides in their highest oxidation state [1]. Using this approach, we demonstrate how different dopants in SnO_2 supports are influencing the catalyst stability and activity.

ii) unsupported catalysts forming extended structures of the active phase are widely described (e.g., Pt-black or NSTF-like structures as introduced by 3M [1]). Using this apporach we will demonstrate the superior activity and stability of metallic high surface are nanostructured catalysts [2], so-called noble metal aerogels offering in a purely metallic system specific surface areas of approx. 100 $m^2 g^{-1}$.

In this contribution, there will be a discussion on the suitability of these aforementioned two approaches including their advantages and disadvantages.

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Bilirubin Oxidase from *Myrothecium verrucaria* Physical Adsorbed onto Graphite Electrodes. Insights into the Alternative Resting Form of the Enzyme and the Impact of Chloride, Temperature and pH

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The oxygen reduction reaction (ORR) is one of the most important chemical processes in energy converting systems and living organisms. Mediator-less, direct electro-catalytic reduction of oxygen to water was obtained on spectrographite electrodes modified by physical adsorption of bilirubin oxidases from *Myrothecium verrucaria*[1]. The existence of an alternative resting form of the enzyme is validated[2,3] and the effect of temperature, pH, and chloride on the catalytic cycle are analyzed. Previous results on the electrochemistry of BOD and on the impact of the presence of chloride are presented under new perspectives and new interpretations are formulated.

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What Electrochemistry has taught us about Hydrogen Activation by Enzymes

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Over the past decade, Protein Film Electrochemistry (PFE) - a technique whereby the electron transfer (ET) and ET-coupled reactions of an adsorbed protein or enzyme are studied with a suite of dynamic electrochemical methods – has provided unrivalled new mechanistic information on redox enzymes possessing very high activity or unusual reactivities. A particular example has been the application of PFE to investigate hydrogenases - microbial metalloenzymes that catalyse the rapid and reversible interconversion of H_2 and H^+ - which are inspirational for various aspects of renewable energy development. The active sites of hydrogenases contain Fe, or Ni and Fe, coordinated by thiolates, CO and CN^-, and their favourable activity comparison with platinum has proved that efficient H_2 activation is entirely possible using inexpensive first-row transition metals provided these are coordinated in the right environment. Cyclic voltammograms of hydrogenases adsorbed on a rotating carbon disc electrode serve as fingerprints for enzymes from different sources, the potential cycles revealing intense currents due to H^+ reduction and H_2 oxidation along with inactivation/activation processes that show up as hysteresis. The active sites of hydrogenases are susceptible to attack by small molecules ranging from O_2 to formaldehyde, in potential-dependent reactions that can be studied by chronoamperometry. Accordingly, an excellent example of a major contribution made by PFE has been the determination of how certain hydrogenases are able to operate in air, without inactivation by O_2 – a question that has intrigued scientists for many years, not least because of the potential for exploiting photosynthetic H_2 production by algae. Hydrogenases can be incorporated into novel devices such as membrane-less fuel cells or solar fuel cells based on semiconducting materials, in each case giving new insight into both mechanisms and technology possibilities. This lecture will describe some recent highlights in this research.

Conductive $Ti_{1-x}Mo_xO_2$ Oxide Supported Pt nanocrystals Used as High-Performance Catalyst for Oxygen Reduction Reaction

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The search for catalysts with high activity and long-term stability for oxygen reduction reaction (ORR) in PEMFC is ongoing. In this research, we investigated the feasibility of the advanced $Ti_{1-x}Mo_xO_2$ nanosupports significantly enhanced the ORR activity and stability of supported-Pt catalysts. Here the approach of synthesis involves anchoring of Pt nanoparticles on the $Ti_{1-x}Mo_xO_2$ nanosupports. While the structural defects of $Ti_{1-x}Mo_xO_2$ are made by doping Mo into anatase-TiO_2 structure and hydrogen treatment at high temperature (300℃). The structural of this material were studied by the experimental Raman, electronic conductivity measurements.

Rotating disk electrode (RDE) measurements showed that 20wt% Pt/$Ti_{0.9}Mo_{0.1}O_2$ catalyst had 1.5 times and 9.1 times higher Pt mass activity for ORR than those of 10 wt% Pt/$Ti_{0.9}Mo_{0.1}O_2$ and commercial Pt/C catalysts, respectively.The observed high activity of metal oxide supported-Pt catalyst could be attributed to the role of the advanced oxide support with electron donation from support to Pt catalyst surface, oxygen vacancies on nanosupport surface and high conductivity. Pt nanocatalysts on the advanced robust non-carbon $Ti_{0.9}Mo_{0.1}O_2$ nanosupports also exhibits improved stability against Pt sintering under a potential cycling regime (3000 cycles from 0.4 V to 1.0 V vs. RHE) due to strong metal-support interaction (SMSI) between Pt catalyst and support materials. This approach can be extended to the different catalysis reactions such as CO oxidation, hydrogenation, etc.

Physical Characterization of Pt Nanoclusters Modified Carbide Derived Carbons and Oxygen Electroreduction Kinetics in Acidic and Basic Solutions

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Oxygen electroreduction on Pt-nanoclusters activated electrodes, based on different microporous-mesoporous carbide-derived carbon (CDC) supports, were studied in 0.5 M H_2SO_4 and 1.0 M KOH solutions using cyclic voltammetry, rotating disk electrode, and impedance methods. The CDC supports with variable ratio of sp^3 and sp^2 carbon areas, specific surface area, microporosity-mesoporosity, good electrical conductivity and corrosion stability at positive potentials were prepared from VC, TiC, WC and Mo_2C at temperatures from 600 to 1100 °C using chlorination method. Pt-nanoclusters were deposited onto/into carbons using sodium borohydride reduction method. The Pt-catalyst loading onto glassy carbon disc electrode was varied from 0.2 to 0.6 mg cm^{-2} and the total catalyst loading was about 1.0 mg cm^{-2}. The Nafion® dispersion solution in water has been used for preparation of the ink to give a catalyst with 1 wt% of Nafion® ionomer. In addition, polyvinyl-alcohol binder has been used for preparing the electrodes working in 1.0 and 0.1 M KOH.

Raman spectroscopy, XRD, XPS, XRF, FIB-SEM, HR-TEM, SAED and EELS methods were applied for the structural and electronic characterization of catalyst materials. Gas adsorption (N_2, Kr) at liquid nitrogen temperature or room-temperature CO_2 was used for the porosity analysis of materials under discussion. The effective size of the nano-clusters has been calculated using XRD, SEM-EDX and HRTEM methods.

For unmodified CDC electrodes, the high cathodic current densities, depending strongly on the C(Mo_2C) synthesis temperature, indicate that in addition to the high specific surface area, the crystallinity has noticeable influence on the O_2 electroreduction rate. Reasonable O_2 diffusion constant values of $1.7(\pm 0.3)\times 10^{-5}$ cm^2 s^{-1} and the number of electrons transferred per electroreduction of one O_2 molecule (~4) were calculated from Levich plots for Pt-nanoclusters activated C(Mo_2C).

Analysis of impedance data demonstrated nearly capacitive behaviour in low *ac* frequency region, explained by quick cathodic electroreduction of oxygen followed by slow electrical double-layer formation step limited by the rate of adsorption of the ions and intermediates at/inside microporous-mesoporous C(Mo_2C) and Pt-nanocluster modified electrodes. Very high series and parallel capacitance values have been established, attractive also for hybrid aqueous supercapacitor applications.

The coupling of amperometry with 3D Holography for simultaneous opto-electrochemical imaging of single Ag nanoparticle oxidation

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Symposium 12: Electrochemistry Combined with Spectroscopic and Microscopic Techniques for Molecular Descriptions of ET Processes

Nanoparticles (NPs) are of increasing scientific interest due to their growing applications across a wide range of fields, for example: biological sensors; drug delivery; catalysis; electronics; optics; agriculture etc. Monitoring the chemical (or electrochemical) reactivity of single NPs is key to the understanding of many fundamental and applied issues relating to these wide ranging applications. Although several methods exist for the study of single NPs they are predominantly *ex situ*, and in order for a comprehensive understanding of single particles in real media *in situ* investigations are essential. In addition to single particle electrochemical detection,[1,2] recent developments have focused on the coupling of *in situ* and real-time characterization techniques for the imaging of the chemical processes. The combination of an imaging microscopy with electrochemical activation is appealing for the direct imaging of local (electro)chemical fluxes or gradients of chemical species at the level of individual nanoparticles.[3,4] A highly attractive route by which this can be achieved is via the coupling of amperometry with 3D holography for opto-electrochemical imaging microscopy. This method provides a novel route by which individual particles can be tracked in 3D and in real-time - within the solution and on the electrochemical interface – during which the ensemble electrochemical response of the surface bound NP population can be recorded simultaneously. The ability of this coupled technique to allow the visualisation and quantification of single (electro)chemical NP events is demonstrated for the case of single Ag NP oxidation.

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Integrity of Anodic Films Formed on Aluminium Alloys

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In the present study, the effect of anodizing parameters and alloying elements on the growth of anodic film on aluminium alloys has been investigated. Effort has also been made to tailor the morphology, composition and structure of the resultant films through control of anodizing parameters in order to achieve improved performance.

It was found that the continuity of the resultant anodic film and appearance of anodized aluminium alloys is largely determined by the oxidation of intermetallics. As shown in Figure 1, the oxidation of the Mg_2Si particles and their incorporation into the anodic films can significantly change the morphology, composition and structure of the resultant films. It was also revealed that alloying elements with Gibbs free energies of oxide formation per equivalent greater than that of alumina enrich at the alloy/film interface; when a critical enrichment is reached, oxidation of the alloying elements occurs. For copper-containing alloys, the structure of copper-enriched layer is grain orientation dependent. The oxidation of copper is responsible for the additional lateral porosity in the anodic film. It is also revealed that copper in the alloy matrix can be occluded in the anodic film material as copper-rich nanoparticles or it can be oxidized and incorporated into the film material as copper ions, depending on the anodizing voltage. Consequently, such dependence has significant effect on the morphology and corrosion resistance of the oxide films.

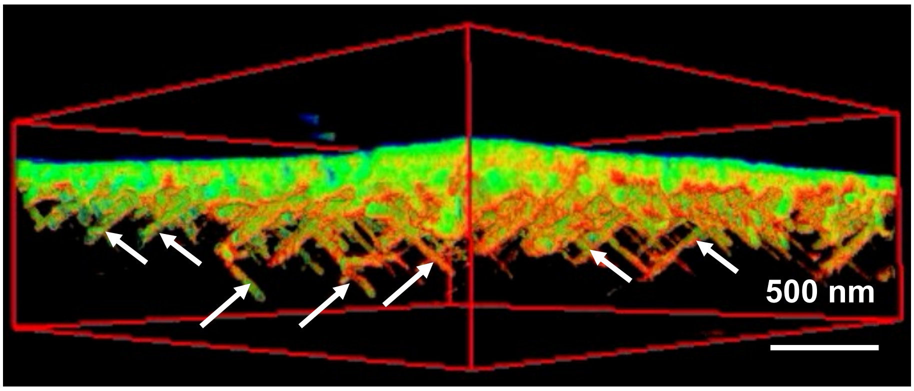

Figure 1 3D volumetric reconstruction of the anodic film formed on AA6063 aluminium alloy, with selective transparency applied to the aluminium matrix, and green and orange applied to oxide of different compositions respectively, revealing preferential oxidation of Mg_2Si particles and the impact on the morphology and composition of the resultant thin film.

Electrochemiluminescence on bipolar electrodes for bioanalysis

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Electrochemiluminescence (ECL) technique has been developed as one of the most versatile methods for the detection of biological recognition events of interest due to its high sensitivity, good temporal and spatial control, and simplified optical setup. It is immune to interferences from luminescent impurities and the scattered light in fluorescence assays because no excitation source is required. Recently, ECL detection on bipolar electrodes (BPEs) has emerged as a sensitive, high-throughput, and low-cost approach. [1,2] BPEs are usually set up in microfluidic chips. The potential difference (Eelec) on the BPE is obtained by applying a potential at the two ends of a microchannel (Etot). When it reaches a critical value, the redox reaction takes place at both poles of the BPE simultaneously. Compared with other detection methods, this platform possesses the advantages of concentration enrichment, high sensitivity, low cost, portable sensor system, and no need for a direct external connection to the electrode, which facilitates its integration in miniaturized devices. This report will focus on several ECL bioanalytical approaches based on BPEs for sensitive detection of cell surface receptors and proteins,[3,4] quantitatively monitoring adenosines and mRNA in tumor cells and simultaneously investigating the apoptosis of tumor cells,[5,6] visualizing prostate-specific antigen (PSA) on the basis of electrical switch control of ECL generation on BPEs.[7]

Acknowledgements

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In situ Investigations of EDL Charging with Focus on QCM-D Methodology

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Combination of classical electroanalytical techniques such as cyclic voltammetry (CV), chronopotentiometry and electrochemical impedance spectroscopy (EIS), provides effective means for general characterization of both electric double layer (EDL) and redox-type charging processes in supercapacitive electrodes. In particular, the kinetics of charging of related to ion (and electron) transfers across different interfaces in a composite supercapacitive electrode, and the kinetics of ions transport in the porous electrodes can be conveniently studied by EIS measurements and adequate modelling of the related spectra. However, the electrode impedance reflects ions transport indirectly, and the information obtained should be validated by the use of direct techniques, such as in-situ NMR, in-situ infrared spectroelectrochemistry, and especially, electrochemical quartz-crystal microbalance (EQCM), and its much more powerful modification- electrochemical quartz crystal admittance (EQCA), which is equivalent to the use of QCM with monitoring of dissipation processes occurring across the electrode coated crystal/electrolyte solution interface.

Only in the case when dissipation of the oscillation energy is absent, the change in the resonance frequency during ions adsorption can be transformed into the mass changes (the gravimetric limit of EQCA based on Sauerbrey's equation): $\Delta m = - \Delta f / C_m$, where C_m is the sensitivity factor equal to 0.056 Hz/ng cm^2 for 5MHz crystal. In practice, this is a relatively rare case, which will be illustrated by the results with nanoporous carbons recently obtained in our laboratory.

In contrast, a more general case, typical for a large variety of energy-storage materials, relates to potential-dependent changes of the thickness (also shape and volume) of the electrode coatings. A macroscopic view of the dimensional changes in the electrode coatings under polarization is based on *in situ* dilatometry measurements, whereas the microscopic view can be elaborated using *in situ* X-ray diffraction and atomic force microscopy measurements. The gap between the both approaches related to the *mesoscopic* view of the mechanical changes in supercapacitive/battery electrodes during their charging can be effectively bridged by QCM with dissipation monitoring and modelling of the related of quartz-crystal admittance. The entire methodology can be defined as electrochemical quartz-crystal admittance (EQCA). The hydrodynamic models used in our EQCA methodology to electrode coatings is significantly different from the conventional viscoelastic models, providing direct assessment of potential-dependent changes in the effective electrode layer thickness and its permeability length (characteristic porous structure). The use of this technique and the related admittance modelling provide excellent opportunities for designing new supercapacitive electrodes, and for optimization of the already existing supercapacitor devices.

Organic and Bio-Organic Devices for Sustainable Optoelectronics and Solar Energy Conversion

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Organic light emitting diodes (OLEDs), organic photovoltaic cells (OPVs) and organic field effect transistors (OFETs) are device elements for a future organic optoelectronics. Maturing from the academic research into the industrial development, such devices are entering the markets. Pure organic nanostructures and organic/inorganic hybrid nanostructures are comparatively studied for devices. This talk gives an overview of materials' aspect and devices. Especially organic photovoltaics promises to be a important player in future solar energy conversion.

In order to account for a sustainable future, the application of biodegradable and biocompatible systems for organic optoelectronics are needed. The use of cheap electronic devices and solar cells in a large scale will move us from "consumer electronics" to "consumable electronics". As such the contribution of electronic devices to urban waste is already increasing rapidly today. Imagining the terawatt challange of solar photovoltaics, therefore, environmentally friendly materials are important to use. This is a next great challenge to material science in organic optoelectronics. New developments of bio-inspired and/or bio-origin, bio-compatible materials are interesting. Such materials can also be used to interface the biological and biomedical research with the organic electronics field.

Keywords: Organic Solar Cells, Bio-organic Semiconductors, OFETs, OLEDs, OPVs.

Peculiar Behavior of FSI-based Ionic Liquid Electrolyte at Electrode Interphase and its Effect on LIB Performance

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The application of ionic liquids (ILs) in Li-ion batteries (LIBs) would ensure safety taking advantage of their lower flammability than conventional organic electrolytes. However, decomposition of ILs on a negative electrode and intercalation of an organic cation, which lead to irreversible Li^+ insertion/extraction, had been serious problems of losing their charge-discharge capacity. Nevertheless, we successfully applied bis(fluorosulfonyl)imide anion (FSI)-based ILs to electrolytes for LIBs, which provide reversible Li-ion insertion/extraction and high efficiency for a graphitized anode without any additives.[1-3] We have also investigated electrochemical behavior of various anodes in the ILs, e.g., Ni-Si-C composite; the alternative anode also exhibits excellent reversibility in our various FSI-based IL electrolytes.[3]

We also tested the performance of some positive electrodes in FSI-based IL electrolytes: two active materials, $LiNi_{1/3}Mn_{1/3}Co_{1/3}O_2$ (NMC) and $LiNi_{0.5}Mn_{1.5}O_4$ (NM). According to 1.0/1.0 C-rate charge/discharge measurements in a potential range of 3.0–4.5 V vs. Li, the NMC cathode in EMImFSI with a Li salt (LiTFSI) maintains 95% of the initial discharge capacity even after 100 cycles, suggesting that the FSI-based IL provides relatively stable operation of the NMC cathode without any additives. Another remarkable point is that the NMC cathode in our FSI-based ionic liquids represents an excellent rate capability of ca. 70% even at 10 C-rate. Surprisingly, the value is rather better than that obtained in a conventional electrolyte of $LiPF_6$/EC+DMC. We also tested Li-ion batteries containing FSI ILs as a “full cell”. A Li-ion battery with NMC as cathode material maintained over 80% of its initial capacity in 2000 cycles at 100% DOD.

Although we successfully developed a reversible lithium insertion/extraction for a graphite electrode in a promising ionic liquid electrolyte containing FSI^- in the absence of additives,[1] our research concerning charge-discharge behavior of various graphitized negative electrodes in the FSI-based ionic liquid revealed that the reversibility of the graphite electrode is affected by its surface structure. Among them, poor cycleability was observed only for an edge-rich graphite. However, we successfully improved it with the use of an additive or of LiFSI to unify anion species, instead of LiTFSI.

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Determination of Reaction Kinetic Parameters for Electrochemical Oxidation of Ampicillin Antibiotic using Boron-Doped Diamond Anode

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In this study, electrochemical oxidation of ampicillin antibiotic was investigated using boron-doped diamond (BDD) anode in a batch electrochemical reactor. Reaction conditions were operated at 200-1000 mg/L initial ampicillin concentration, 0-8 g/L supporting electrolyte (NaCl), 4-20 mA/cm^2 current density, and 25-45°C reaction temperature at 120 min reaction time. Ampicillin concentrations were determined using Shimadzu Prominence LC-20AD HPLC system, and chemical oxygen demand (COD) analyses were done using Merck Spectroquant COD cell test method. Process optimization was accomplished through response surface methodology in CCD designed experiments using Design-Expert 8.0 software in order to determine the influence of independent factors on ampicillin removal and COD reduction along with the experimental conditions. Optimized conditions under specified constraints were obtained for the highest desirability at 618 mg/L initial ampicillin concentration, 3.6 g/L supporting electrolyte, 13.4 mA/cm^2 current density, and 36°C reaction temperature. In a batch electrochemical reactor, the reaction rate of ampicillin degradation was expressed based on ampicillin concentration, and overall electrochemical conversion rate of pollutants was expressed based on COD concentration. Reaction kinetics was determined by the method of initial rates, and specific reaction rate constants (k) were obtained using Arrhenius equation. Under response surface optimized conditions, reaction kinetic parameters for electrochemical oxidation of ampicillin antibiotic using boron-doped diamond anode were evaluated and outlined in Table 1. The activation energy (E_a) depends on the nature of the reaction, and fast reactions generally have small E_a values.

Table 1. Reaction kinetic parameters for electrochemical oxidation of ampicillin antibiotic using boron-doped diamond anode

Parameter	**Ampicillin degradation**	**COD removal**
Reaction order (n)	2/5	1/2
Activation energy (E_a)	2.273 mg$^{3/5}$/(L.min$^{3/5}$)	0.315 mg$^{1/2}$/(L.min$^{1/2}$)
Reaction rate constant (k)	0.88 kJ/mol	6.12 kJ/mol
Frequency factor (k_o)	4.340 mg$^{3/5}$/(L.min$^{3/5}$)	3.568 mg$^{1/2}$/(L.min$^{1/2}$)

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Charging/Discharging Phenomena of Conducting Polymers – A Multifaceted Problem

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The voltammetric charging/discharging curves of conducting polymers (CP) have been described in numerous publications. Characteristic features of such voltammograms are a steep wave at the beginning of the charging followed by a broad, flat plateau as potential increases. Moreover, during discharging very often a strong hysteresis is observed. Different causes of these phenomena ranging from conformational effects to N-shaped free-energy curves as a consequence of phase transitions have been presented in the literature. A consistent interpretation is difficult because the voltammetric response under solid state conditions may depend on quite a large number of different factors such as intermolecular forces within the polymer, surface properties, overlapping redox steps, chemical reactions as well as ion and solvent transport. Furthermore, the experimental conditions during electropolymerization and electrochemical measurements also influence the charging/discharging behavior. Characteristic experimental parameters are the potential or the temperature.

The aim of the lecture is to present a general overview and mechanistic interpretation of important charging/discharging phenomena in the field of CPs. This includes *inter alia* the memory effect, the overpotential phenomenon of the first reduction, the dimerization of chains during charging, or the cation vs. anion transport.[1] The available experimental data support the view that surface effects and dimerization reactions in comparison to simple redox reactions mainly influence the charging/discharging mechanism of CPs.

A basic detail concerns the question at which interface heterogeneous electron transfer processes occur during charging/discharging steps of CPs. Measurements of Aoki[2] or our group unambiguously confirm that these transfer steps take place at the polymer/ electrode interface but not at the polymer/solution interface as postulated by some authors. The results clearly show that the surface of a CP does not behave like an electrode. Rather, the electrochemical properties of CPs are similar to those of redox polymers that behave like porous layers.

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Comparative use of different anode materials in the electrochemical degradation of organics

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The electrochemical degradation of organic pollutants (especially at concentrations below 5 g L^{-1}) is a quite promising technology, mainly due to its versatility[1]. For these electrolyses, many different anode materials are available, e.g.: Pt, β-PbO_2, TiO_2-RuO_2, SnO_2-Sb_2O_5, and boron-doped diamond (BDD). Most commonly, the degradation is carried out by oxidation via intermediates of the oxygen evolution reaction – OER (mainly hydroxyl radicals – $^{\bullet}OH$), electrogenerated by polarizing the anode at highly positive potentials in the OER region[2]. Then, the efficiency of the process is strongly dependent on the anode materials used, since they present different oxidizing powers that increase in the following order, as clearly discussed by Kapalka et al.[3]: TiO_2-RuO_2 < Pt < β-PbO_2 < SnO_2-Sb_2O_5 < BDD. On the other hand, since the $\cdot OH$ species is highly reactive, its concentration is high only very close to the anode surface[4]. As a consequence, efficient $\cdot OH$ mediated electrooxidation requires a combination between high values of current density and mass transport rate of the organics. However, the degradation of organics can also be mediated by electrogenerated inorganic oxidizing species, such as active chlorine (Cl_2, HOCl, OCl^-)[2], which are more stable and thus may reach significant concentrations in the bulk of the solution. Taking the above considerations into account, in our laboratory, in many cases, we have investigated the electrochemical degradation of specific organic compounds or real wastewater comparatively using different anode materials in flow reactors and in the presence or absence of chloride ions in solution. For instance, this was the case of a real textile wastewater[5], whose electrochemical degradation was carried out using BDD and β-PbO_2 anodes, in the absence or presence of 1.5 g L^{-1} NaCl, or of bisphenol A[6], when the performances of BDD, β-PbO_2, and TiO_2-RuO_2 anodes were compared, also in the absence or presence of 1.5 g L^{-1} NaCl. These and additional cases will be briefly reviewed in this lecture.

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FluidFM: a Force-Controlled Nanopipette for Spatially Resolved Stimulation of Electrochemical Reactions under the Tip Aperture

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The FluidFM [1] combines AFM technology with nanofluidics. A channel incorporated directly in the cantilever and an aperture at the apex of the tip allows for local liquid dispensing of soluble molecules in air and in liquid [2]. Therefore, the FluidFM may open new opportunities for experiments of local chemistry with spatial resolution.

Hereby, we discuss the possibility of integrating an electrode in the liquid reservoir of the microchanneled AFM probe, enabling the controlled local activation of electrochemical reactions under the probe. This extension of the FluidFM system opens up new functionalization possibilities, such as local electroplating of metal structures on conductive substrates or local electrografting of organic molecules.

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In situ stress, strain and dielectric measurements to understand electrostriction in anodic oxides

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Internal stresses in anodic oxide films may influence their reliability. In addition, the coupling between the internal stress and the oxidation behaviour may be important to understand the formation mechanism and the breakdown of anodic oxides. Internal stresses in anodic oxide films arise from two distinct contributions. The first one is due to the volume changes caused by the migration of ions during film growth. The second one, electrostriction, is due to the electric field: polarization of the anodic oxide film deforms it and the internal stress changes. The influence of these two contributions has been recognized in the past but many contradictory results have been reported. For instance for electrostriction, ellipsometry measurements have shown that the thickness of anodic oxides increases with the square of the electric field, while other groups reported non-quadratic dependence [1,2]. Furthermore, the internal stress decreases (compressive direction) with the electric field, consistent with the intuition that the thickness of the oxide film decreases with electric field, as predicted by the Maxwell stress [3].

We precisely determined the electrostrictive behaviour of anodic niobium and silicon oxide by combining measurements of the internal stress, thickness and dielectric measurements *in situ* by curvature, spectroscopic ellipsometry and electrochemical impedance measurements. Remarkably, these oxides behave differently. For anodic niobium oxide, the internal stress decreases (compressive stress) with the electric field whereas it increases (tensile stress) for anodic silicon oxide. We derive the constitutive electrostriction equation describing the relationship between deformation, internal stress and electric field from energy conservation equations we apply to dense anodic oxide films and predict a quadratic relationship between the internal stress and the electric field. Experimentally, we measure a quadratic dependence for anodic silicon oxide but not for anodic niobium oxide. We attribute the latter to a dependence of the dielectric constant on deformation and electric field. The reason for this will be further discussed.

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A Comparative Study of PVdF-HFP and Crosslinked PEO with Ionic Liquids as Polymer Electrolytes for Lithium Ion Batteries

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Li ion batteries are today considered as one of the most important electricity storage technology since it is adapted to various mobile applications. In such technologies, the increasing of degree of security and safety is considered as key concerns. In this context, the development of no volatile and low flammability electrolytes to replace classical alkylcarbonates based electrolytes is then highly popular. Therefore, two kinds of alternative electrolytes are studied: Room-temperature ionic liquids (RTILs) and polymer based electrolytes.

In this communication, our results on the characterization and the use of RTILs instead of alkylcarbonates based electrolyte will be exposed. In addition, very recent results on the encapsulation of RTILs in linear and crosslinked polymer matrix and its use as solid/gel electrolytes in Li based batteries will be exposed and discussed on the basis of ionic conductivity, thermal behavior, compatibility with lithium electrode and electrochemical studies (cyclic voltammetry, galvanostatic cycling, and impedance spectroscopy). Li based batteries are made using $LiNi_{1/3}Mn_{1/3}Co_{1/3}O_2$ (NMC) as positive electrode. RTIL electrolytes are made from dialkylpyrrolidinium bis(fluorosulfonyl)imide (PxyFSI) and LiTFSI salt with different concentrations. Linear polymer electrolyte is obtained by mixing PVdF-HFP and RTIL based electrolytes. Cross linked polymer electrolyte is obtained by radical polymerization of polyethylene glycol dimethacrylate/monomethacrylate precursors in RTIL electrolytes. This later, exhibits enhanced mechanical properties compared to the linear polymer electrolyte with moderate capacity retention and ionic conductivity. Our results show the achievability of mechanically and dimensionally stable polymer electrolytes which are suitable for practical use.

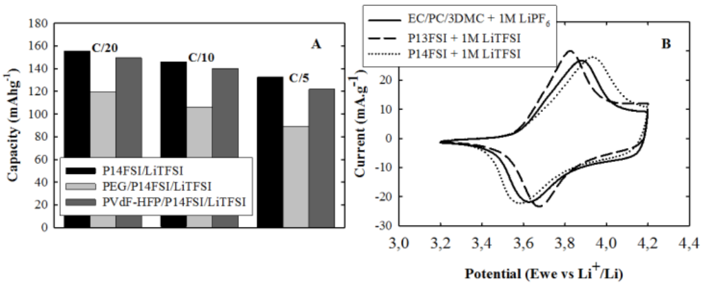

Figure: A) Capacity of NMC/Li half cell in various electrolytes; B) Cyclic voltamograms of NMC/Li half cell in performed at 20µVs^{-1}

Impedance and in situ STM study of 4,4'-bipyridine at Bi(111), Sb(111) and Cd(0001) electrode surfaces

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Impedance spectroscopy and *in situ* STM methods have been used for investigations of the 4,4'-bipyridine (4,4'-BP) adsorption at the electrochemically polished Bi(111), Sb(111) and Cd(0001) electrodes from neutral Na_2SO_4 and weakly acidified Na_2SO_4 pH ≈5.5÷ 6.0 supporting electrolyte solution. The atomic resolution for polished Sb(111) and also for Cd(0001) electrodes has been obtained and the in situ STM data showed that there was no quick surface reconstruction process. The surface structure was stable within the potential region investigated, similarly for Bi(111) single crystal [1-3].

In the region of maximal adsorption, the capacitance pits in the differential capacitance versus electrode potential curves have been observed. At the more anodic potential, there is a big rise in differential capacitance for the Bi(111) electrode [4]. In the case of Sb(111) the anodic capacitance hump occurs only at the very slow scan rates and the adsorption of 4,4'-BP is very slow, almost irreversible process. For the Cd(0001) electrode the capacitance peak appears at the very anodic potentials where the compact adsorption layer formation starts.

The Nyquist plots and phase angle frequency plots where measured and analysed. At the more negative potentials the cathodic faradic hydrogen evolution starts at both electrodes studied. Within the maximal adsorption region the Nyquist plots and phase angle log *f* dependences have very complicated shape and the heterogeneous adsorption and diffusion steps are the rate determining stages for 4,4'-BP adsorption. At the more anodic potentials, where the 2D compact adsorption layer formation starts, there are two frequency dependent limiting adsorption areas.

It was found that 4,4'-BP forming strongly bonded well visible (applying in situ STM method) adsorption layers only at more anodic potentials, where the co-adsorption of sulphate ion is and the formation of 4,4'-BPH_2^+ ion complexes at the electrode surface are possible. 4,4'-BP adsorption patterns also depend on the base electrolyte concentration, and in less concentrated sodium sulphate solutions, 4,4'-BP forms sparse adsorption layer if compared to more concentrated base electrolyte solution. This is mainly caused by the comparatively strong van der Waals interaction of protonated 4,4'-BP^+ molecules with anions where the charge excess provided by 4,4'-BPH_2^+ is screened by co-adsorbed sulphate anions [4].

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Effect of Electrochemical Control Function on the Growth and Spatially Variant Composition of Conducting Polymer Films

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We present dynamic *in situ* neutron reflectivity (NR) experiments permitting observation of film evolution during deposition at an unprecedented level of detail.

Electroactive polymer film modified electrodes have attracted huge interest. In the case of conducting polymer systems, for example derived from pyrrole-, thiophene- and aniline-type monomers, this is driven by practical application of their electronic and optical properties. Generally, successful exploitation of these characteristics is dependent on being able electrochemically to change the film charge state in a rapid and reproducible manner. While this is measured *via* the rate of coupled electron and ion transport in the polymer film, solvent plays a critical role. Specifically, it controls the local viscosity of the medium through which dopant ions must move and it plasticises polymer segmental motions required for delocalisation of electronic charge.

Despite great effort put into this field, the literature contains numerous examples of nominally the same material with quite different characteristics or device performance. Anecdotally, this is attributed to diversity of film structure, established during deposition. The hypothesis is that different electrochemical control functions drive different nucleation and growth dynamics that create different structures with different solvent content. However, to date there is little evidence to substantiate this.

We have previously used *in situ* neutron reflectivity to determine solvent content and spatial distribution within electroactive polymer films. Here we extend this to dynamic monitoring of film composition during deposition of polypyrrole (PPy) and poly(3,4-ethylenedoxythiophene) (PEDOT) *via* potentiostatic (PS), potentiodynamic (PD) and galvanostatic (GS) control functions. Through monomer or solvent deuteration we achieve good "contrast" between the polymer and solvent components; careful selection of parameters allows generation of films of similar *total* polymer (redox site) population, so film thickness effects *per se* can be eliminated.

We will present NR data (supported by AFM topological imaging) that reveal compositional and structural distinctions between PPy and PEDOT films each deposited using PS, PD and GS control functions. Specifically, for a given total surface population of electroactive sites, we determine the volume over which they are dispersed, the solvent content, the degree of compositional heterogeneity across the film and the sharpness of the polymer/solution interface. We find that, *during deposition*, the effect of electrochemical control function is greater for PPy than for PEDOT. The longevity of these distinctions – which is central to future applications - is explored in analogous observations *subsequent to deposition*, during which the films are redox cycled and may undergo relaxation after transfer to background electrolyte.

Physical and electrochemical properties of binary systems based on ionic liquids and organic solvents as supercapacitor electrolytes for extreme temperatures

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Symposium 6 : Electrochemical Energy Conversion and Storage: Capacitors

Physicochemical and electrochemical properties of three different commercial ionic liquids based on pyrrolidinium or imidazolium cations and fluorosulfonimide anions (Pyr13FSI, Pyr14TFSI and EMITFSI) were investigated and compared with binary mixtures of those ionic liquids and an organic solvent like acetonitrile, propylene carbonate and γ-butyrolactone. The latter proved to be the most promising solvent.

It was found that the ionic conductivity of binary mixtures depends on its composition, and the highest value was obtained at a proportion close to 50%wt in ionic liquid. Thermal, transport and electrochemical properties were evaluated from 223K to 373K for the neat ionic liquids and 50 %wt binary mixtures with γ-butyrolactone.

DSC measurements revealed that the addition of organic solvent prevents the crystallisation of ionic liquids from happening on a wide temperature range (from 183K to 373K).

Moreover, the addition of organic solvent enhances the conductivity and fluidity of mixtures, especially at low temperature. For instance, the residual ionic conductivity of EMITFSI-GBL is 1.9 mS/cm at 223K and its viscosity is 70 cP.

Viscosity and conductivity temperature dependence of each studied mixture and neat ionic liquid will be discussed. In both cases the Vogel-Tamman-Fulcher behaviour is observed.

The ionicity of electrolytes studied was evaluated by the Walden plot approach with temperatures rising from 283K to 353K. Pure ionic liquids follow the ideal line. By adding solvent, the conductivity of the mixtures rises but not as much as the fluidity. Their behaviour follows the partial Walden's rule.

Cyclic voltammetry was used to determine the electrochemical window of each electrolyte, using a glassy carbon working electrode. The addition of solvent leads to a reduction of the electrochemical window that can reach 1V. Finally, we have tested our best binaries electrolytes in supercapacitors configuration with bucky-paper electrodes and performances will be evaluated according to working temperatures from 283K to 353K.

Theoretical Evaluation of Electron Transport in Dye-sensitized Solar Cells

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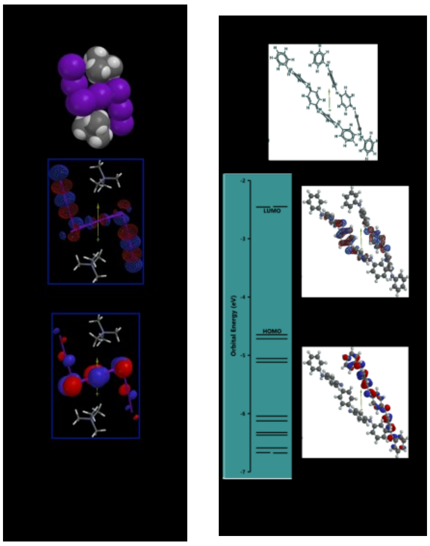
Efficient dye-sensitized solar cells should have molecular structures that are integrated by molecular orbitals. If sensitizing molecules and electron transporting components and also the component themselves are integrated by molecular orbitals, electron diffusion length will become comparable with device thickness, resulting in giving remarkable Voc and fill factors in the molecular structured DSC. Diffusion length depends on mobility and lifetime of electron in the integrated electron transporting layers, and then unidirectional and effective conductivity of the DSC electrolytes is essential for maximization of the efficiency.

In the quasi-solid state polyiodide-based DSC, which are composed of high concentration of pentaiodide (I_5^-), the exchange ion mechanism via I_5^- well explains notable diffusion length of the devices.[1)] In addition, our recent research has revealed that phenyl-capped aniline tetramer (EPAT)-based DSC gives a respectable Voc when Z907 is employed, because EPAT interacts with Z907 through molecular orbital and EPAT shows notable conductivity in solution.[2)]

Taking into consideration that π-conjugated molecules have strong tendency to aggregate each other through van der Waals and Coulombic interactions, the dimer structure of $N(Me)_4^+I_5^-$ (TAP-2) in the x-ray crystallography[3)] is modeled using DFT, B3LYP, 6-31G*(Figure 1). Interestingly, the lowest unoccupied molecular orbital (LUMO) is degenerate and the configuration looks convenient for electron diffusion in TAP-2. EPAT is also simulated by DFT(MM/QM) for association via van der Waals interaction, and LUMO is evaluated for the electron transport ability in the EPAT-based DSC. The electron hopping mechanism through LUMO will be discussed in comparison with the theoretical evaluation that has been developed for understanding of semi-conductivity of large molecular crystalline aggregates.



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Synthesis and Characterization of novel Ionic Liquids for the utilization in Lithium-Ion Batteries

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The synthesis and properties of new Ionic Liquids (ILs) based on a novel cyclic cyano-substituted anion and various cations are reported. By adopting an anhydrous and halide-free synthesis procedure it was possible to get the imidazolium ([EtMeIm], [BuMeIm]), pyrrolidinium ([BuMePy]), ammonium ([Et_3NH], [Me_4Gu]) and phosphonium ([Bu_3PMe]) based salts in high yields. Depending on the nature of cation-anion interaction, characterized by XRD, the ILs are low viscous and liquid at room-temperature or higher melting solids (T_{melt} < 73°C). Thermal degradation measured by TGA directly starts after the first weight loss in one step up to a rest mass of 10 % at 600 °C. Thermal stabilities of the aprotic specimen are limited by anion decomposition (T_{stab} = 240 °C). ILs with a protic cation have a reduced thermal stability (T_{stab} = 120 °C), probably due to an acid base equilibrium [1].
Based on these results the characteristics of the [EtMeIm] and [BuMePy] ILs with different concentrations of lithium bis(oxalate)borate (LiBOB) are determined. LiBOB displays a promising conducting salt for future electrolytes in Lithium Ion Batteries (LIBs) [2]. The phase behavior of the ILs depends on the concentration of LiBOB which is soluble up to 0.5 mol/kg. According to other IL-based electrolytes [3], crystallization is suppressed at higher LiBOB-concentrations (> 0.1 mol/kg). It occurs at T_{cryst} = -13 and -30 °C for the neat compounds. Also the glass transition temperatures increase with increasing LiBOB-concentration. The ionic conductivity of the pure [BuMePy] IL ($\sigma_{20°C}$ = 5.4 mS/cm) is in the same order of magnitude as [EtMeIm][FAP] while that of the [EtMeIm] IL is considerably higher ($\sigma_{20°C}$ = 11.5 mS/cm). They show a Vogel-Fulcher-Tammann like behavior. At increased LiBOB-concentrations the conductivity decreases. Based on the similar trend of the conductivities for different LiBOB-concentrations in a T_g-scaled Arrhenius plot and the linear correlation between conductivity and viscosity in a Walden plot, the ionic transport of the electrolytes and the viscous flux are strongly coupled [4]. The electrochemical stabilities of the ILs, analyzed by cyclic voltammetry on Pt-electrodes with a ferrocene reference, range from 1.4 V to 5.8 V vs Li/Li^+ for the [BuMePy] IL. The diffusion controlled decay of the current density at low potentials and at subsequent cycles can be explained by the formation of surface layers on Pt by partial degradation of the ILs. In agreement to this assumption reversible Li-plating-stripping in Li symmetric cells is possible. The novel IL electrolytes show first promising results during electrochemical tests of high voltage $LiNi_{0.5}Mn_{1.5}O_4$/Li cells.

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Use of Dendrimer-Encapsulated Nanoparticles for Decoration of Electrode Surfaces

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Here, we report on decoration of electrode surfaces with dendrimer-encapsulated nanoparticles (DENs) and the use of the DEN-decorated electrodes for analytical applications. Two types of decoration methods are mainly discussed: electrochemical decoration of glassy carbon or indium tin oxide surfaces and covalent decoration of chemically converted grapheme (CCG) surfaces. First, amine-terminated polyamidoamine (PAMAM) dendrimers encapsulating nanoparticles were immobilized on the electrode surfaces via electrooxidative grafting of the terminal amine groups of dendrimers [1-3]. Second, a universal approach was reported for preparation of nanoparticle-decorated CCG electrodes, on which size-monodisperse nanoparticles were uniformly distributed with preservation of their original size, via covalent immobilization of DENs [4]. A brief description is also presented how the DEN-decorated electrodes can be applied as electrochemical sensors [5].

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A critical analysis of the theory of amorphous semiconductor Schottky barrier for oxides

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The theory of Schottky barriers in amorphous semiconductors (a-SC), developed by R.A. Abram et al. [1] and D.V. Lang et al. [2], is now well-established and generally accepted for investigating the electronic properties of solid–state junctions. Following their arguments, the localized electronic states in the mobility gap (DOS) behave as deep traps, which can capture and release the mobile species in the conduction and valence band. Both groups arrived to the same description of the ac electrical response of the Schottky barrier according to which the barrier can be modeled by a frequency dependent capacitance and conductance, according to:

$$\begin{aligned}
\frac{1}{C_{SC}(\omega,\psi_S)} &= \frac{1}{\sqrt{\varepsilon|e|^2 N}}\left[\ln\left(\frac{\psi^*}{\psi_C}\right)+\sqrt{1+\frac{2}{\psi_g}\left(\psi_S-\psi^*\right)}\right]\\
G_{SC}(\omega,\psi_S) &= \frac{\pi\omega}{2}\frac{k_BT}{|e|\psi_C}\sqrt{\varepsilon|e|^2 N}\left[\ln\left(\frac{\psi^*}{\psi_C}\right)+\sqrt{1+\frac{2}{\psi_g}\left(\psi_S-\psi^*\right)}\right]^{-2} \qquad (1)\\
\psi_C &= -k_BT\cdot\ln(\omega\tau_0)-\Delta E_F
\end{aligned}$$

where k_B is the Boltzmann constant, T the absolute temperature, e the charge of the electron, ψ_S the band bending at the surface of the semiconductor, ψ_g is the band bending at the mid-gap (indicating the kinetic equilibrium of the traps), and N is the value of DOS at the Fermi level, ψ^* is equal to ψ_S for $\psi_S < \psi_g$ and is equal to ψ_g for $\psi_S > \psi_g$. Equation (1) describes the electrical behavior of the barrier in presence of an infinite amorphous semiconductor with constant electronic DOS in the mobility gap. In this work the limit of validity of equation (1) for the case of thin and thick passive oxide films will be investigated by means of simulations. We will show that a variation in energy of the DOS could be misinterpreted as a spatial distribution of DOS. The analysis takes into consideration also the thickness of the semiconductor and, approaching the thin film region, it is observed that the capacitance tends to become constant and frequency independent [3]. The limit of validity of equation (1), in presence of a length of the space charge region, x_{SC}, comparable to the thickness of a-SC will be given and discussed.

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Mechanistic studies on BDD: the O_2 Evolution Reaction and the Oxidation of small organic molecules

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Hydroxyl-radicals, the primary products of oxidation reactions at high potentials at boron doped diamond electrodes[1, 2] , can either recombine to form H_2O_2 or react with e.g. an organic substrate. Which of these reactions prevails should depend on the relative (homogeneous second order) rate constants but also on mass transport.

Here, the electro-oxidation of ethanol, acetone, i-propanol, its fluorinated analogue hexafluoroisopropanol(HFiP) and cyclohexane in 1 M $HClO_4$ was studied on a boron doped diamond (BDD) electrode by on-line differential electrochemical mass spectrometry (DEMS), using a dual thin layer cell. One can distinguish two oxidation pathways: at potentials below 2.5 V a direct electron transfer to the BDD takes place, while at potentials above 2.5 V OH radicals are produced and scavenged by the reactants. As a consequence, the oxygen evolution reaction is at least partially suppressed. The direct electron transfer to the electrode is observed for i-propanol, ethanol and cyclohexane. For acetone and HFiP, only the second, indirect,pathway with the participation of OH radicals is effective. For all the reactants except HFiP CO_2 formation was observed generally at 2.5 V or higher, the potential for the oxygen evolution reaction (OER) in the pure supporting electrolyte. Hence OH radicals are instrumental in the cleavage of C C bonds. For HFiP,the cyclic voltammograms of the supporting electrolyte with and without the reactant are identical. This indicates that the oxidation of HFiP is initiated by OH radicals followed by a further electron transfer to the electrode, similarly to the oxidation of CO.[3] For both pathways, the reactivity follows the same trend as the homogeneous hydrogen abstraction reaction rates with OH radicals. The intermediate radicals formed in the reaction with the electro-generated OH radicals can react with oxygen present in the solution.

In order to find out more about the mechanism of O_2-evolution, for which H_2O_2 is an intermediate, and the radicals involved, we examined the oxidation of isotopically labelled $H_2{}^{18}O_2$. We have strong evidence that $HO_2^{\bullet}$, which is initially formed upon oxidation, cannot be directly oxidized further but instead disproportionates to H_2O_2 and O_2. According to this reaction, only $^{18}O_2$ is formed. However, at potentials where $HO^{\bullet}$ is formed in parallel from water, also a large amount of $^{18}O^{16}O$ is detected by on line mass spectrometry, which demonstrates that H_2O_3 (formed from $HO^{\bullet}$ and H_2O_2) is an intermediate.

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Electron Transfer and Reaction at the Electrode / Electrolyte Interface by In-situ Scanning Probe Microscopy

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Understanding of the electrode/electrolyte interface at nanoscale and molecular level is of great importance for modern electrochemistry. The development of in-situ microscopic techniques, especially electrochemical scanning probe techniques, and other complementary spectroscopic techniques, has played an important role to reveal the insight of electron transfer and electrochemical reaction. In this contribution, we will introduce our recent work on the electron transfers and electrochemical reactions of a series of functional pi-conjugated organic moelcules, such as porphyrin derivatives, C60 derivatives. For example, the interface adstructure and electron transfer of buckyferrocene Fe(C60Me5)Cp, a typical electron donor–acceptor dyad, is directly probed using in situ electrochemical scanning tunneling microscopy (STM) combined with theoretical simulations. The electrochemical redox process can be clearly followed by the contrast change of Fe(C60Me5)Cp molecules in the adlayer. The in situ STM study of the electrocatalytical process of oxygen reduction on porphyrin adlayer will also be discussed. The molecular level understanding the electron transfer in electrochemical environment provides important dynamic information of electrochemical processes.

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Functional, Water-Soluble Binders for Improved Capacity and Stability of Lithium-Sulfur Batteries

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In recent years, great strides forward have been made in increasing the practical capacity and cycle life of the lithium-sulfur system. Many of the strategies currently pursued involve optimisation of the conductive host structure, in order to maximise sulfur utilisation; coupled with some form of encapsulation of the active material, to mitigate capacity fade due to the well-explored reactions of polysulfide intermediates at the anode[1].

Recently, our group has investigated the use of functional polymers as binders in this system, particularly poly(ethylene oxide) (PEO)[2] and mixtures of PEO and poly(vinylpyrrolidone) (PVP)[3]. PVP has recently been similarly investigated elsewhere[4]. In this work, we demonstrate the improvement to capacity and capacity retention that may be effected by the interaction of polysulfide intermediates with the polyether and lactam functionalities of these respective commodity polymers, compared to the relatively inert conventional alternatives, such as PVdF. These materials are inexpensive, water-soluble, environmentally friendly and widely available, making them particularly interesting for mass production of Li-S cells. Through this simple approach we can demonstrate reversible capacities in excess of 1000 mAh g^{-1} for cathodes using commercial carbon black and high sulfur loading.

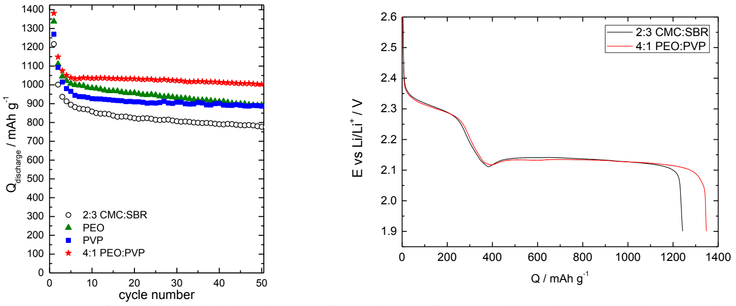

Figure: comparison of water-soluble binders: left) cycling of Li-S cells with Super P host with 50% total sulfur loading at C/5; right) first discharge of Ketjen Black-based composites (58% sulfur) at C/50.

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Preparation and characterization of poly(aminoindoles) by using electrochemical quartz crystal nanobalance

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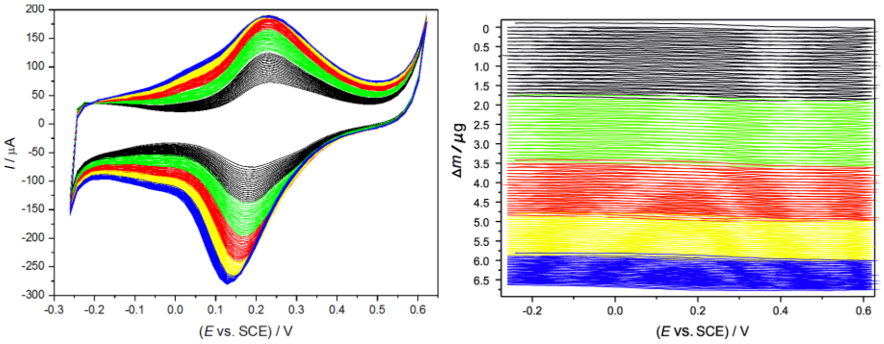
Electrochemical quartz crystal nanobalance (EQCN) was used to study adsorption and electropolymerization of 4-, 5- and 6-aminoindoles on Pt, Au and graphite electrodes in acid media. The electronanogravimetric responses of the polymer films formed were investigated in different aqueous media. An adsorption of the monomers occurs, which strongly depends on the nature of the substrate (Au, C vs. Pt). The polymerization process is extremely sensitive to the positive potential limit, different products can be obtained. The overoxidized poly(aminoindoles) that are formed at higher positive potentials show a decreased electroactivity.



The cyclic voltammetric curves (a) and the corresponding EQCN mass changes (b) obtained during the electropolymerization of 5-aminoindole at Pt in contact with a solution containing 0.5 mol dm^{-3} H_2SO_4 solution and 5 mmol·dm^{-3} 5-aminoindole. v = 50 mV·s^{-1}. Seven consecutive runs involving 20 cycles each.

The redox transformations of the resulting polymers are accompanied with a rather complex protonation/deprotonation and anion sorption/desorption phenomena. Based on these results schemes of the redox and the overoxidation reactions are proposed.

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Effect of iodide additives on the performance of electrochemical capacitors in ionic liquid

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The capacitance of electrochemical capacitors is generally due to charging/discharging an electric double-layer (EDL) at the electrode/electrolyte interface, and in some cases it can be enhanced by a pseudocapacitive contribution coming from faradaic processes. In this work, solutions of organic (Et_3NH-I, Et_4N-I) or inorganic iodides (KI, LiI) in protic (PIL; Et_3NH-TFSI) and aprotic ionic liquid (AIL; N-methyl-N-propyl-pyrrolidinium TFSI) were implemented in symmetric carbon/carbon electrochemical capacitor cells, where a silver pseudo-reference electrode was added in order to monitor separately the potential of positive and negative electrodes.

In presence of the pure ionic liquids, the cells behave as EDL capacitors with capacitance values of 122 and 116 $F\cdot g^{-1}$ for protic and aprotic IL, respectively. When iodides are added, the negative electrode behaves almost identically with a slightly shifted potential range. By contrast, a huge and narrow peak is observed on the cyclic voltammograms of the positive electrode which is attributed to redox I^-/I_2 processes at the carbon/iodine interface. Cyclic voltammograms of the two electrode cells (Fig. 1) show that the electroactive iodides significantly enhance the capacitance. The best results were obtained for 0.2 $mol.L^{-1}$ solutions of inorganic additives in PIL (for LiI – 184 $F\cdot g^{-1}$, KI – 182 $F\cdot g^{-1}$) and also for lithium iodide in AIL – 153 $F\cdot g^{-1}$, characterized by good reversibility as well as operational stability.

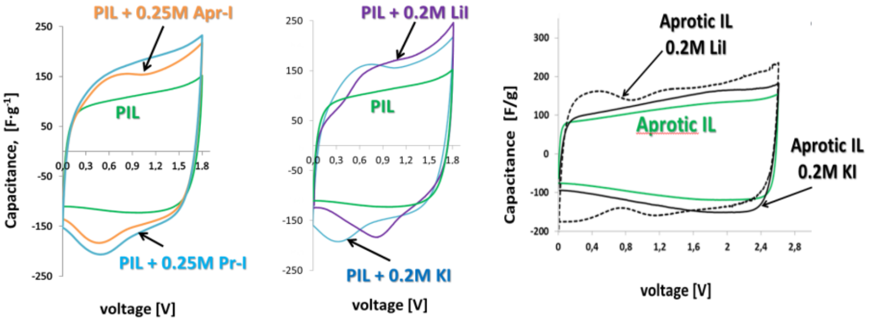

Fig. 1 Cyclic voltammograms (2 $mV\cdot s^{-1}$) of AC/AC symmetric two-electrode cells in PIL, in PIL with 0.25M of organic iodide (Et_3NH-I - PrI, Et_4N-I – Apr-I), in PIL with 0.2M of inorganic iodides (KI, LiI), in AIL and in AIL with 0.2M of KI or LiI.

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Charge Transfer States in Dye-Sensitized Solar Cells

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In dye-sensitized solar cells (DSCs), ultrafast electron injection from a photoexcited molecular sensitizer into the conduction band of a wide-bandgap semiconductor is key to efficient charge separation. According to the current understanding of DSCs' functioning mechanism, charges are separated during this primary electron transfer process, yielding mobile hot conduction band electrons in the solid and holes localized on oxidized dye molecules at the surface.

Basing on combined femtosecond transient absorption and time-resolved THz experimental data, we show that intermediate interfacial charge transfer states (CTS) are rather formed upon ultrafast injection from photoexcited Ru(II)-polypyridyl sensitizers into mesoporous TiO_2 films. Formation and dissociation of these CTS are found to strongly depend on their environment and the excess excitation energy.

Coulomb attraction between photo-injected electrons trapped at the surface of the solid and positive charges localized on oxidized dye molecules is indeed observed to prevent a majority of injected carriers to contribute to the transient THz photoconduction. Electron mobility, however, increases markedly when ions from a liquid electrolyte are adsorbed onto the surface, screening the electrostatic interaction and decreasing the CTS binding energy upon local reorganization at the ns time-scale.

In solid-state DSCs, liberation of conduction band electrons in TiO_2 is found to be concomitant with the picosecond injection of positive charges into *spiro*-MeOTAD hole transporting material. CTS formation also depends on the excess kinetic energy of transferred electrons and/or on the vibrational energy of cations and, therefore, on the excitation energy of the sensitizer. CTS formation decreases for shorter excitation wavelengths and becomes negligible for $\lambda_{exc} < 460$ nm.

This finding founds a new mechanism for charge separation in DSCs, where the involvement of interfacial charge transfer states or charge transfer excitons represents a true paradigm change. It also offers a rationale for the effect of the electrolyte composition in liquid-based devices and of ion doping in solid-state solar cells under working conditions. Finally, it shows that the existence of CTS is a common property of OPV and DSCs, providing a unified picture for charge carrier separation in third generation photovoltaic systems based on donor-acceptor heterojunctions.

Boron-doped Diamond Electrodes: Electrochemical Impedance, AFM and Raman spectroelectrochemistry

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The boron doped diamond films were grown by a microwave plasma enhanced chemical vapor deposition and surface-terminated either by hydrogen or oxygen.[1] The number of acceptors was evaluated from Mott-Schottky plots by electrochemical impedance spectroscopy in aqueous phosphate buffer and referenced to the B-concentrations from the neutron depth profiling. Morphology studies using AFM have been carried out in situ on the films under electrochemical control in phosphate buffer (pH 6.8). No morphological changes of diamond surface were observed at potentials from 0 V to 2 V vs. SCE. After electrochemical treatment in the range from 0 V to 3 V vs. SCE, the tip-movable impurities were observed. This indicates cleaning of the surface from sp^2 carbon at large anodic potentials.[2] The quality (presence of graphitic or amorphous phases) and boron doping levels in the films were analyzed by Raman spectroscopy and by Raman spectroelectrochemistry. The boron doping manifests itself by the appearance of new bands at 500 and 1225 cm^{-1}, and by the simultaneous downshift and attenuation of the diamond line at 1332 cm^{-1}. The in-situ Raman spectroelectrochemistry in aqueous 0.5 M H_2SO_4 allows selective addressing of the modes of sp^2 impurities in the region of 1430–1610 cm^{-1}. While the Raman response of sp^3 carbon is intact to electrochemical charging, the D, G and D' Raman modes of sp^2 carbon are not. The quality of diamond electrodes can be thus analyzed in detail by a combination of electrochemical, spectroelectrochemical and microscopic techniques.

ACKNOWLEDGEMENT
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Ångstrom resolved growth and characterization of noble metal oxides

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Structure and dynamics at electrochemical solid/liquid interfaces of metal electrodes drive functionality, stability and capabilities in a wide range of important technologies such as batteries, super capacitors, fuel cells, electrochemical hydrogen generator and corrosion phenomena, etc. Under operating conditions, electrochemical potentials at electrodes may vary and cycle strongly giving rise to the formation of metal oxide films and/ or their reduction promoting materials degradation. Hence, the mechanism of electrochemical oxidation and reduction of metals is fundamental to the understanding of interfacial electrochemical processes such as corrosion or catalysis, and has been the focus of numerous studies over the last decades. Here, we present a real time in-situ monitoring of the electrochemical interfaces with Angstrom resolution, based on the recently developed electrochemical surface force apparatus[1]. We have, for the first time, monitored oxide growth on noble metals in sulfuric acid solutions in real time, with Ångstrom resolution in thickness and milliseconds resolution in time. Our experiments reveal stark differences of oxide thickness and electronic properties during potentio-dynamic and potentio-static oxide growth on noble metals, which will be discussed in the presentation.

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Strategies towards Multi-color Electrochemiluminescence Sensors

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In recent times Electrochemiluminescence (ECL) has emerged as an important analytical technique, its selectivity and sensitivity making it suitable for the detection of a wide range of compounds. ECL is exploited routinely in commercial applications for rapid, sensitive detection and quantification of biomarkers, food borne pathogens and biowarfare agents. New applications of ECL as a sensing technique continue to appear in a wide range of fields, with a range of novel ECL-active luminophores having diverse properties being developed. Generally a single luminophore is excited in an ECL experiment without wavelength discrimination, for example tris(2,2′-bipyridyl)ruthenium(II) ($[Ru(bpy)_3]^{2+}$) emits strong co-reactant ECL at 620 nm. Spatial differentiation is generally utilized in order to create a multiplexed assay.

This work explores the use of multiple, selectively excited ECL luminophores. The emitting species of interest have been developed to have complimentary photophysical and electrochemical properties, and can thus be selectively excited via application of different electrode potentials.

Quantification of the emission from the luminophores is investigated using two different approaches. Simultaneously collecting electrochemical and spectral data using a potentiostat and typical wavelength-sensitive detector such as a CCD can be exploited to generate a 3D map of the emission *vs.* applied potential. Alternatively, the use of a low cost consumer-level digital camera and image analysis algorithms to isolate and quantify the contribution of each complex has been explored. Using this approach we demonstrate simultaneous detection of three emitting species at the low micro-molar level. This low cost multiplexed ECL detection system has potential applications in the emerging fields of mobile phone based telemedicine, as well as expanding the utility of current ECL based assays.

Benzene Oxidation at Diamond Electrodes: Comparison of Microcrystalline and Nanocrystalline Diamond

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A comparative study of benzene oxidation at boron-doped diamond (BDD) and nitrogenated nanocrystalline diamond (NCD) anodes in 0.5 M K_2SO_4 aqueous solution is performed by using cyclic voltammetry and electrochemical impedance spectroscopy. It is shown by measurements of differential capacitance and anodic current that during the benzene oxidation at the BDD electrode, adsorption of some intermediate of the benzene oxidation occurs, which partially blocks the electrode surface and lowers the anodic current (figure). At the NCD electrode, benzene is oxidized concurrently with oxygen evolution, some (quinoid) intermediate being adsorbed at the electrode. The adsorption and the electrode surface blocking are reflected in the impedance-frequency and impedance-potential complex-plane plots [1].

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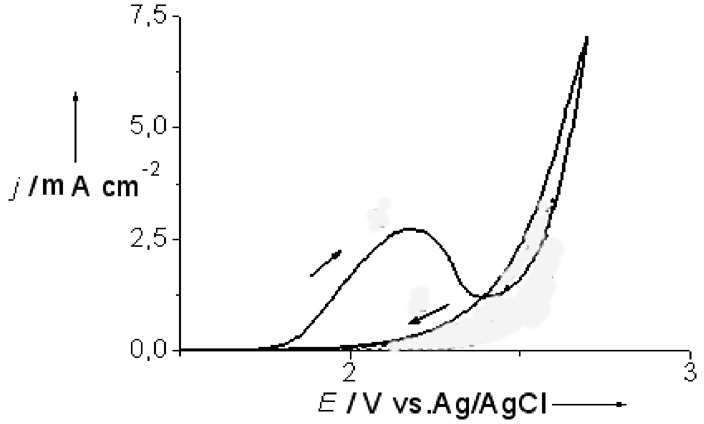

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Electrochemistry and electrogenerated chemiluminescence of $Au_{38}(SC_2H_4Ph)_{24}$ clusters

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The inherent electrochemical and optical properties of gold clusters e.g. $Au_{25}(SR)_{18}$ and $Au_{38}(SR)_{24}$, including their electrogenerated chemiluminescence (ECL), make them candidates for wide range of applications. For example, $Au_{25}(SC_2H_4Ph)_{18}^+$ clusters are near-infrared (NIR) ECL emitters in both annihilation and coreactant routes[1], a region useful for bio-imaging.[2] Here, we discuss the electrochemistry and ECL of the atomically precise $Au_{38}(SR)_{24}$ (R=), which exhibits well defined electrochemical behavior in both cathodic and anodic potential regions. Although, no ECL emission is observed for the Au_{38} cluster through the annihilation pathway, NIR-ECL emission occurs with the reactive intermediates generated with coreactants such as tri-*n*-propylamine (TPrA) and benzoyl peroxide (BPO). These two coreactants produce $TPrA^•$ and $BPO^•$ as strong reductive and oxidative agents with $E^° = -1.7$ V and $E^° = +1.5$ V *vs*. SCE, respectively.[3, 4] The $TPrA^•$ can inject an electron to the LUMO orbitals of the oxidized form of the cluster ($Au_{38}^{2+/+}$), while the $BPO^•$ is capable of removing electron from the HOMO of the reduced form ($Au_{38}^{-/2-}$). Results indicate that a number of different excited state(s) are generated, depending on the working electrode potential. Using our newly established spooling ECL spectroscopy, we were able to correlate the observed ECL spectra to their corresponding electrochemical potential. The recorded accumulated and spooling ECL spectra showed that the [TPrA] coreactant affected the emission intensity.

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Hard X-Ray Photoelectron Spectroscopy (HAXPES) and photoelectrochemistry characterization of new Al-Cr-Fe Complex Metallic Alloys passive film composition

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Al-Cr-Fe Complex Metallic Alloys (CMA) are corrosion resistant Al- based intermetallic phases (quasicrystalline approximants) stable in pHs ranging from 0 to 14[1,2] that can be exploited in resistant "multifunctional" coatings of Al alloys and steels. Hard X- Ray Photoelectron Spectroscopy (HAXPES) allowed performing a *non-destructive* characterization (artifacts' free) of the 6-10 nm thick passivation oxyhydroxide layers grown on Al-Cr-Fe CMAs by potentiostatic anodic polarization. X-Ray excitation energies from 2.3 to 15 keV were used at ID32 and BM25 beamlines of ESRF synchrotron.

The HAXPES technique allowed studying the in-depth composition gradients (including hydroxides identification) of the protecting passive oxide film and its metal/oxide interface difficult to be assessed by conventional XPS. In very aggressive solutions (H_2SO_4 pH 0 and 2), chromium and aluminium cations are found in the passive film with an enrichment of Cr oxyhydroxide in the outermost layer, while the inner part of the passive layer is then mostly composed of the Al oxyhydroxides.

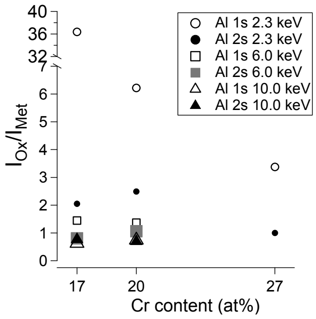

Figure 1: *Al 2s and Al1s oxide/metallic ratios obtained at various X-Ray energies for different Cr at% alloys electrochemically treated.*

The composition of the oxide layer and the behaviour of isostructural alloys having different Cr content will be discussed in detail. Additional photoelectrochemical characterizations will be linked to hydroxide structure and chromium integration in the passive film.

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ac-Electrogravimetry Investigations of Birnessite type MnO_2 Thin Films

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The need for new materials with improved ion transfer properties continues to be one of the main pressing concerns in energy storage materials research. In accompanying this search for optimal materials, appropriate characterization tools to assess key parameters of newly developed materials are required.

This paper will focus on coupling electrochemical impedance spectroscopy (EIS) with fast gravimetric methods (fast quartz crystal microbalance (QCM)) under dynamic regime. This coupling, so called *ac*-electrogravimetry measures the usual electrochemical impedance, $\Delta E/\Delta I$ (ω), and the mass/potential transfer function, $\Delta m/\Delta E(\omega)$, simultaneously.[1] The main interests of this coupling are its ability to indicate the contribution of the charged and uncharged species and to separate the anionic, cationic, and free solvent contributions during the electrochemical/chemical processes. These features make the *ac*-electrogravimetry as an attractive and appropriate tool to investigate transfer/transport phenomena of charged and uncharged species in ion insertion materials.

As a pertinent example, the adaptation of *ac*-electrogravimetry to evaluate the ion (Li^+, Na^+…) transfer phenomena in MnO_2 based thin films will be discussed. As a functional metal oxide, MnO_2 is one of the most attractive inorganic materials because of its physical and (electro)chemical properties, particularly in energy storage.[2] Thin films of MnO_2 with Li^+ ion intercalated are synthesized by a one-step electrodeposition method and the electrodeposition process is monitored by QCM.[3] The resulting Li_xMnO_2 thin films were characterized through classical methods. The ion transfer properties (Li^+ and Na^+ in aqueous and acetonitrile solutions) are investigated by electrochemical quartz crystal microbalance (EQCM) and *ac*-electrogravimetry. Our primary findings based on the mass/potential transfer function, $\Delta m/\Delta E(\omega)$, report that the cations are inserted under their hydrated form and the free solvent molecules participate indirectly in the charge compensation process with different kinetic constants.

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Carbon onions versus high and low surface area carbon black: what is the better conductive additive?

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Carbon supercapacitors have emerged as a promising technology for rapid and highly efficient energy storage and power management.[1] Supercapacitor electrodes are commonly composed of a mixture of porous carbons (mostly activated carbon) and polymer binder (such as PTFE). To improve the overall conductivity, highly conductive carbon particles are often added. Carbon black is the most frequently used conductive additive.[2, 3] Recently, carbon onions [4] (also known as onion-like carbon or carbon nano-onions) have been introduced as a novel class of high performance electrode materials.[5] First studies also have indicated an improved electrochemical performance (most importantly: rate handling),[6, 7] but until now, no systematic study has evaluated the effect of carbon onion additions to conventional activated carbon electrodes as compared to carbon black.

In our study we present a comprehensive overview and comparison between three kinds of spherical carbon nanoparticles as conductive additives: carbon onions (derived via thermal annealing from nanodiamonds), high purity carbon black (acetylene black), and carbon black with a high specific surface area (BP2000, >1000 m^2/g). YP80 as a common commercially available activated carbon was chosen as base material. Especially the comparison between carbon onions (300 - 400 m^2/g) and high surface area carbon black as additive is important, since carbon onions have a significantly higher specific surface area compared to conventional carbon black (~50 - 100 m^2/g). All experiments are carried out in 1 M TEA-BF_4 in either acetonitrile or propylene carbonate. We compare the results of electrochemical performance from cyclic voltammetry and galvanostatic charge / discharge for up to 20 mass% of conductive additives with the electrode resistance and values for the electrode density to ascertain preferable strategies on choosing a good compromise between high gravimetric / volumetric capacitance and rate handling ability.

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Electrochemical Conversion/Combustion of a Model Organic Pollutant on BDD Anode: Role of sp^3/ps^2 Ratio

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The concept of "non-active" anode was proposed by Comninellis [1] to classify a specific variety of anode materials used for electrochemical oxidation of organic pollutants, such as PbO_2, SnO_2 and boron doped diamond (BDD). The main remarkable quality of these anodes is the high overpotential for water electrolysis, which promotes the generation of large amounts of hydroxyl radicals with high and indiscriminate reactivity [2, 3]. Hydroxyl radicals, electrochemically generated, are physically adsorbed on the BDD surface (do not bind the oxygen atom at the anode surface), and these seem to play an important role in the electrochemical conversion/combustion of organic pollutants [4]. However, the non-active character of BDD electrode has been questioned by some authors due to the different results obtained during electrochemical degradation of different organic pollutants [5, 6]. Nevertheless, recent results have demonstrated that electrochemical oxidation is strongly influenced by the BDD characteristics, particularly the ratio of diamond/graphite carbon. Therefore, in this work, we attempt to discuss critical evidence about the influence of sp^3/sp^2 ratio on the performance of electrochemical oxidation of a model organic pollutant. These results have been interpreted in terms of the oxidation mechanism involved.

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Coupling Nanoscale Electrochemistry with micro-Raman Spectroscopy: New Views of sp^2 Carbon Electrodes

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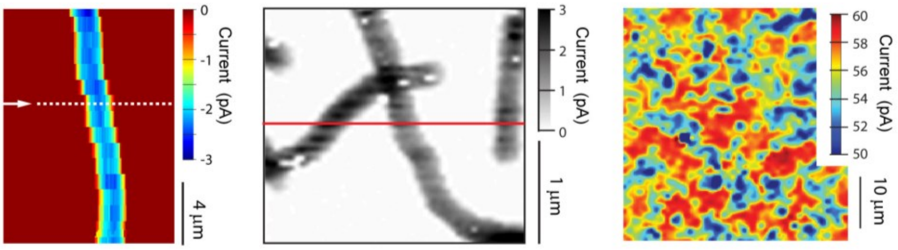
Within the family of nanostructured materials, carbon based nanostructures such as carbon nanotubes and more recently graphene, are attractive as electrode materials with widespread applications. Their exceptional electronic properties, chemical and mechanical stability has led to carbon-based electrodes being considered ideal substrates for electronics, transparent electrodes, sensing systems, electrocatalytic supports and batteries. Thus, probing heterogeneous electron transfer in carbon-based electrode materials is interesting fundamentally and essential in order to optimize future technological applications.

Here we show how Scanning Electrochemical Cell Microscopy (SECCM) [1] combined with complementary techniques such as micro-Raman spectroscopy is a powerful platform for the establishment of structure-activity correlations at the micro-nanoscale. The confinement of electrochemical measurements achievable with SECCM allows the interrogation individually of the different structural functionalities of carbon nanotubes [2,3] (sidewalls and ends) and graphene [4] (different number of layers). The combination of SECCM with spectroscopic techniques leads to unprecedented structure-activity correlations on carbon nanotubes and graphene, allowing new microscopic models for carbon-based electrodes to be advanced. This project was supported by the European Research Council ERC-2009-AdG 247143-QUANTIF.



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Benzenediacrylates as novel materials for organic Na- and Li-ion batteries

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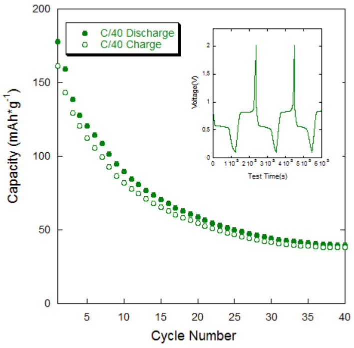
The rapidly increasing utilization of Li-ion chemistries for energy storage has led to a vast increase in the price of Li metal and other Li compounds in the past years. Since these resources are finite, it will be of importance to also explore battery chemistries based on metals which are cheaper and more widely spread, perhaps at the expense of energy density. In this context, Na has recently attracted a lot interest as one alternative to Li [1]. Moreover, conventional battery chemistries are based on inorganic compounds and involve transition metal elements, therefore giving rise to high costs and environmental issues. Organic materials issued from biomass, on the other hand, could constitute an environmentally better option in order to decrease the use of non-renewable resources.

Only a very limited number of organic compounds suitable for Na batteries exist to date. Here, we are investigating a novel Na-based organic battery electrode material, disodium benzenediacrylate (Na_2BDA), and compare it with its Li-ion homologue. The Li compound has shown promising battery properties, such as stable cycling and good capacity retention [2,3]. We report the synthesis and characterisation of Na_2BDA and Li_2BDA and discuss their electrochemical performances as functional anode materials in Na- and Li-ion batteries.



Electrochemical behaviour of a Na|| Na_2BDA cycled galvanostatically between 0.1 and 2 V at a rate of 1 Na^+/20 h (C/40) in 1 M NaFSI/EC:DEC.

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Alternative electrolyte for lithium battery: Fluorinated solvents and additives

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Recently a great effort has been undertaken to adapt Li-ion battery technology, widely used in nomad electronic, to fully electrified vehicles (EV) and hybrid ones (HEV, PHEV). Batteries intended to automotive applications require an increase in power/energy densities, safety, cycle life and a sharp cost-cutting. Several approaches can be carried out to improve both safety and performances.

Conventional electrolyte based on $LiPF_6$ salt dissolved in carbonate mixtures e.g.LP30™, results in reactive electrode/electrolyte interface at high potential and present poor stability: thermal instability at elevated temperatures and hydrolysis, resulting in the formation of HF. Accordingly, research on electrolytes for lithium-based batteries has focused both on the development of new $LiPF_6$ free electrolyte formulations and the use of additives in order to limit the electrolyte reactivity.

Therefore, this presentation will focus on both aspects. The physico-chemical and electrochemical investigations of electrolytes based on fluorinated solvent and LiTFSI salt were performed. The physico-chemical and electrochemical properties of electrolytes based on fluorinated solvents (carbamate, carbonate), as dielectric constant, viscosity, flash point, ionic conductivity and electrochemical stability were investigated with both pure solvents and solvent mixtures.

In order to minimize the reactivity of the electrolyte at high potential, the incorporation of additives based on biphenyl compounds was investigated [1]. The properties of the resulting deposit films were characterized by electrochemical methods. The influence of the film on lithium insertion was evaluated by cyclic voltammetry and impedance spectroscopy. A neat decrease of the self-discharge was observed without compromising the lithium insertion kinetic.

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Differential Linear Scan Voltammetry: Analytical Performance in Comparison with Pulsed Voltammetry Techniques

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We report here on differential linear scan voltammetry, DLSV that combines the working principles of linear scan voltammetry, LSV, and the numerous existing pulsed voltammetry techniques. DLSV preserves the information from continuous interrogation in voltage and high accuracy that LSV provides about electrochemical processes, and the much better sensitivity of differential pulsed techniques. DLSV also minimizes the background current compared to both LSV and pulsed voltammetry. An early version of DLSV, derivative stationary electrode polarography, DSEP, had been proposed in the 1960's but soon abandoned in favor of the emerging differential pulsed techniques. Relative to DSEP, DLSV takes advantage of the flexibility of discrete smoothing differentiation that was not available to early investigators. Also, DSEP had been explored in pure solutions and with reversible electrochemical reactions. DLSV is tested in this work in more challenging experimental contexts: the measurement of oxygen with a carbon fiber microelectrode in buffer, and with a gold microdisc electrode exposed to a live biological preparation. This work compares the analytical performances of DLSV and square wave voltammetry, SWV, the most popular pulsed voltammetry technique. An interesting observation made in measurements at live 3D cell constructs is that substantial biofouling is seen over time when square wave voltammetry is used for monitoring oxygen but practically no biofouling is apparent with differential linear scan voltammetry.

Cell Morphology of Anodic Porous Alumina Films

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Investigations concerning the cell morphology of porous anodic oxide films formed on aluminum have been extensively performed after the confirmation of the hexagonal cell model proposed by Keller et al. In these studies, it was suggested that cell dimensions, such as pore and cell diameters and barrier layer thickness, primarily depended on the formation voltage, and that they increased linearly with increasing voltage. Nevertheless, the role of current density as a controlling factor of the cell geometry is essential, especially for the self-ordering of pore arrangement (1). This is because the current density is a determining factor of electric field strength, which shows a linear relation with log of current density, at the barrier layer during anodic film growth (2). The content of anion incorporation to anodic film, which directly affected to the oxide property, is also determined by the current density (3). Furthermore, electric current flow played an important role for morphology of anodic alumina film (4).

In the present study, we investigated how electrolyte species influenced to the detailed cell morphology of anodic alumina including pore diameter / cell diameter ratio as well as fine pores/defects found in cell walls with focusing on anodizing conditions.

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CHARGE TRANSPORT IN PYRROLE/QUINONE CONDUCTING REDOX POLYMERS

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Polypyrrole functionalized with redox active pending groups functions both as a conducting polymer and as a redox polymer.[1] The electrochemical response varies with the applied potential, and exhibits capacitive charging of the conducting backbone, as well as redox cycling of the pending groups. While the backbone provides an electrically conducting matrix for fast electron transport through the material, the pending groups offer a large charge storage capacity, much greater than that of polypyrrole itself. We have investigated a series of such conducting redox polymers, based on polypyrrole with covalently attached hydroquinone moieties, with different linkers between the two groups. *In situ* spectroscopic, EQCM and conductivity experiments during electrochemical cycling were employed in order to understand the charge transport mechanisms in this type of system. Although the pending groups are not significantly affected by the attachment to polypyrrole, their redox activity has a large impact on the properties of the conducting backbone. The influence of the linker unit and the concentration of hydroquinone pending groups were specifically investigated. In view of the presented results, the use of conducting redox polymers as organic battery electrodes will be discussed, as they have several desirable properties for this application, such as low solubility, high conductivity and high specific capacity.

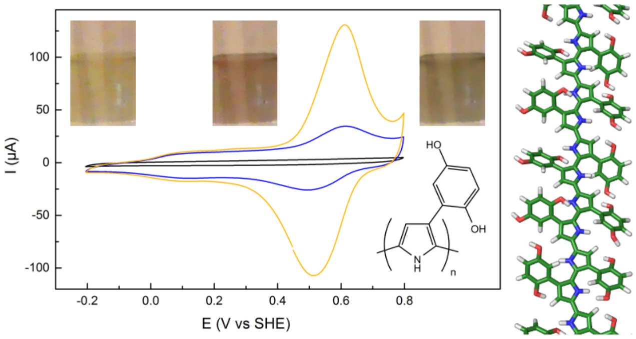

Figure 1. CV and color changes during cycling of a polypyrrole derivative with hydroquinone pending groups directly attached to the backbone.

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Silicon based micro-supercapacitors: How to improve their performances?

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Nowadays, micro-supercapacitors integration in micro-electronic circuit is a thriving topic [1]. One way to succeed is to elaborate silicon based micro-supercapacitors. That's the challenge that our group takes up for nearly four years. Here, we will explain how to get efficient silicon based micro-supercapacitors, with a special focus on our recent advances on the silicon nano-trees (SiNTrs) growth, silicon oxide layer key role [3] and micro-supercapacitors performances evaluation in several electrolytes [4].

Only highly doped silicon exhibits an excellent capacitive behavior [2]. Thus, the electrode capacitance can be improved by increasing their developed surface area with the growth of nanostructures by gold catalyzed Chemical Vapor Deposition [2-4]. Thanks to the growth of highly doped and hyperbranched SiNTrs, the electrode capacitance has been increased up to 950 µF.cm^{-2}, i.e. about 158 fold bulk silicon capacitance and two fold the one of the corresponding nanowires. Adding an oxide layer enables to tune the electrode electrochemical behavior and stability [3]. Micro-supercapacitors voltage can be increased up to 4V by using ionic liquid as electrolyte (Figure 1). SiNTrs/SiNTrs micro-supercapacitors show high power densities up to 225 mW.cm^{-2} and highly stable capacitance over at least 1 000 000 cycles for current densities up to 1 mA.cm^{-2} (Figure 2).

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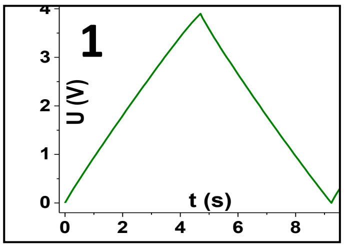

Figure 1: *SiNWS/SiNWs micro-supercapacitors galvanostatic cycle using ionic liquid as electrolyte.*

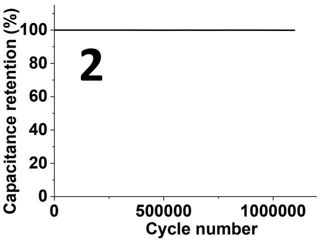

Figure 2: *SiNTrs/SiNTrs micro-supercapacitors electrochemical stability.*

Ammonia Electrolysis: Recovery of Energy from Waste

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Hydrogen as a fuel carrier coupled with an appropriate cell is a viable source of renewable energy. However, most hydrogen is still produced from high temperature conversion of fossil fuels, defeating the purpose of hydrogen as a renewable energy. A more renewable form of hydrogen production involves water electrolysis in an alkaline or proton exchange medium. Alternatively, ammonia electrolysis can be considered due to its high hydrogen density. Aside from the purity of the water required, ammonia electrolysis is more thermodynamically favourable with a cell voltage of 0.06 V in comparison with 1.23 V for water.

Ammonia is a highly valuable chemical due to its use in fertilizer production. However, this process consumes a lot of energy due to the high temperatures and pressures required in the Haber-Bosch process for combining nitrogen and hydrogen. In addition to its production process, ammonia is found in municipal wastewater treatment plants, wastewater from farm runoffs, and due to urea decomposition from animal waste. Therefore, there is an opportunity for a dual-pronged approach through denitrification of wastewater coupled with hydrogen production for renewable energy generation. These have been the efforts and focus of Dr. Botte and researchers at Ohio University in the Center for Electrochemical Engineering Research (CEER).

In the electrochemical deammonification of wastewater, ammonia electrolysis is integrated with the ammonia removal by ion exchange in a natural zeolite. Over 90 % of the ammonia can be removed from the wastewater through ion exchange, due to the high affinity of the zeolite for ammonia. Once the zeolite is saturated, ammonia is desorbed using an alkaline solution by means of the pH increase and ion exchange. The spent regenerant solution rich in ammonia, which corresponds to less than 5% of the volume of wastewater fed to the ion exchange columns, is fed to the electrolyzer to complete the ammonia dissociation to hydrogen and nitrogen.

Dr. Botte has performed extensive research and development of this technology, including: conceptualization of the process design and optimization, supplemented with the fundamental understanding of the reaction mechanism (based on computational chemistry, mathematical modeling and in-situ spectroscopy and microscopy techniques).

In this talk, a summary of the development of the technology will be presented.

Boron-doped diamond electrodes: From spectroelectrochemistry to AFM tip-integrated electrodes

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The investigation of interfacial processes requires analytical techniques providing ideally molecular selectivity and high sensitivity with the appropriate temporal/spatial resolution. For example, molecular specific information along with topographical information of electrochemical processes can be obtained by combining IR spectroelectrochemistry using *in-situ* infrared attenuated total reflection spectroscopy (IR-ATR) with atomic force microscopy (AFM)[1]. For spectroelectrochemical investigations in the mid-IR region boron-doped diamond (BDD) is frequently used as transparent electrode. BDD is a metallic-like semiconductor providing a large potential window, chemical inertness, favorable signal-to-noise-ratio and a broad optical window ranging from the near UV to the far IR spectral regime. This superior chemical and physical properties[2] in combination and the possibility to fabricate BDD-modified diamond ATR crystals, microelectrodes[3], microelectrode arrays or integrate BDD electrodes into AFM-scanning electrochemical microscopy (AFM-SECM) probes[4] renders them highly suitable for bioanalytical applications.

This presentation will give an overview on the state-of-the-art, current challenges, and the future potential of combined analytical surface techniques such as combined IR-ATR-SE-AFM and combined AFM-SECM based on BDD electrodes. The advantages of such combinations will be demonstrated with examples ranging from in-situ monitoring of polymerization processes to the in-situ investigation of biofilm formation. The application of AFM tip integrated BDD electrodes will focus on the localized detection of biological relevant analytes such as sulphur-containing molecules and neurotransmitter.

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Recombination Inhibitive Donor Structure of Organic Dye for Cobalt Complex Redox Electrolyte in Dye-sensitized Solar Cells

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Dye-sensitized solar cells with cobalt complex redox (Co-redox) electrolyte have achieved high photo-conversion efficiencies. However, low efficiency in Co-redox electrolyte could also be observed due to the fast recombination reaction at the interface between the TiO_2 and the electrolyte. Previously, we suggested the effect of steric hindrance of the donor and π-linker groups in donor-π-linker-acceptors (D-π-As) structured organic dyes on the recombination reaction.[1,2] Sustaining the cobalt redox couple away from TiO_2 surfaces is one of the key requirements for realizing a high photovoltaic performance with cobalt redox electrolytes. While, the relationship between the type of donor and DSSC performance has not been studied systematically. It is important to understand the blocking features of donor structures to cobalt complex electrolytes in order to develop high-performance dyes. In this study, we prepared the organic dyes using carbazole (**MK-1**), coumarin (**MK-31**), and triphenylamine (**MK-88**) and *N*-phenyl-carbazole (**MK-90**) in Fig. 1 and studied the electron lifetime dependence on the donor structure in each dye.

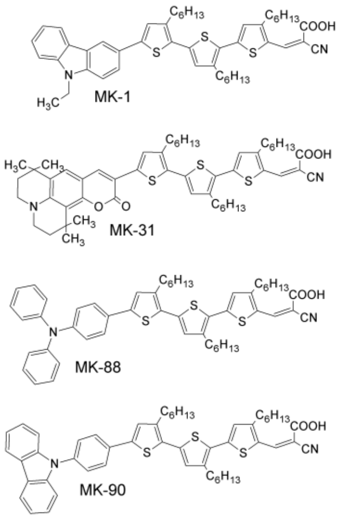

Fig 1. Chemical Structure of organic dyes

The cell with **MK-88** produced the highest open circuit voltage (ΔV_{oc}) and longest electron lifetime. It was attributed to the blocking effect by steric hindrance of the non-planar structure of the triphenylamine donor. On the other hand, the lowest ΔV_{oc} and shortest electron lifetime was obtained with **MK-31**, suggesting that the coumarin donor attracted the Co-redox couples to the surface of the TiO_2 layer, thus increasing the concentration of cobalt complex. [3]

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WO_3 Nanochannels by Anodization in Molten o-H_3PO_4

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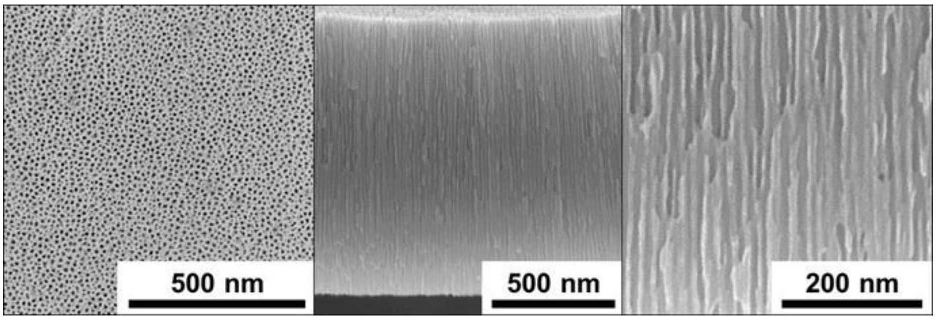
As soon as the importance of morphological features on the potentialities of semiconductors was outlined, large attention has been devoted to nanostructuring. Electrochemical anodization allows for the fabrication (in a single-step-process) of highly ordered, nanostructured oxide films at the surface of metallic substrates. So far, the growth of titania nanopores, nanotubes and nanochannels by anodization represents a well-established knowledge [1]. On the other hand, only few studies report on successful anodization approach for fabricating nanostructured WO_3 [2-4], this in spite of the great technological relevance that this semiconductor possesses (*i.e.*, as photo-anode or gas-sensor and for photo- and electro-chromic devices). Attempting to cover such a lack of knowledge, we have been developing an anodization approach where W is positively biased (at potentials in the range of 5–10 V) in pure, molten o-H_3PO_4 (no additives are needed). The figure below shows some structural features of straight, 5–20 nm in diameter, highly-ordered WO_3 nanochannels fabricated through the approach here presented. These anodic layers, upon conversion into crystalline oxide, were shown to exhibit strikingly enhanced performances as photo-anodes (for photo-electrochemical water splitting) and as H_2 gas-sensors. The novelty of this approach relates also to the following aspects: *i*) other phosphorus-containing acids (*e.g.*, pyro- and poly-phosphoric acid) can be used under similar conditions yet providing ordered WO_3 nanostructures; *ii*) the process, upon tuning of the conditions (temperature and applied potential), can be extended to Al, Nb and Ti (so far), this enabling the fabrication of other nanostructured oxides.



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Normalised Sampled-Current Voltammetry at Microdisc Electrodes: Kinetic Information from pseudo steady state to steady state voltammetry

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Sampled-current voltammetry (SCV) produces sigmoidal current-potential curves akin to steady state voltammograms but each curve corresponds to a specific timescale set by sampling at a fixed time successive current transients acquired after stepping the potential to a range of values where the redox process of interest takes place. In this way, multiple SCVs can be recorded from the same collection of current transients.

The concept is often used to describe the current-time-potential relationship at planar electrodes, but is rarely employed as an electroanalytical method except in normal pulse voltammetry, where the chronoamperograms are sampled once to produce a single voltammogram.

We report here the combination of SCV at a Pt microdisc electrode with a conditioning waveform to produce voltammograms where each data point is recorded with the same history. We demonstrate that the conditioning waveform is crucial to obtaining reliable SCVs below 100 ms.

To facilitate analysis of the voltammograms and reveal kinetic information, we remove the time dependence by normalizing the currents with the theoretical diffusion controlled current, reported by Mahon and Oldham[1]. We validate the procedure with the reduction of $Ru(NH_3)_6^{3+}$, a model one electron outer sphere process, and apply is to the derivation of the kinetic parameters for the reduction of Fe^{3+} on Pt microdiscs.

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High Energy Hybrid Lithium Ion Capacitors Using Graphene-based Electrodes Combined with Activated Carbon

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Hybridizing battery and supercapacitor technologies have the potential to overcome the limitations of the currently prevailing energy storage systems.[1-2] Combining high-power capacitive electrodes from supercapacitor with the high-energy intercalation electrodes in lithium ion batteries provides the opportunity to create a single device that can deliver both high energy and high power. While energy densities in such hybrid systems easily exceed those found in supercapacitors, the kinetic imbalance between capacitive and intercalation electrodes remains a bottleneck to achieving the desired high performance. This imbalance was eliminated through the use of graphene from a simple, one-step process as high-power anode in the new hybrid supercapacitor. The high energy and power of this hybrid supercapacitor is expected to bridge the gap between conventional batteries with high energy/low power and supercapacitors with high power/low energy.[1-2]

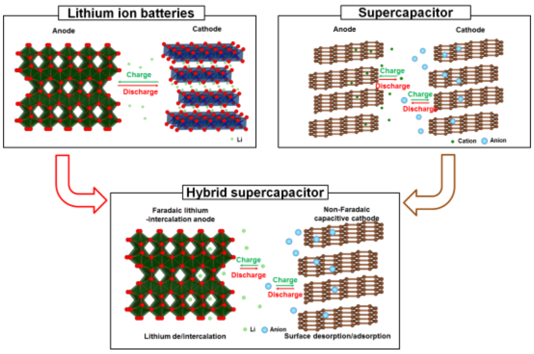

Figure 1. An illustration of the typical hybrid supercapacitor. The hybrid supercapacitor uses a non-Faradaic capacitive cathode from supercapacitors, and a Faradaic lithium-intercalation anode from LIBs.

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CORRECTED APPROACH TO TREATING THE POLARON CONDUCTANCE OF ELECTROACTIVE POLYMERS

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The accepted treatment of the polaron conductance of electroactive polymers is based on the representations elaborated preliminarily for redox polymers with the only premise that a polaron quasi-particle includes three-five monomer units in contrast to one unit assumed for any fragment of redox polymers. This means that, in scope of such approach, three-five neutral and neighboring polymer fragments should be considered as a reduced quasi-particle in case of polaron conducting films. If so, the length of consecutive translocations of a polaron (bipolaron) along polymer chains should also amount three-five monomer sizes. As pointed out in [1, 2], such treatment meets certain difficulties. To remove these difficulties due to a proper reformulation of the material balance equations for polaron conducting films is the aim of the given communication. Such reformulation is performed for model film systems including non-ramified polymer chains, along which polaron and bipolaron quasi-particles move in such manner, that their single translocations constitute only one monomer length. In addition, possibility of polaron/bipolaron transformations is also accounted for. The consecutive quasi-particle translocations are considered as a sequence of similar reactions, which allows one to use the Brönsted rule of linear connections between activation energies of translocations and their heat effects. As a result, systems of the quasi-particles fluxes and material balance equations that differ from those known previously have been obtained. It is worth noting that, at equilibrium conditions, the derived equations lead to the thermodynamic results given in [1, 2]. As concerns non-stationary conditions, the primary conclusions obtained permit one to expect some new results. In particular, the impedance problem for the simplest system containing only two-site polarons, neutral film fragments, and counter-ions might be solved easily. As the corresponding solution is known in scope of the traditional approach, there appears the possibility of a comparison between such results. Though theoretical consequences of the approaches are qualitatively the same, some difference between the compared expressions is displayed. It remains to add that the desired generalization of the proposed approach seems possible.

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A Superconcentrated Electrolyte for Fast-Charging and High-Voltage Lithium-Ion Batteries

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A stable, functional electrolyte is a key component in fast-charging and high-voltage lithium-ion batteries as well as next-generation advanced batteries (e.g., lithium-oxygen system). Herein we report unusual reductive stability and ultrafast charging character of superconcentrated electrolytes.[1-4] As an example, a superconcentrated acetonitrile (AN) solution (4.5 mol dm^{-3} LiN(SO$_2$F)$_2$/AN) overcomes the inherent low reductive stability of AN solvent to allow for reversible lithium intercalation into a graphite electrode (Fig. 1). More importantly, the charging (lithium intercalation) kinetics is much faster than in a currently used commercial electrolyte (e.g., 1.0 mol dm^{-3} LiPF$_6$/ethylene carbonate (EC) : dimethyl carbonate (DMC) (1:1 by vol.) (Fig. 2). We used first-principle molecular dynamics simulations to reveal that the peculiar reductive stability arises from modified frontier orbital characters unique to such superconcentrated solutions, in which all solvents and anions coordinate to lithium ions to form a fluid polymeric network of anions and lithium ions.

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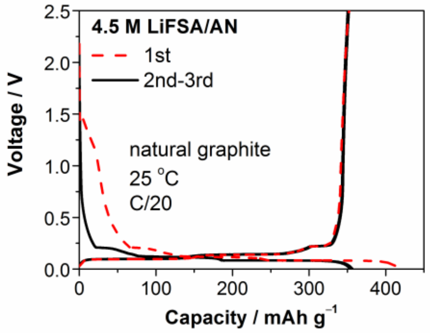

Fig. 1 Charge-discharge curves of natural graphite/lithium metal cell with 4.5 mol dm^{-3} LiFSA/AN electrolyte at C/20-rate.

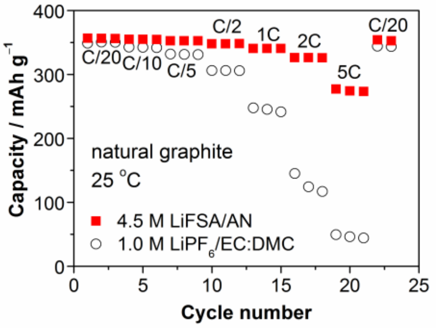

Fig. 2 Reversible capacity of natural graphite at various C-rates. Charge and discharge were conducted at the same C-rate without using a constant-voltage mode.

Fabricating and testing electrochemical capacitors

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Performance offered by an electrochemical capacitor electrode material can only be determined by evaluating it in a proper test vehicle. Button cells typically are used as the test vehicle since they can be easily made and have low cost. Unfortunately, such test vehicles often make power performance measurements difficult and stability measurements impossible. These limitations are generally associated with electrical contact resistance between an electrode material and the interior surface of the metal button cell package, unknown and often non-uniform electrode compression, and uncontrolled void-volume within the package.

We have developed an approach for evaluating electrochemical capacitor electrode material that overcomes the limitations found with button cells. Furthermore, our approach allows accurate performance projections to be made for large-size devices using data from small prototype cells.

Prototype cells are fabricated using a sequence of steps. First, electrode material is plastic bonded with PTFE (3% by weight) then formed into thin, uniform disks. Second, a disk electrode is placed in direct contact with a treated current collector material (the same as used in typical commercial cells). Third, dimension control is closely maintained by using a precision impulse-heat-seal apparatus to seal the cell. A thermoplastic at the perimeter of a cell is rapidly melted then cooled to form this seal, which is in stark contrast to button cell crimping with the associated metal deformation needed to make the seal. And fourth, internal springs are not used to compress the electrodes in the cell. Compression force is applied, controlled, and precisely maintained using external means.

Details of this electrochemical capacitor materials evaluation approach are presented. Standard test protocols and limitations are discussed.

Point defects at oxide interfaces and their control at atomic scale

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Mechanistic understanding of corrosion and stability of oxide interfaces exposed to various environment is a topic of active interest. Of particular importance is the role of the near-surface point defects in controlling the passive (or insulating) nature of oxide films that may form on an underlying metal or alloy or a deposited film on any surface. Charged point defects in ionic materials like oxide coatings can lead to electron leakage and consequently increased reactivity and pitting breakdown. We will discuss some examples of how non-stoichoimetry in model passive oxide films such as alumina and zirconia can influence the electron transport across them and subsequently their stability in contact with aqueous media. Experimental techniques to control point defect concentration at atomic scale using non-thermal photon illumination will then be presented along with discussion of the elementary mechanisms. Finally, we will present new approaches to reversibly control point defect concentrations at oxide interfaces utilizing strong electric fields with electrolytic gating. These points to new directions to explore oxide heterostructures for corrosion protection research and understanding the role of defects in design of oxide thin films.

A new family of single-ion BAB triblock copolymers as efficient solid electrolytes

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Electrochemical energy storage is one of the major societal challenges of this century. The performances of classical lithium–ion technology based on liquid electrolyte have made great strides in the past two decades, but the intrinsic instability of the liquid electrolyte results in safety issues. Solid polymer electrolyte would be a perfect solution to these safety issues. However, as in liquids, the fraction of charge carried by lithium ions is small (< 20%), limiting the performances in terms of power. Furthermore, solid polymer electrolytes operate at 80°C so that mechanical properties are weak with a limited electrochemical stability window. Lithium metal as anode is the ultimate negative electrode and the only choice to complement the positive air (O_2) or sulfur cathodes to really take advantage of the latter's high specific capacities.

In this context, we have developed a multifunctional single-ion triblock copolymer electrolyte (BCE), B-PEO-B comprising a poly(ethylene oxide) (PEO) central block and a B block comprising grafted lithium trifluoromethanesulfonylimide (TFSILi). The TFSILi has been grafted on different backbone based on the styrene or the acrylates/methacrylates. They overcame most of the above limitations, with a lithium ion transport number close to unity, excellent mechanical properties and an electrochemical stability window spanning now 5 V vs. Li^+/Li. A prototype of battery using this new type of single-ion BCE outperformed conventional batteries based on polymer electrolyte, notably offering very good performances at 60°C[1].

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Fast electron-transfer kinetics at single nano disk electrodes

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The kinetic data at ultra microelectrodes (UME) should be consistent with those by fast scan voltammetry. The relation of the radius a, at UME with the scan rate v, at a large electrode is given by $v = 8.15RTD/Fa^2$. The values of reported data are changed in the context of diffusion layer thickness. For example, $a = 1$ nm corresponds to $v = 210$ MV/s at a large electrode. As a result, single nano electrode allows us to determine fast kinetic constants by changing electrode diameter, which is often too fast to be obtained with conventional electrodes. However, it is dangerous to consider simply $v = 8.15RTD/Fa^2$ from the diffusion process, because the heterogeneous reaction occurs at electrode surfaces rather than in the diffusion layer. This question will be discussed by determination of rate constants of fast electron transfer reactions of hexachloroiridium, hexamine ruthenium, aminoferrocene, tetracyanoquinodimethan, benzoquinone, ferrocenecarboxylic acid and ferrocene.

This work is motivated by the experimental feasibility of high current density at ultra microelectrodes without effects of capacitive currents or solution resistance. A number of nanoscale platinum electrodes which was sealed with a glass are stable（Fig.1）. Half wave potential was refereed by a non-charged species which be used as reference potential （Fig.3）. The potential can be accurately controlled even in high resistive solutions owing to eliminating ohmic effects. Mass-transport mechanisms can be analyzed from the ratio between the steady-state current of sample and that of the reference species.

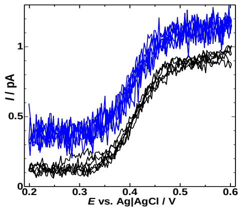

Fig.1. $2a = 0.8$ nm, $v = 5$, 100 mV/s

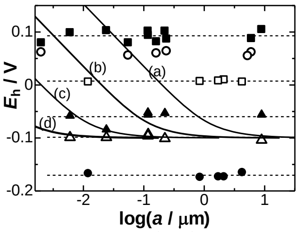

Fig.2. Dependence of halfwave potentials with log *a*. ● $Ru(NH_3)_6^{3+}$, ■ $IrCl_6^{2-}$, □Fc, △ $TCNQ^-$, ▲ $TCNQ^{2-}$, ○ FcA.

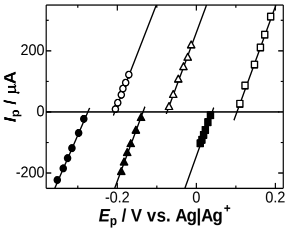

Fig.3. ○ $TCNQ^-$, △ $TCNQ^{2-}$, □ Fc in 0.2 M $TBAPF_6$ at $2a = 1.6$ mm, $v = 0.1$, 1, 3, 5, 7, 10 V s^{-1}

No potential shift is observed even at electrodes 10 nm in diameter for the six species (Fig.2). This fact implies that the heterogeneous rate constants are at least larger than 10 cm/s. Fast scan voltammetry is carried out at a large electrode for scan rates less than 10 V/s. The inconsistency between the two methods is ascribed partly to solution resistance and partly to the resistance relevant to the electric double layer at fast scan voltammetry. The contribution of the solution resistance is demonstrated from the facts that the peak currents vary linearly with the peak potentials, that the slope of the linearity is independent of kinds of redox species (Fig.3).

The electro-oxidation of recalcitrant compounds in a new FM01-LC reactor by Hydrodynamic and Mass Transport Turbulence Modeling by CFD with a reaction term coupled with a continuous stirred tank (CST).

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Most studies on electrodegradation of recalcitrant compounds have only been performed in laboratory cells whose operating conditions cannot be scaled up to a prototype or industrial reactor. The filter-press type FM01-LC reactor is a kind of reactor that allows controlling hydrodynamics and mass transport in a well-defined geometry, thus making it very attractive to industry because it can be scaled up to any size. On the other hand, since the electrochemical conversion is small during the residence time, the continuous stirred tank (CST) in recirculation mode in electrochemical reactor is a common processing mode. This work is aimed at proposing a the numerical modeling of the effect of hydrodynamics on mass transport on the tertiary current and potential distribution in a FM01-LC reactor with a new geometry design of inlet and outlet distributors in parallel plate's configuration coupled with the recirculation CST, where CST equations in transitory regimen were used. The operating conditions of the electrochemical reactor were in turbulent regime and under charge and mass transfer mixed control. The predictions of this parametric model (obtained by computational fluid dynamic) are compared to experimental data obtained from thiourea electrooxidation system. Fluid dispersion obtained in the reaction zone (depending on the fluid flow velocities and geometric configuration), plays an important role in tertiary potential distribution.

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Novel Family of Porphine-Based Electroactive Materials. Electrocatalysis of Oxygen Reduction Reaction

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The general goal of our study is to synthesize electroactive polymers on the basis of (metallo)porphines, i.e. non-substituted (metallo)porphyrins. We have discovered for the first time [1,2] that electrooxidation of Mg(II) porphine (Fig.1) results in deposition of a polymeric film composed on Mg(II) porphine units, their molecular structure being dependent on polymerization conditions (Figs 1, M = Mg).

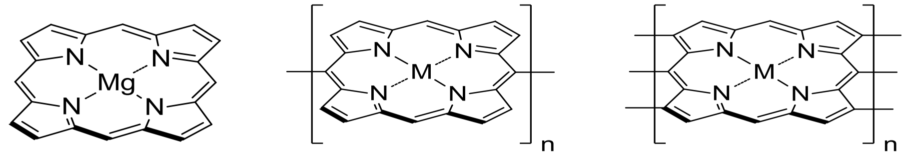

Fig. 1 Starting monomer, Mg(II) porphine (left). Poly(metallo)porphines of type I (center) and of type II (right). Central ion(s), M, may be Mg(II), 2 H^+, Zn(II) or Co(II).

This Mg(II) polyporphine of type I, pMgP-I, has been used to synthesize a novel polymer, "free-base polyporphine of type I", pH_2P-I (Fig.1, M = $2H^+$) by means of acid treatment. Then, the ion-exchange method was applied to transform this metal-free polymer, pH_2P-I, into novel polymetalloporphines of type I, pZnP-I and pCoP-I, having the same molecular structure (Fig.1 center) but with M = Zn(II) or Co(II), respectively. All these poly(metallo)porphines of type I, pMP-I (Fig.1 center), have been transformed into corresponding poly(metallo)porphines of type II, pMP-II (Fig.1 right, Mg(II), 2 H+, Zn(II) or Co(II)) by electrochemical oxidation of the polymer film.

All these polymers of type I and II demonstrate a pronounced electroactivity. The polymers of type I may be in a neutral (insulating) or in a positively or negatively charged (conducting) state, depending on the electrode potential. On the contrary, all polymers of type II show a strong redox response and a high electronic conductivity within the whole potential range of their stability (over 3 V wide).

Polyporphines of Co(II) have revealed a high electrocatalytic effect for oxygen reduction reaction, its potential being close to that for Pt electrode both in acidic and alkali solutions.

Acknowledgements to the support of the Russian Science Foundation.

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Porphyrin-polyoxometalate electropolymers

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Polyoxometalates (POMs) are anionic metal oxide molecular analogues presenting a great diversity of structures and applications. In particular, the development of hybrid polymers incorporating POMs is a promising approach to elaborate new functional materials. In this context, we have previously developed a method of electropolymerization based on nucleophilic attacks of bipyridinium-substituted porphyrins onto electrogenerated porphyrin dications [1-2] which can lead to the formation of hybrid POM-porphyrin copolymeric films (Fig. 1) obtained by the electro-oxidation of porphyrin in the presence of the POM bearing two pyridyl groups (Py-POM-Py) [3]. By transferring the film on a silicon wafer, we observe very well defined circular domains indicating remarkable self-assembly (Fig. 1). This process is feasible for other POMs functionalized with two pendant pyridine groups such as Dawson[4] or Keggin type POMs. The electropolymers have been studied by spectroelectrochemistry (UV-vis-NIR), EQCM and impedance measurments. Such films onto ITO electrode are also able to generate photocurrent under visible-light illumination [5-6] or can be used for heterogenous photocatalysis for the reduction of cationic metal in aqueous solution [3].

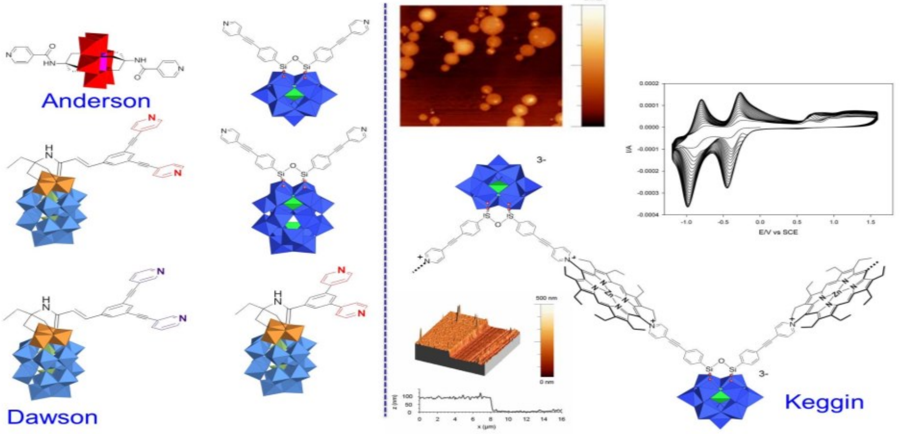

Fig. 1. Left: Different type of Py-POM-Py used. Right: copolymer obtained using Keggin type POM, CVs recorded during the electropolymerization and thickness measurement from AFM. Top: AFM picture of the nanodisks obtained in the case of Anderson-porphyrin electropolymer.

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Tailor-Made Electrolyte/Cathode Interfacial Buffer Layers for 5V-Class All-Solid-State Lithium Batteries

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The ever-increasing demand for electric vehicles (EVs) inspires the need for next-generation rechargeable batteries with higher energy density; 5V-class all-solid-state lithium batteries are considered as one of the solutions.[1] However, they apparently suffer from limited power densities because of the slow charge transfer rates at electrolyte/cathode interfaces, which is likely to be associated with the formation of Li^+ deficient layers caused by the large potential differences ($\phi_{cathode}$ - $\phi_{electrolyte}$) at the interfaces. Such slow kinetics at the electrolyte/cathode interfaces can be improved by modifying the interfaces using dielectric nano-particles (e.g., $BaTiO_3$). [2]

Here we report new interfacial buffer layer materials that will result in further improved charge transfer rates at the electrolyte/cathode interfaces in 5V-class all-solid-state lithium batteries. These new buffer layer materials have high permittivities in order to suppress Li^+ deficient layers at interfaces effectively, as well as high ionic conductivities in order not to hinder charge transfer through the buffer layer itself. These new materials were identified using a unique MBE based High-Throughput Physical Vapour Deposition (HT-PVD) technique [3, 4] in which concentration-gradient thin films of ternary metal oxides were deposited in a single experiment. Subsequently, the materials were characterised to determine their elemental and phase compositions. The lithium ion conductivities and permittivities of the graded samples (ca. 1200 sub-samples) were measured as a function of their compositions and thermal processing conditions. Using this approach we have optimised the chemical compositions and crystallinity of ternary oxides and identified a new buffer layer material for this application.

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Displacement of Voltammetric Peaks with Nanoparticles Size: a Nonextensive Thermodynamic Approach

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The ***nonextensive thermodynamics*** (NET) adopts the same conceptual basis as classical thermodynamics but uses an extensity, χ, in the expression of internal energy. This extensity is an Euler's function of the particle mass with a homogeneity degree, m, which can be other than one; m is the ***thermodynamic dimension*** of the system. This approach can be used to account for the variations of a redox couple according to the size of the reduced solid species by a ***power law*** [1]. The consequence is that for such systems, the electrochemical behaviors change. Thus, several recent experimental and theoretical studies on the electro-oxidation of metal nanoparticles (NP) deposited on electrodes show the complexity of the physico-chemical behavior of the material in a divided form. Indeed, a destabilization of the reduced species with a decrease in size[2], or rather a stabilization[3], or sometimes, conditions of metastability[4] can be observed depending on the nature of the selected systems, the size of NP and the experiment conditions. Obviously, all these changes cannot be described, let alone formalized by the Gibbs (extensive) thermodynamics, which attaches great importance to the shape of the aggregate of nanometric size. The latter is usually assumed spherical, which is rarely the case in reality. We propose here to show how the concepts of the NET can be used to express by a ***power law*** of the NP mass the variations to the electrochemical kinetics of NP and in particular to voltammetry. Thus, we offer a generalization of Plieth's[5] relationship (which comes from Gibbs-Thompson equation) for non-spherical aggregates. Thus, the relations of NET can quantitatively account or the displacements of electro-oxidation potentials of metal NP deposited on electrodes, according to their measured size (length, diameter,…). Our approach also permits to formally justify the stability of the particles may increase as their size decreases.

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Electrochemical wastewater treatment: applications and development of full scale electrolysis cells

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In recent years great progress has been made in the research of electrochemical wastewater treatment (EAOP) with the aim to develop a universal method for the treatment of persistent water constituents. Especially anodic oxidation of organic substances with boron-doped diamond (BDD) electrodes has demonstrated its high potential for the degradation of persistent pollutants. Especially in combination with physical or biological treatment full scale electrochemical wastewater treatment systems have a great potential.

The principles of electrochemical oxidation in wastewater treatment were developed and the applicability of this technology was verified in laboratory and pilot scale. The degradation trends were characterised for synthetic and industrial wastewater effluents. The influence of the water matrix and the operating parameters were monitored and analysed. Boron-doped diamond electrodes prove to be a highly appropriate electrode in terms of oxidation power, application and stability. Full scale electrolysis cells equipped with BDD-electrodes were constructed with a maximum electrode area of 3.6 m^2 per cell. This cell size is a good compromise between required electrode area and number of electrolysis cells. With this electrode configuration the purification of a variety of industrial wastewaters was successful. Side reactions and the formation of side products due to chloride, carbonate or ammonium load were also investigated.

The results of the research activities confirm that electrochemical wastewater treatment can establish as highly reliable technology for manifold industries.

Gravity Induced Flow Cell: An Interdisciplinary of Mechanical Engineering, Suspension Rheology and Electrochemistry

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The high power energy storage and scalability of flow batteries provide a solution to improve the reliability of a grid system that aims to incorporate renewable sources from solar and wind power. However, simultaneous control of flow and electrochemistry with pumps, sensors and valves increases the complexity and cost of the flow batteries. To reduce the amount of actuators, we designed and engineered a patented-concept that utilizes gravity to induce the flow of the electro-active material across the current collector region during which charging or discharging can occur; hence the term gravity induced flow cell (GIFCell) (Figure 1). The GIFCell is tilted at an angle to allow the electro-active material to flow from the top to the lower compartment. In exchange, gas is displaced accordingly through the connecting tubing. Flipping the GIFCell at regular time interval then allows for continuous flow of the electro-active material through the current collector region. In our research, we selected lithium polysulfide suspension, formed by percolating network of nano-sized carbon as the cathode material for its high energy density and lithium metal as the anode. The technical difficulties of the GIFCell involved achieving a uniform flow with this non-Newtonian suspension and extracting reasonable capacity during operation. We overcame these challenges through the implementation of the following ideas/studies: (1) Applying a Teflon coating to provide a non-wettability surface to the polysulfide suspension; (2) Preventing viscous fingering from happening during flow through the optimization of the width of the flow channel; (3) Incorporating a membrane system to significantly reduce the flow rate for maximizing energy extraction. Moreover, we applied the principles of rheology and electrochemistry to theoretically model the GIFCell. In summary, the lab-scale GIFCell successfully demonstrated the idea of utilizing the work of gravity to move the electro-active material through a series of electrochemical cycling.

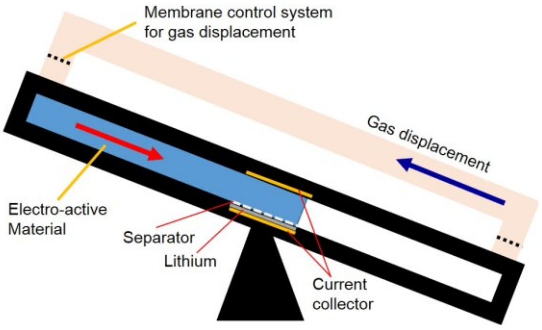

Figure 1: Schematic showing the working principle of a GIFCell

Ultrafast nc-TiO_2 (B) /CNF Composites for Negative Electrode of 'Nanohybrid Capacitor'

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We have been applying our original in-situ material processing technology called 'Ultra-Centrifuging (UC) Treatment' to prepare a novel ultrafast nano-crystalline $Li_4Ti_5O_{12}$ (nc-LTO) /carbon nano fiber (CNF) composite electrode for the generation-II capacitive energy storage device of 'Nanohybrid Capacitor' producing more than triple energy density of a conventional electrochemical capacitor.[1] To further improve the energy density of 'Nanohybrid Capacitor', we have been pursuing LTO alternatives. Among different candidates, TiO_2 (B) possesses several advantages such as its 2-folds theoretical capacity (335 mAh g^{-1}) of LTO (175 mAh g^{-1}) and the comparable redox potential (1.6 V *vs.* Li/Li^+). In addition, TiO_2 (B) is an industrially attractive material because of its inexpensive raw materials and its environmentally benign synthesis using only aqueous solution (e.g., water-soluble complexes [2]a) without any Li-sources.[2] However, TiO_2 (B) has intrinsic problems; its low electronic conductivity and Li^+ diffusivity due to the b-axis oriented growth of TiO_2 (B) [2]b. In this report, we successfully synthesized b-axis shortened and hyper-dispersed nc-TiO_2 (B)/CNF composites, which has a potential to substitute nc-LTO/CNF as a negative electrode of 'Nanohybrid capacitor'. Inhibition of b-axis growth and hyper dispersion of TiO_2 (B) into the carbon matrix were simultaneously achieved by the UC treatment and the subsequent hydrothermal method [2]c. The prepared nc-TiO_2/CNF exhibited 236 mAh g^{-1} (active material) at high rate of 300 C, which even exceeds that of nc-LTO/CNF composites.

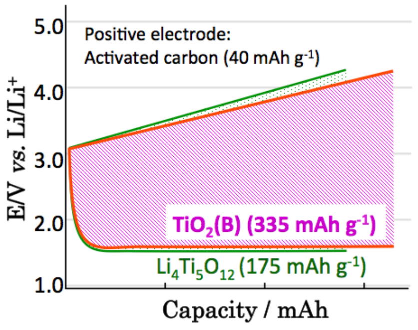

Fig.1 Comparison of potential-capacity curves between AC/LTO and AC/TiO_2 (B) system

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Smart Anodizing of Tungsten through the Alumina Nanopores: from Nanocolumns to Nanocapsules and Nanotubes

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Nanostructured tungsten oxide (TO) semiconductor exhibits excellent electrochromic, photochromic, and gas sensing properties. However, the well-controlled fabrication of stable TO nanofilms remains a challenge. In our previous work [1], we demonstrated that an array of self-organized solid TO nanocolumns can be synthesized in a highly reproducible way via anodizing of tungsten metal through the alumina nanopores. Here we show, for the first time, that an Al/W bilayer can be anodically processed in such a way that it allows the growth of a self-organized array of long-aspect-ratio TO nanocapsules (cylinders with closed tops and empty interior), which them can be chemically top-opened and thus transformed to vertically aligned nanotubes, spatially-ordered and not merged in a continuous oxide layer underneath the alumina film, unlike the case of the solid TO nanocolumns [1].

The TO nanocapsule array is developed via initial growth of a nanoporous alumina layer, followed by the pore-directed high-potential anodizing of the W underlayer in a fluoride-free acid electrolyte at room temperature. The smart formation approach allows for the smooth growth of amorphous and crystalline TO nanocapsules without early dielectric breakdown, physical defects, and destructive dissolution at the respective interfaces (Fig. 1). From the high-resolution SEM with FIB sectioning, the capsules/tubes may have the outer diameter of 30-150 nm, the length of up to 700 nm, and the population density of 10^8 cm^{-2}. From the XPS, XRD, and EDX point analysis results, the as anodized capsules/tubes are mostly composed of amorphous WO_3 mixed with minor amount of Al_2O_3 without impurities from the electrolyte. Annealing the films in air and vacuum results in the formation of lower tungsten oxides, crystallization of capsule/tube material, and transformation from dielectric to *n*-type semiconductor properties. A model of porous-alumina-assisted growth of the TO nanocapsule array is proposed and experimentally justified. Investigation into functional properties of the films developed here is in progress now, the results to be reported in due course.

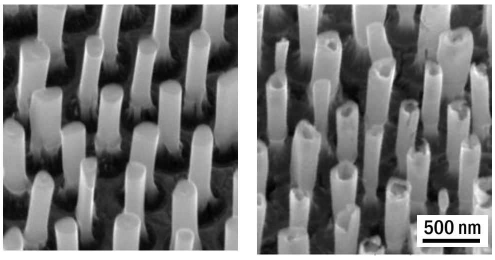

Figure 1. SEM images of tungsten oxide nanocapsule (left) and nanotube (right) arrays derived from anodically oxidized Al/W metal layers sputter-deposited onto a Si wafer

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Electrochemical Degradation of Azo Dye Disperse Blue 3

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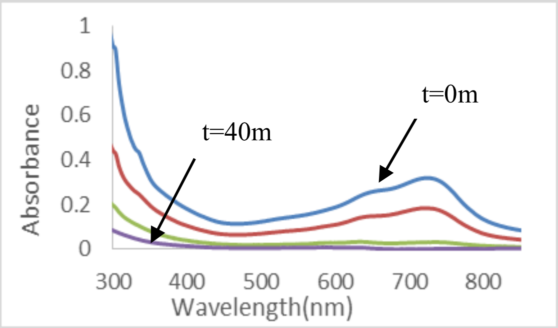
In this work the electrochemical degradation of organic azo dye (Disperse Blue 3) is presented. The degradation was carried out using the technique of chronoamperometry at anodic potential 0.7 V vs SCE (saturated calomel electrode) before oxygen generation and potential cell 2V, 2.5 V, 3 V after oxygen generation. Phosphate buffer solution (1M) at pH 7.4 was used as a supporting electrolyte and ruthenium (IV) oxide on titanium and platinum on titanium as active electrodes. All systems of electro degradation were built inside the 1cm x 1cm x 5cm quartz cell of the ultraviolet-visible spectrophotometer and measurements were taken insitu during the process of electrochemical degradation. The maximum dye degradation was carried out at an potential cell 3 V with a current density of 245 mA cm^{-2} and 40 minutes yielding a 99.6% colour loss. Figure 1 shows colour degradation of Disperse Blue 3.



Ultraviolet-visible spectrum corresponding to the colour degradation dye Disperse Blue 3 in phosphate buffer (1M) to pH 7.4 by potential cell 3V

Currently working on cathode and anode separated cells inside the ultraviolet-visible spectrophotometer using a salt bridge as a connection between the two compartments and using as cathode electrode graphene supported on FTO (fluorine doped tin oxide).

The authors are grateful to CONACYT and CONCYTEG for the economic support via the projects FOMIX GTO-2012-C04-195057

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Frequency-Dependent Electric Double Layer Capacitance

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The charging current, *I*, caused by frequency-dependent capacitance, *C*, is expressed by the time-derivative of the double layer charge, $q = CV$, i.e

$$I = \frac{\mathrm{d}\left(C(\omega)V(t)\right)}{\mathrm{d}t} = C(\omega)\frac{\mathrm{d}V(t)}{\mathrm{d}t} + V(t)\frac{\partial C(\omega)}{\partial \omega}\frac{\mathrm{d}\omega}{\mathrm{d}t} = i\omega CV - \omega^2\frac{\partial C(\omega)}{\partial \omega}V$$

The first and the second terms on the rhs are composed of an imaginary and a real part of the ac-impedance, respectively. Therefore the equivalent circuit should be a parallel combination of C ($=C_p$) and the resistance, $1/[\omega^2\partial C/\partial\omega]$ ($= R_p$). Ac impedance was obtained at two platinum wires with common length to evaluate C_p and R_p for four kinds of halides and their concentrations. C_p–values decrease linearly with $\log f$ in aqueous solution as well as 12 organic solvents, regardless ionic concentrations (Fig. 1). R_p was inversely proportional to f (slope -1 in Fig. 2), which is consistent with the linearity of C_p with $\log f$ through the definition of R_p. Since R_p was inversely proportional to the electrode area, it is a double layer resistance. It is not a real resistance but an apparent one observed through the frequency-depence of C_p. The present concept can demonstrate well-known linear variations of Nyquist plots, as in constant phase elements.

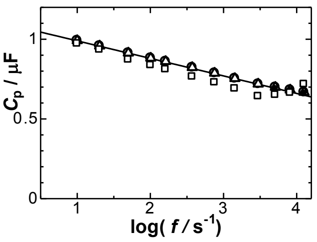

Fig. 1. Variations of the parallel capacitances with log(*f*) for (o) 2, (Δ) 0.5, (•) 0.1 and (□) 0.01 M KCl.

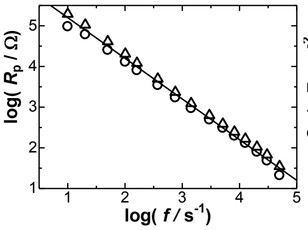

Fig. 2. Variations of the parallel resistance with frequency on the logarithmic scale for (o) 0.5 M KF and (Δ) 0.5 M KCl.

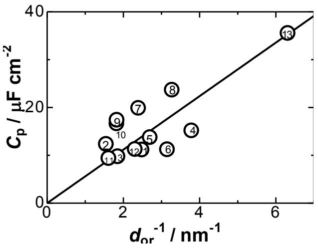

Fig. 3. Variation of the capacitance with the inverse of molecular diameter obtained from 13 solvent molecules.

Values of C_p had no systematic relation with diameter of solvent molecules determined by molar volume, dipole moments, boiling points, or viscosity, but had inversely proportional to the molecular lengths along the dipoles (Fig. 3). This relation suggests the presence of a satutation of dielectic constant, 6, common to 13 solvents. The dielectric satutation can be explained quantitatively in terms of the orientation of solvents, which is caused by not only the elcetric field but also image force of the dipole charge against the electrode. It is demonstrated by modification of Debye's statistical mechanics.

Donor-Acceptor Thiophene Copolymer with Pendant Fulleropyrrolidine Moieties

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A composites containing the π-conjugated polymers as electron donors and fullerene derivatives as electron acceptors were found to be one of the most promising materials for photovoltaic devices. However, integration of C_{60} units to the π-conjugated polymer remains still a challenge. One of the main problems of this systems is a control of the phase separation between the conjugated polymer and the fullerene derivative. Although synthesis of several polythiophene/fullerene composites by electrochemical methods have been already reported, the starting compounds included rather complex thiophene derivatized fullerenes or/and the resultant mateials contained relatively low amount of C_{60}.

Herein, we report advantageous electrochemical copolymerization of simple thiophene (Th) with thiophene-substituted fulleropyrrolidine (C_{60}-ThFP) that allowed obtaining well defined electroconducting films on Pt electrode, with high content of pendant fullerene moieties along polythiophene chains.

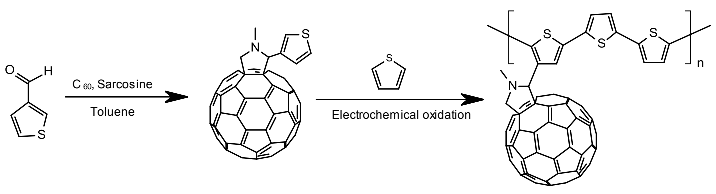

Fig. 1. A scheme of synthesis of Th - C_{60}-ThFP copolymer on Pt electrode

Electropolymerization was carried out at constant potential from the solution of both monomers in CH_2Cl_2. The cyclic voltammograms of the resultant film formed on the electrode have indicated the redox behavior in p-doping range typical of polythiophenes and sequential reversible redox waves characteristic of C_{60} derivatives in the range of negative potentials (from -0.2 to -2.2 V) [1].

Copolymerization of thiophene and C_{60}-ThFP was confirmed by FTIR spectra, and X-ray photoelectron spectroscopy. Atomic percent of the components obtained from XPS spectra of copolymer indicated that the ratio of C_{60}-ThFP and unsubstituted thiophene rings in the electrodeposited film is approximately 1:2.

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Capacitive Deionization: An Electrochemical Technique to Store Energy and Treat Water

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Capacitive Deionization (CDI) is a technology to deionize water by applying an electrical potential difference over two porous carbon electrodes. Ions are removed from the water and are stored in the polarized electrodes. While removing these ions, one actually stores capacitive energy (the same as charging and discharging an electrochemical double layer capacitor [1] (see Fig. 1)). If one recovers this energy efficiently during a regeneration step, this process likely consumes less power than any competing technology (distillation, reverse osmosis and electrodialysis)[2].

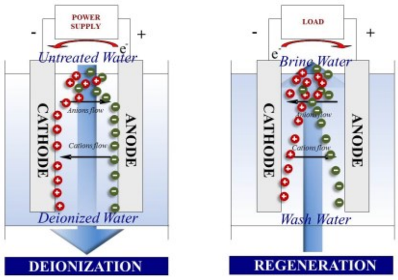

Figure 1. Capacitive Deionization showing deionization and regeneration steps.

We see that the common assumption proposes that the main problem in CDI may be the ions adsorption capability of the electrode material during charging [3][4]. In fact, desorption processes may be even more problematic, in energy efficiency terms, since experiences diffusional difficulties when submitted to relatively high current [5].

Today, CDI is mainly used for the desalination of water with a low or moderate salt concentration. This work reviews operational methods for treating water to do the CDI being considered as an energy-efficient technology for brackish water desalination.

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Tuning of solid state properties of Al-Ta mixed oxides

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Anodic oxides on tantalum and aluminium have been studied in the last decades for their possible application in electrolytic capacitors and in corrosion protection of steel (1-3). Mixed aluminium-tantalum oxides appear very promising dielectrics for electrolytic capacitors or integrated circuit, owing to the expected higher values of dielectric permittivity with respect to pure Al_2O_3, provided that an improving in leakage current with respect to tantalum oxide can be obtained (1-2). Atomic layer deposited $Al_xTa_yO_z$ mixture coatings are grown on steel for corrosion protection. In comparison to single-layer and nano-laminate ALD Al_2O_3 and Ta_2O_5 coatings, all mixtures are found to have better protective properties (3).

In this frame we have started an extensive investigation on the characterization of anodic oxides grown on magnetron sputtered Al-Ta alloys covering all the range of composition. More specifically, in this work we have prepared Al-Ta mixed oxides of different thickness by anodizing the alloys to different formation voltages in slightly alkaline solutions, where both Al_2O_3 and Ta_2O_5 are thermodynamically stable. A photoelectrochemical investigation was performed in order to estimate the band gap, E_g, and flat band potential, U_{FB}, of the oxide as a function of the growing conditions. The dependence of E_g on the oxide composition has been rationalized in the frame of the semi-empirical correlation between the electronegativity of the oxides' constituents and the band gap previously proposed in ref. (4).

Differential admittance and electrochemical impedance measurements were also carried out for some selected composition (including pure Al_2O_3 and Ta_2O_5) to get information on their dielectric properties. The dependence of both the components of the admittance on the electrode potential and on the frequency of the ac signal suggests that all the films show a behaviour typical of amorphous insulating materials. The dielectric constant resulted to increase monotonically from the value estimated for Al_2O_3 to that estimated for Ta_2O_5.

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Ultrafast cathode and anode materials for high energy and high power asymmetric-hybrid supercapacitors

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Asymmetric supercapacitors are very promising concept for increasing the energy density in comparison to a classical capacitor system. However, an asymmetric system which employs a pure activated carbon electrode on one side and a pure Li-insertion material on the other side still suffer of energy and power limitations in comparison of the pure battery and capacitor systems. The energy is limited by the activated carbon electrode and the power is limited by the Li-insertion electrode. With this work, composites cathode and anode have been optimized in terms of power and energy. A developed cathode material based on $Li_3V_{1.95}Ni_{0.05}(PO_4)_3$ (LVNP) posses very high capacity retention with 94 mAh/g at 100C. This material has been firstly coupled with an activated carbon anode in an asymmetric configuration. However, in this asymmetric capacitor the activated carbon is still limiting the capacity of the whole system. The challenge is to use a bi-material anode based on Activated Carbon (AC) and $Li_4Ti_5O_{12}$ (LTO). The optimum composition LTO:AC has been found to be 50:50 (Fig.1a). One can observe from Fig.1b that the capacity of the composite LTO-AC at 100C is two times higher then the pure AC and is approaching the capacity of the LVNP cathode material (which facilitates the electrodes balancing). The rate capabilities and the relatively high capacities of these electrodes are high enough for developing an advanced asymmetric-hybrid supercapacitor.

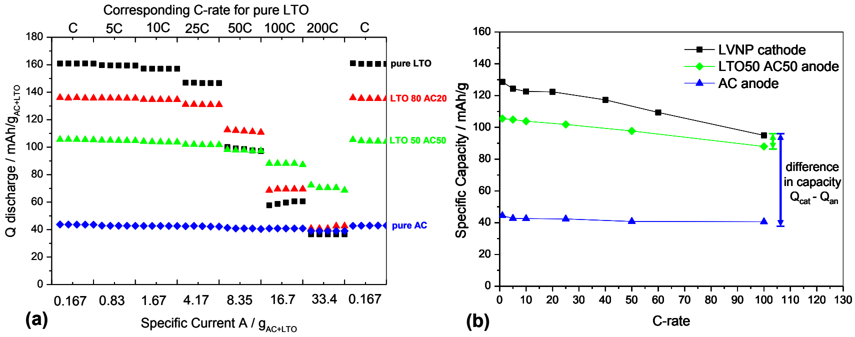

Fig.1 – a) discharge capacities of different composites anodes at various C-rates (charging using CC-CV protocol); b) rate capabilities of LVNP cathode, LTO50AC50 and pure AC anodes. Electrolyte: 1M $LiPF_6$ in EC:DMC (1:1)

Acknowledgements
Financial support from the German Federal Ministry of Education and Research (BMBF) under the grant 03EK3021 is gratefully acknowledged. The authors wish also to thank Clariant for providing the $Li_4Ti_5O_{12}$ and HayCarb for providing the activated carbon.

Abatement of Acid Orange 7 in water by different electrochemical approaches

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Very large amounts of synthetic dyes are discharged in the environment from industrial effluents [1]. Due to their large-scale production and extensive application, synthetic dyes can cause considerable nonaesthetic pollution and are serious health-risk factors [2]. Dyes are commonly classified from their chromophore group. The majority of these compounds consumed at industrial scale are azo (–N=N–) derivatives that represent more than 50% of the all dyes used in textile industries, although antraquinone, indigoide, triphenylmethyl, xanthene, sulphur and phtalocyanine derivatives are frequently utilized [3].

Since dyes usually present high stability under sunlight and resistance to microbial attack and temperature, most of these compounds are not degradable in conventional wastewater treatment plants. The research of powerful and practical treatments to decolorize and degrade dyeing wastewaters to decrease their environmental impact has then attracted increasing interest over the past two decades. Electrochemical methods are considered to be among the more efficient Advanced Oxidation Processes (AOPs) for the removal of dyes [2]. The main electrochemical procedures utilized for the remediation of dyestuffs wastewaters are electrocoagulation (EC), direct electrochemical oxidation (EO) with different anodes, indirect electro-oxidation with active chlorine (IOAC) and Electro-Fenton (EF) [2]. The azo dye Acid Orange 7 (AO7), also called Orange II, was often chosen as model compound to evaluate promising approaches because, being a simple molecule, it is very useful as test and since it is widely used in paperboard industries, for coloration, and in wool textile dyeing. In our lab, the electrochemical abatement of AO7 was carried by a large variety of electrochemical processes including direct anodic oxidation, electro-Fenton, oxidation by electrogenerated active chlorine and coupled processes and using very different devices such as conventional lab cells, microfluidic reactors, reverse electrodialysis cells and microbial fuel cells. Main results achieved during this investigation were here reported.

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Studies on the Zn-Ce and Zn-Br_2 redox flow battery systems.

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Redox flow batteries (RFB) offer a potential solution to implementation of medium to large scale energy storage (10 kWh – 10 MWh) since they have the advantage of cost, flexibility, rapid response and safety over other alternatives such as the lithium ion and sodium-sulfur batteries. In this paper, two zinc-based RFB systems are reported on. The first is the zinc-cerium hybrid RFB which is one of the most promising redox flow battery systems due to its high open circuit cell voltage (E_{cell} = 2.4 V) and power to weight ratio. The second and also one of the oldest, is the zinc-bromine RFB system which has a theoretical cell voltage of 1.86 V. The investigation here examined the impact of operating parameters such as charging/discharge current density, electrolyte composition, flow velocity, temperature and the use of different carbon composite electrodes on the performance of these battery systems. For the Zn-Ce RFB, high zinc concentration on the catholyte (*viz.* 2.5 M in 1.5 M CH_3SO_3H) yielded energy efficiencies of ~64% at currents of 1 A over the temperature range 45°C – 60°C (Fig.1). Under these conditions, the duration of the charging cycles, from 10 min to 2 hours, had little impact on the energy efficiency.

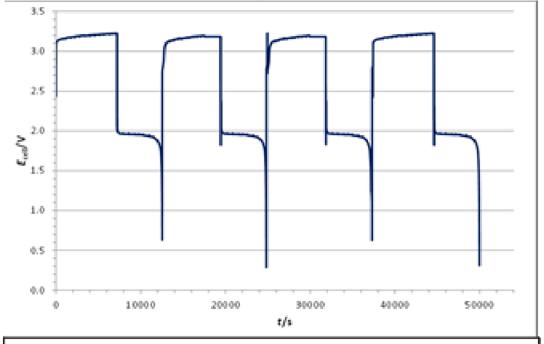

Fig. 1 Charge/discharge cycles for the Zn-Ce RFB at electrolyte temperature of 45°C.

For the Zn-Br_2 RFB, coulombic efficiencies >95% were obtained for a system containing 2 M $ZnBr_2$ in 4 M KCl employing carbon composite electrodes. In this system, a tetraalkylammonium bromide salt is usually added to the electrolyte on the positive side of the battery in order to reduce the loss of the electrogenerated Br_2 due to crossover and evaporation. In this part of the study, the impact of different concentrations of tertraethylammonium bromide on the electrode kinetics of the positive reaction and charging current density were examined using a rotating disc electrode. Here, the amount of adsorption of the bromine complex on the positive electrode as a function of solution velocity and charging current density could be evaluated during prolonged charge/discharge cycling of the RFB. The impact of this adsorbed layer on both voltage and coulombic efficiencies of the RFB was examined.

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How the pH and the Composition of Pyrrole Solutions influence the Templateless Electrogeneration of Polymer Nanostructures.

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Due to their potential applications, nanostructured conductive polymers have attracted growing attention. Up to now, conductive polymer nanostructures were primarily obtained using 'hard' templates (such as zeolites, track-etched polymeric membranes and alumina films containing anodically etched pores) or 'soft' templates (surfactant molecules that spontaneously organize into micelles when their concentration reaches a critical value or liquid-crystalline phases).

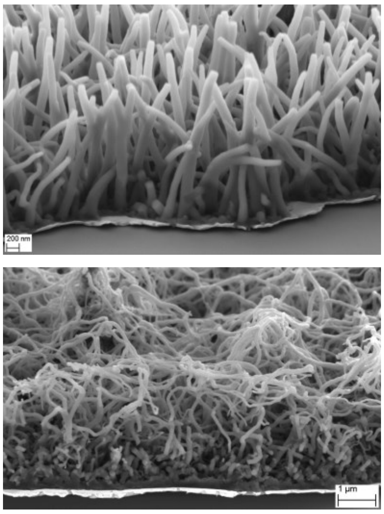

Figure 1: SEM images from PPy films electrogenerated in 1 mM or 10^{-2} M $LiClO_4$ + 0.2 M K_2HPO_4 + 0.15 M Py at 0.78 V/SCE.

In this presentation, it will be shown that the direct electrodeposition of either oriented nanowire array or nanofiber network can be achieved without using a template (Fig. 1). These structures are obtained by electrochemical oxidation of pyrrole in the presence of jointly weak-acid and non-acid anions. Notice that if only weak-acid anions are present in the electrolyte, an ultra thin (10 nm) film of overoxidized polypyrrole is deposited on the electrode [1,2]. The growth mechanism of the polypyrrole nanostructures will be discussed. Notably, it will be highlighted that the presence, at the electrode/solution interface, of weak-acid anions is essential and that, at the beginning of the process, water oxidation which leads to hydroxyl radicals and O_2 evolution should occur [3,4]. It will be shown that the variation of the interfacial pH, due to pyrrole oxidation, is the key point of the process. Some applications of these nanowires will be shown and discussed: gas sensors [5], biosensors and supercapacity.

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Efficient Growth of Anodic Films on Magnesium in Fluoride-containing Electrolytes

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Magnesium and its alloys are of practical importance because of their superior properties, including low density, high thermal conductivity, good workability and bio-compatibility. For the practical applications of magnesium and its alloys, surface treatments are needed to improve their corrosion resistance. Anodizing has often been used to protect magnesium alloys, but the mechanism of film growth on magnesium and its alloys is still not well understood. One of the reasons is the difficulty of uniform film formation on magnesium at high current efficiency. In the present study, anodic films are formed on magnesium at high current efficiency in fluoride-containing organic electrolyte, and through the characterization of the anodic films, the film growth process is discussed.

Magnetron-sputtered magnesium films were anodized at a constant current density of 10 A m^{-2} in ethylene glycol electrolyte containing 0.1 mol dm^{-3} NH_4F and 0.1 mol dm^{-3} H_2O. The anodizing voltage increased linearly with time at a rate of 1.0 V s^{-1} to ~350 V. Fig. 1 shows transmission electron micrograph of an ultramicrotomed section of the specimen anodized to 200 V. It is obvious that a barrier-type anodic film, 247 nm thick, with flat and parallel metal/film and film/electrolyte interfaces is developed. A selected area diffraction pattern disclosed that the anodic film contain crystalline MgF_2 phase. A broad band with relatively light appearance is present at the depth of two third of the film thickness, probably associated with an air-formed film, which was present before anodizing. Assuming the band as a maker layer, it is likely that the transport number of cations is larger than that of anions. From RBS analysis of the same specimen, it was found that the composition of the anodic film was $MgO_{0.1}F_{1.8}$ throughout the film thickness. The Pilling-Bedworth ratio was estimated to be 1.67, being greater than the unity. This may be one of the reasons for the film growth at high current efficiency.

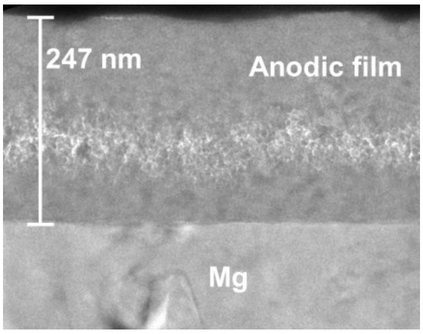

Fig. 1 TEM image of magnesium anodized to 200 V.

Three-Dimensional Reduced Graphene Oxide Network on Copper Foam as High-performance Supercapacitor Electrodes

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Electrochemically generated copper foam (Cuf) could serve as an effective template for fabrication of three-dimensional (3D) reduced graphene oxide (rGO) networks. Here we present a facile approach to preparation of 3D rGO network supported by Cuf as binder-free and current collector-integrated supercapacitor electrodes (3DrGO@Cuf) [1]. The method involves a two-step procedure, self-assembly of graphene oxide (GO) nanosheets on Cuf and electrochemical reduction of GO into rGO. We have systematically characterized as-synthesized materials using AFM, SEM and XRD to reveal their morphological and structural features. Electrochemical functional tests show that such electrodes are capable of delivering a specific capacitance as high as 623 F g^{-1} at a current density of 1 A g^{-1}. The observed high specific capacitance is most likely attributed to the unique porous structure consisting of highly connected nanoscale pores and high-density capacitive sites. 3DrGO@Cuf electrodes also exhibit considerably high stability over successive charge-discharge switching. For example, over 98 % specific capacitance is retained after 2000 cycles. To the best of our knowledge, we may have achieved the highest specific capacitance with 3DrGO@Cuf electrodes among reported pure 3D graphene materials to date (i.e. 3D graphene materials without doping additional capacitive species) [2, 3].

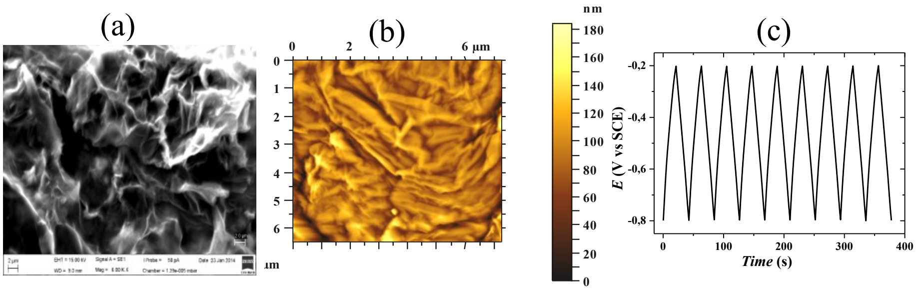

Fig. 1. (a) SEM and (b) AFM image of 3DrGO nanostructures on Cu foam. (c) Charge-discharge profile of 3DrGO@Cuf in 1M PBS (current density: 10 A g^{-1}).

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Does Electrochemistry have a role to play in the treatment of dilute solutions and micropollutants ?

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It is nowadays well known that micropollutants such as pharmaceuticals are widespread in the aquatic environment. The difficulty in removing these contaminants from waters comes from their resistance to biological degradation, their small size or their extreme dilution. Similarly, the treatment of industrial wastewater containing persistent organic pollutants has become one of the most urgent environmental problems. Electrochemical methods seem to be promising, in particular when using the boron doped diamond (BDD) anode. Since the 90s, many studies have demonstrated the high efficiency of this material for the complete mineralization of organics. The use of the BDD anode allows the production of hydroxyl radicals by water discharge; it does not require addition of any reagent. Although direct electrochemical oxidation possesses many advantages, its efficiency is limited for the treatment of dilute solutions because of mass-transfer limitations. To overcome these limitations an alternative approach is suggested: the coupling of electrochemistry with a pre-concentration step. To illustrate the input of the electrochemistry in the treatment of dilute solutions and micropollutants, two examples will be presented:

(i) The coupling of nanofiltration (NF) and electrochemical processes to treat pharmaceuticals in a real hospital wastewater: In this study the ciprofloxacin, Cip, has been chosen as model of antibiotic. The pre-concentration step is performed by cross-flow filtration on plane NF membrane. The filtration is conducted at a transmembrane presssure of 25 bars and a flow rate of 145 L/h, from 10 L of feed (doped pure water or membrane bioreactor permeate) until a volume reduction factor of 5. In these conditions, the rejection of CIP went beyond 99% in MBR permeate matrix. Then the NF concentrate was treated by electrochemical oxidation. Results have shown that BDD is very efficient to oxidize and mineralize the ciprofloxacin in aqueous solution: the removal of total organic carbon and chemical oxygen demand reached 97 % and 100% respectively for an electrical charge of 2.5 Ah/L.

(ii) The coupling of sawdust adsorption and electrochemical regeneration for the treatment of dilute methylene blue (MB) containing wastewater: The electrochemical oxidation of MB beforehand adsorbed onto sawdust leads simultaneously to their degradation and sawdust regeneration for the next adsorption. Multiple adsorption and regeneration cycles lead to an enhancement in adsorption capacity of the sawdust. As for example, after five cycles, the maximal adsorption capacity reaches 100 mg of methylene blue per gram of sawdust. The increase in adsorption capacity after electroregeneration can be explained by the modification of the surface chemistry of adsorbant which change the interaction affinity between adsorbates and adsorbents.

The aqueous all-copper Redox Flow Battery

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In this work we describe a novel Redox Flow Battery (RFB) chemistry based on aqueous solutions of copper salts. The batteries exploit the three redox states of copper when it is complexed by chloride ions. This results in the two redox reactions shown in equations 1 and 2.

Positive half-cell reaction: $Cu^+ \underset{\textit{Discharge}}{\overset{\textit{Charge}}{\rightleftarrows}} Cu^{2+} + e^-$ equation 1

Negative half-cell reaction: $Cu^+ + e^- \underset{\textit{Discharge}}{\overset{\textit{Charge}}{\rightleftarrows}} Cu^0$ equation 2

The facile kinetics of both electrode reactions, combined with high solubility, results in energy efficiencies and densities similar to those reported for vanadium systems. Initial studies to optimise operation of the all-copper system are reported and demonstrate the possibility to eliminate catalysts, simplify stack design and substitute commonly used separator materials, such as ion exchange membranes, with microporous separators. These modifications result in a significant cost reduction per kWh. Combined with the large availability of copper this promises to offer a genuine solution to the problem of storing large amounts of renewable energy.

We also illustrate how fundamental electrochemical techniques, such as the use of an RDE or impedance spectroscopy can be easily applied to gain rapid understanding of the limiting processes in each part of the battery system.

Real-Time In Situ AFM Study of the Templating Influence of Polymeric Sulfonic Acids on Aniline Electropolymerization

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Aniline electropolymerization in the presence of different polymeric acids is known to produce high-quality polyaniline (PANI) films with a complex of properties valuable for a wide range of practical applications: electrochromic “smart” windows, sensors, corrosion protection, etc. However, the influence of the polyacid conformation on the course of electrosynthesis and the properties of obtained films still is studied insufficiently. This report presents the results of real-time in situ AFM study of aniline electropolymerization on HOPG-electrode in the presence of polymeric sulfonic acids distinguished by the rigidity of polymer backbone. These are commercially available PAMPSA and PSSA, possessing flexible polymer backbone, as well as laboratory synthesized phthalamide-based polyacids possessing semi-rigid and rigid backbones.

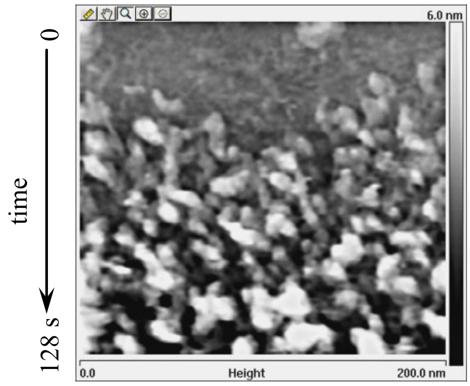

Fig. Real-time in situ AFM image taken during the initial stage of potentiostatic electrosynthesis of PANI at 0.65 V (vs. Ag/AgCl) in the presence of 0.05M PAMPSA Time scale is indicated left to the figure.

For the majority of polyacids a pronounced induction period of the aniline electropolymerization (manifests itself as bare HOPG surface in the upper part in the Fig.) is observed. This correlates well with the low synthesis current in this moment. The flexible-backbone polyacids, which are capable of adapting their conformation to the conformation of PANI, do not interfere with the formation of a vide variety of “curled” structures during the process (see Fig.). On the contrary, the rigid backbone polyacids (their macromolecules exist in the solution in a straight bar conformation) predetermine the conformation of PANI/polyacid interpolymer complex and, consequently, the shape of PANI “nuclei”. The “nuclei” in the presence of semi-rigid-backbone polyacids have some intermediate shape. The conclusions are also supported by the results of molecular modeling of the polyacds’ oligomers.

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High Frequency Vertically Oriented Graphene Nanosheet Electrical Double Layer Capacitors Synthesized from CH_4 and C_2H_2

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Symposium 6: Electrochemical Energy Conversion and Storage; Capacitors

The growth of vertically oriented graphene nanosheet (VOGN) thin films by radio frequency plasma enhanced chemical vapor deposition (RF PECVD) for electrical double layer capacitors is presented. The nanosheets are grown using an RF power of 1000 W on Ni foil substrates at temperatures between 550 and 850ºC using CH_4/H_2 or C_2H_2/H_2 feedstock. The growth proceeds initially by planar Volmer-Weber island impingement followed by vertical nanosheet growth controlled by sp2 bonding. In this temperature range, significant C dissolution into the Ni substrate was observed and resulted in complex plane plots with an ESR varying from 0.05 (CH_4) to 0.07 (C_2H_2) Ohms with absolutely no evidence of porous electrode behavior. The growth rate observed was found to be 70 nm/min using CH_4 and 190 nm/min using C_2H_2 and is approximately linear with time. The specific capacitance (geometric area) of symmetric parallel plate EDLC devices fabricated for films ~2 μm tall, was, approximately, 120 $\mu F/cm^2$ (1 kHz) using CH_4 and ~300 $\mu F/cm^2$ (1 kHz) using C_2H_2. The capacitance increased linearly with growth time with a slope of 0.5, suggesting an additional mechanism to area increase. Morphology deterioration with growth temperature was observed from a vertical sheet array to a more cauliflower like structure, as indicated by SEM and Raman D band to G band ratio. EIS data showed an increased specific capacitance up to 850ºC, presumably from increased molecular surface area and defect formation, but a corresponding reduction in frequency response. However, good frequency response (phase angle of -85º) at 120 Hz was observed for all growth temperature tested, suggesting that EDL capacitors fabricated by this technique are excellent for filtering applications.

Electrochemical Impedance Spectroscopy of a Carbon Xerogel GDE in the Li/O_2-System

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Symposium 5: Electrochemical Energy Conversion and Storage: Batteries

Gas diffusion electrodes (GDE) have attracted broad attention for different energy storage devices such as fuel cells or metal air cells. In case of aprotic Li/Air Cells one important question is how the formation of solid discharge product influences the electrochemical reactions at the GDE.

The most common active material used for the GDE is carbon because of its low cost and weight. Although it has been shown that the oxygen species formed in the cell may react with the carbon at high overpotentials [1] it can still be used under controlled conditions. Very versatile carbon materials are the Carbon Xerogels. They exhibit a large inner surface and pore volume. Therefore they are able to store large amounts of discharge products before clogging while having a high surface area for the reaction to take place.

Following the procedure by Lytle *et al.* [2] we synthesized Carbon Xerogels directly into a woven carbon paper to create ready-to-use electrodes without any binder. The electrochemical impedance spectroscopy was used to investigate the alteration of the Xerogel GDE during discharge in the Li/O_2-system. Besides the changes in the charge transfer resistance and the diffusion due to the formation of discharge product we report an inductive loop in the mid frequency area which disappears near the end of discharge. This behavior can be explained by the relaxation of an adsorbed intermediate species [3] at the carbon surface.

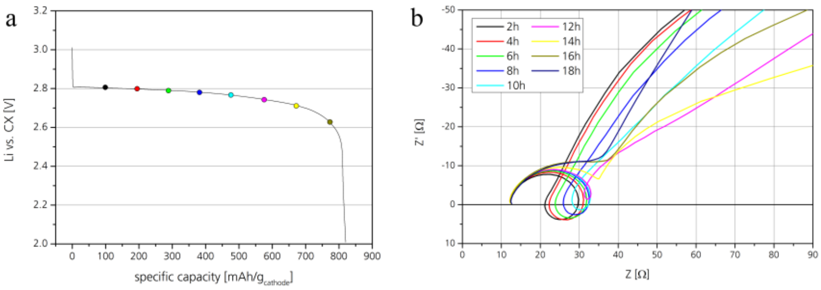

Figure 1. (a) Discharge curve and (b) Nyquist plot of the Carbon Xerogel GDE at different states of discharge

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Scaling up of electro-irradiated processes for the removal of persistent organic pollutants from treated wastewater

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Persistent Organic Pollutants (POPs) have been detected in the aquatic environment due to conventional treatment of wastewaters plants are not able to carry out an efficient removal of these compounds. Thus, recent researches are developing new technologies in order to solve this problem. In this context, Advanced Oxidation Processes (AOPs) and, specifically, Conductive Diamond Electrochemical Oxidation (CDEO) are considered by many authors as a good alternative to the treatment of these emerging pollutants from waters and wastewaters [1, 2]. Moreover, the efficiency of CDEO can be increased by coupling irradiated technologies such as light irradiation and/ or ultrasounds.

With this background, the goal of this work is to improve the efficiency of CDEO by coupling US and UV irradiation in the removal of metoprolol and progesterone (selected as model of β-blocker and hormone, respectively) from the effluents of municipal Wastewater Treatment Facilities (WWTF) and to scale up the electro-irradiated process. In a first stage, it has been study the influence of the initial concentration of pollutant and current density in bench scale experiments. After that, the scaling up of the process has been carried out in a pilot scale plant of 0.35 m^2 of anodic area. Bench scale tests show that CDEO is an able technology for obtain an efficient degradation of these compounds and that the combined use of photo and sono irradiation technologies allow increasing the efficiency due to they promote the activation of electrochemically generated reactive species and also mass transfer of pollutants to diamond electrodes [3, 4]. The present of chlorine in the effluent of WWTF discharges the use of high current densities to avoid the formation of chloro-species with high toxicity (chlorates). The scaling up of the process was successfully achieved.

Acknowledgements
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Electrochemically tunable plasmon resonance of gold nanoparticles functionalized by covalently grafted oligomers or by deposited conducting polymers

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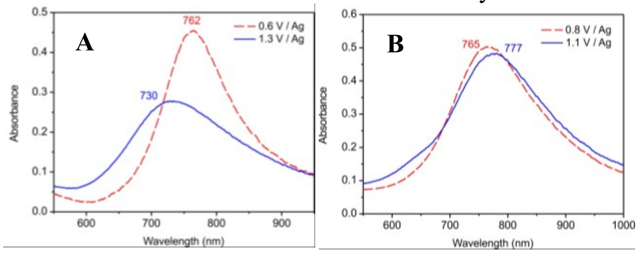
A large variety of nanometer-scale devices have been investigated in recent years because of the continuously increasing demand for ultimate miniaturization of electronic and photonic systems. Among them, devices based on gold nanoparticles (AuNPs) are well-known for their remarkable properties due to plasmonic effects.

In this context, several active plasmonic devices have been developed. In such systems, an external stimulus can reversibly tune the frequency and/or the amplitude of the plasmon resonance. Several external stimuli have already been employed, based on thermo-, pH-, photo- and redox- responsive layers of molecules surrounding NPs. For instance, we have previously reported electrochemical switching, using redox-sensitive layers based on electroactive conducting polymers such as PANI and PEDOT deposited onto AuNPs gratings [1]. Indeed, switches from the reduced non-conducting state and the oxidized conducting state of these conducting polymers lead to a change of the dielectric constant, leading to shifts of plasmon resonance.

In our recent works, we have firstly investigated the influence of the thickness of the surrounding layer of conducting polymer onto the plasmon resonance of AuNPs. We have then compared the effect of deposited conducting polymers with the effect of covalently grafted electroactive oligomers, in order to investigate the influence of the nature of the interaction of the surrounded layer onto AuNPs [2].



Extinction spectra of AuNPs gratings overcoated with polythiophene (A) and bisthienylbenzene (BTB, B) in their reduced blocking state and in their oxidized conducting state.

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Aluminium alloys anodizing: effect of the composition and the microstructure

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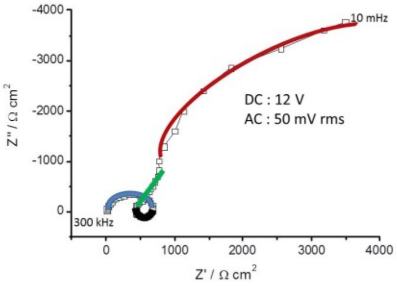
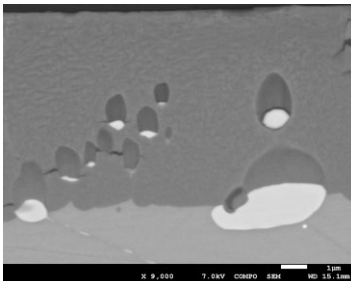
The protection against corrosion of aluminium alloys 2XXX and 7XXX, extensively used in the aircraft industry, is generally achieved by an anodizing process performed in H_2SO_4 (200 g L^{-1}) around 15V. Coatings formed in these conditions consist of a thin intern barrier layer (5 to 20 nm) surmounted by a nanoporous columnar structure (pore diameter 10 to 20 nm). This study focuses on the growth of the anodized layer on 2024, 2618 and 7175 alloys.

In-situ electrochemical measurements, especially electrochemical impedance spectroscopy, were carried out during the anodizing process in order to finely characterize the phenomena involved in the electrochemical conversion of the surface. The obtained results reveal that both the electrical parameters of the process (applied voltage) and the metallurgical parameters (composition and microstructure of the alloy) influence the growth and the properties of the anodized layers.



Impedance spectra recorded during the anodizing of a 2024 alloy



SEM micrography oft he anodized layer on 2618 alloy

On the other hand, post-treatment cross-section observations show that microscopic defaults are induced by the presence of intermetallic phases in these aluminium alloys. Indeed, many cracks, holes, heterogeneities or changings in the oxide density are present in the anodized layers of these alloys.

The corrosion behaviour of the coated alloys, investigated by stationary methods and electrochemical impedance spectroscopy in NaCl 35g L^{-1}, is greatly influenced by the morphology of the anodized layer and therefore highly depends on the composition and microstructure of the alloy.

Tuning Ionic Interaction For Improving Selectivity

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As one kind of intermolecular interaction, ionic interaction is the most popular phenomenon in nature and plays an important role in the biosystems. The main interaction force between ions (i.e., interionic interaction) includes coulombic force, ionic-hydrogen interaction, cation-π and so on. By rationally designing the structure of ions and tuning the interactions between ions, various kinds of excellent fluorescent and electrochemical sensors have so far been developed. Our recent focus has been on the improvement of selectivity of some recognition units (e.g., enzymes and aptamers) by rationally designing and tuning the inter-ionic interactions.

We synthesized ionic compounds with an enzyme cofactor as the anion and used them to form a bucky gel with carbon nanotubes, in which methylene green electrocatalyst was stably encapsulated for the oxidation of nicotinamide adenine dinucleotide. With such kind of rationally designed and one-step-formed multifunctional gel as the electronic transducer, we simply developed the dehydrogenase-based electrochemical biosensors by polishing the electrodes onto the gel followed by enzyme immobilization. This capability greatly simplifies the biosensor fabrication, prolongs the stability of the biosensors, and, more remarkably, minimizes the biosensor-to-biosensor deviation.

More recently, we have developed the ferricyanide-based second-generation biosensors for selective in vivo measurements of neurochemicals based on regulation of redox potential of ferricyanide mediator by carefully controlling the different adsorption ability of ferricyanide and ferrocyanide onto electrode surface. To realize the negative shift of the redox potential of $Fe(CN)_6^{3-/4-}$, imidazolium-based polymer (Pim) was synthesized and used as a matrix for surface adsorption of $Fe(CN)_6^{3-/4-}$ due to its stronger interaction with $Fe(CN)_6^{3-}$ than with $Fe(CN)_6^{4-}$. The different adsorption ability of $Fe(CN)_6^{3-}$ and $Fe(CN)_6^{4-}$ onto electrodes modified with a composite of Pim and multiwalled carbon nanotubes eventually enables the stable surface adsorption of both species to generate integrated biosensors and, more importantly, leads to a negative shift of the redox potential of the surface-confined redox mediator. This study essentially paves a new avenue to developing electrochemical biosensors effectively for in vivo neurochemical measurements.

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Advanced Nanomaterials for Oxygen Reduction Process

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Significant progress has been achieved in the search of catalysts based on cluster-like mono-, bi-metallic and chalcogenides. Several strategies have been devised, e.g., alloying platinum with 3*d* transition metals and rare earth element (M = Ti, Co, Ni, Fe, Y, Gd, etc...); second using composites materials as substrates to modify the electronic properties of the catalytic center, and third, developing non-precious metal centers. These approaches are not only intended to reduce costs, but to lower precious metal loadings to maintain a higher oxygen reduction activity than that of pure Pt in acidic media.

Recent electrocatalytic studies from our group [1-7], revealed an interaction between Pt nanoparticles (NPs) and a substrate leading to a change of the electronic properties of the metal center. Such an interaction between carbon and Pt NPs can be electrochemically probed by examining the desorption energy of an adsorbed CO monolayer. All these aspects, for improved electrocatalyst materials, constitute indeed the core of electrochemical energy conversion devices, as for example in microfluidic systems, dominated by the optimization of kinetic activity, selectivity of catalysts and efficiency of whole cells.

Acknowledgements: The author thanks his co-authors. This work was partially supported by the European Union’s Seventh Framework Programme (FP7/2007-2013) for the Fuel Cell and Hydrogen Joint Technology Initiative under grant agreement n◦303492 CathCat.

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GOLD NANOPARTICULES AS PLATFORMS FOR ELECTRICAL CONNECTIONS OF BIOMOLECULES

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H_2/O_2 fuel cells based on renewable resources are attractive devices able to take up the energy challenges launched by fossil fuel exhaustion. In this "green" device, hydrogen would be produced from biomass and biocatalysts would replace chemical catalysts. To implement these biofuel cells robust enzymes are required. One way is to search in the biodiversity bacteria which have evolved in extreme environments, and in which enzymes have set the molecular basis for resistances. A hyperthermophile [NiFe] hydrogenase was previously identified from an ancestral bacterium able to oxidize H_2 on a large range of temperature in the presence of O_2 and CO.[1] Associated to a thermostable bilirubin oxidase for oxygen reduction, a H_2/O_2 biofuel cell was designed. This device delivered up to 1.5 $mW.cm^{-2}$ over a large range of temperature from 30 to 80 °C.[2] However, current densities must be enhanced in order to envision the applications of this biotechnological device. Moreover, this biofuel cell showed a weak stability with time, losing 60% of its performances over 24h. The reasons for the decrease in current densities are still misunderstood.

To address these issues we propose in this work to control the immobilization of the enzymes using gold nanoparticles (NP) as conductive platforms. The similar size between these nanoelements and enzymes is expected to facilitate their electronic connection, while allowing the study of the biohybrid through coupling methods, such as electrochemistry, Surface Plamon Resonance, Quartz Crystal Microbalance or Electron Paramegnetic Resonance. We will first present a detailed characterization of the Au NPs by Dynamic Light Scattering, UV-Visible spectroscopy, microscopies and electrochemistry. Different chemical modifications will be presented that yield electrode nanostructuration. The electrical connection between these Au NPs and various redox proteins will be then analyzed. Special attention will be focused on proteins and enzymes identified in extremophilic bacteria, which present many resistances to classical inhibitors or denaturating agents (T°, pH, CO, sulfides, O_2…). Finally, the connection of the enzymes, hydrogenase, bilirubin oxidase and laccase, suitable as biocatalysts in H_2/O_2 biofuel cells will be discussed.

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Wiring redox enzymes in functionalized carbon nanotube matrixes for high power Glucose-Oxygen Biofuel cells

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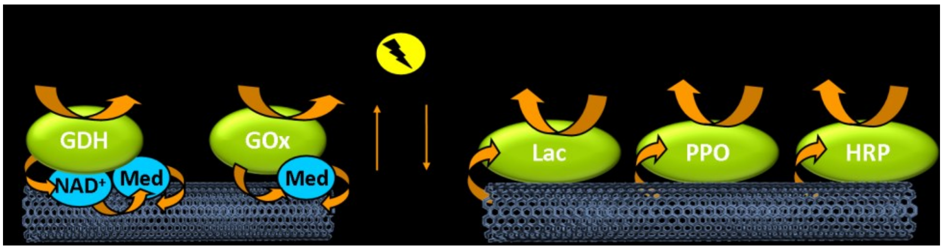
Biofuel cell (BFC) conception involves the use of redox enzymes or micro organisms as biocatalyst for energy conversion. In glucose-O_2 BFC, the conversion of chemical energy to electrical power relies on the bioelectrocatalytic oxidation of glucose at the anode and the reduction of O_2 at the cathode. Both glucose and O_2 being both present in biological fluids, these BFCs represent a good candidate for energy supply of implantable biomedical devices. Carbon nanotubes (CNT) matrix is one privileged electrode material, due to their ability to easily connect a broad variety of protein on high specific surfaces.

At the bioanode, we have especially investigated the indirect wiring of glucose oxidase (GOx)[1] and glucose dehydrogenase (GDH), either through the use of insoluble electron carrier incorporated in 3D CNT matrixes or by entrapment in electrogenerated metallopolymers.

At the biocathode, in addition to the study of direct electron transfer of laccases (Lac) immobilized in CNT matrix, we have investigated the direct wiring of polyphenol oxidases[2] (PPO) and horseradish peroxidase (HRP). We especially improved enzyme direct wiring by non covalent functionalization of CNTs with boronic acid derivatives[3].



Scheme: Schematic representation of an enzymatic glucose Biofuel Cell with a mediated electron transfer et the anode (left) and direct electron transfer at the cathode (right)

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Spectroelectrochemical Investigation of Glucose Oxidase at Different pH

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Glucose oxidase (GOx) is one of the most frequently applied enzymes in bioelectrochemistry and is often referred to as a model enzyme for bioelectrochemical devices. Nevertheless, the published redox potentials for GOx differ significantly[1-3] and thus, the electrochemical properties are still under debate.

We performed UV/Vis spectroelectrochemical measurements of GOx at different pH using a homemade miniaturized spectroelectrochemical cell as described by Bistolas et al.[4] (inner volume > 100 µL) which is additionally computer controlled by a LabView® routine. Using this setup, consistent and repeatable measurements of the GOx redox potential could be made over the entire pH range of investigation. Optimized equilibration times between changes of the redox potentials and careful choice of the electron transfer mediators facilitated the attainment of the electrochemical equilibrium. Under these conditions, the flavin adenine dinucleotide (FAD) cofactor in GOx directly changed from the fully oxidized to the fully reduced state, whereas the neutral flavin semiquinone radical could be observed under non-equilibrium conditions.

The GOx redox potentials determined between pH 4.5 and pH 8.5 will be presented and details of the GOx reduction mechanism will be discussed. At acidic pH the GOx reduction mechanism depends on the presence of chloride ions.

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Carbon Corrosion in PEMFCs: From Model Experiments to MEAs Operated in Real-Life Conditions

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Proton-exchange membrane fuel cells (PEMFC) electrodes are composed of Pt nanocatalysts supported on a high surface area carbon support (Pt/HSAC). Due to high water content, the high oxygen concentration and the high electrochemical potential, the porous carbon support is unstable at the cathode. Harsh accelerated stress tests (ASTs) are currently used to reproduce the excursion to high potential experienced during start/stop or fuel starvation events. However, these ASTs are poorly informative in a mechanistic viewpoint, and our knowledge of the carbon oxidation reaction (COR) mechanisms in stationary PEMFC operating conditions remains elusive.

In this study, Pt/HSAC electrocatalysts were subjected to 96 h polarization at different electrode potentials ranging from 0.4 V to 1.4 V *vs*. RHE at T = 330 K. Using Raman spectroscopy, we were able to show that the COR is strongly structure-sensitive and proceeds more rapidly on amorphous carbon domains, and defective graphite crystallites than on graphitic domains. The coverage with carbon surface oxides was investigated with X-ray photoelectron spectroscopy. A parallel with real-life membrane electrode assemblies (MEAs) operated during 12,860h discloses a perfect agreement between model (liquid electrolyte) and real PEMFC (solid electrolyte) tests, and strengthen the structural dependency of the COR mechanism.

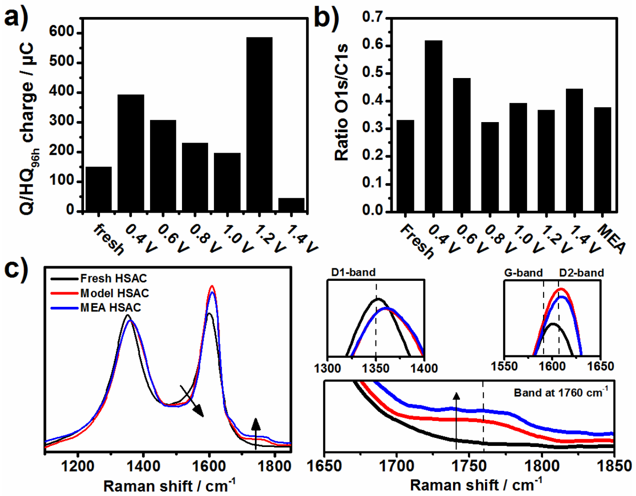

Figure 1 – Variation of the a) quinone – hydroquinone (Q/HQ) electrical charge and b) O1s/C1s atomic ratio as a function of the electrode potential. c) Normalized Raman spectra of the fresh/aged Pt/HSAC electrocatalysts.

A novel bi-enzymatic cathode made with BODs from *Bacillus pumilus* and *Magnaporthe oryzae*

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Implantable medical devices requiring low-power density, may be powered in the near future by enzymatic miniature membrane-less glucose/O_2 Biofuel Cells (BFCs), [1, 2, 3]. Even tough, their performances are continuously improving, the power output and lifetime are still not sufficient for direct applications, especially because of the cathode, the limiting part of the cell.

Bilirubin oxidases (BODs) have been particularly used in these BFCs for the elaboration of O_2 reducing cathodes. Firstly used for the detection of bilirubin, this sub class of the Multicopper oxidases family was discovered in 1981 by Tanaka and Murao (Murao and Tanaka, 1981). These BODs have attracted a lot of attention for the reduction of O_2, since 2001 and the pioneering work of Tsujimura, because they show high activity at neutral pH, high tolerance towards NaCl and unlike laccases, there are stable in physiological conditions (20 mM phosphate buffer, pH 7.4, 0.14 M NaCl, 37 °C).

BOD cathodes made with new species such as *Bacillus pumilus* and *Magnaporthe oryzae* display improved performances compared to the best BOD used until now (from *Trachyderma tsunodae*) [4]. While BOD from *Magnaporthe oryzae* operates at higher potential with higher current in absence or presence of moderate concentration of chloride [5, 6]; the one from *Bacillus pumilus* displays higher stability towards NaCl, temperature and urate [7, 8].

Here we will report a bi-enzymatic electrode made with those two BODs for the elaboration of a novel and promising bi-enzymatic O_2 reducing cathode. This cathode operates at an intermediate potential, with a higher current and higher stability toward chloride and temperature than an electrode only made with *Magnaporthe oryzae*.

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Hollow Graphitic Spheres: beyond conventional carbon supports for efficient PEM fuel cell catalysts

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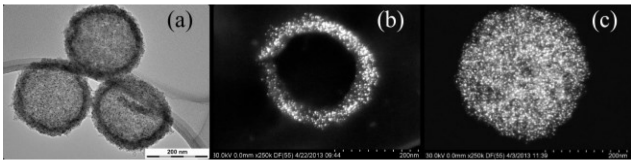
The core of a typical Proton Exchange Membrane Fuel Cell (PEMFC) cathode electrode is essentially composed of a metal catalyst and a conductive carbon support.
Great improvements have been achieved in the last decades for each of them, gaining control on the structure, composition and shape of metallic particles, as well as developing high surface area carbons [1]. However, often, metal catalyst and support are still considered as two separate and independent elements.
Here we present a radically different synthetic and operative approach, where the metal nanoparticles and the support are efficiently combined together in one electrocatalytic system. To achieve that, we developed a unique mesoporous carbon nanostructure, made of hollow graphitic spheres (HGS[2]), that was exploited both for its crucial function during the synthesis of bimetallic catalyst – when it acts as physical confinement in what we defined as confined-space alloying of Pt-based catalyst – and for its active role in improving the overall stability of the catalyst layer.



(a) PtNi nanoparticles in hollow graphitic spheres (HGS); microtome cross-section TEM images of hollow (b) and full (c) graphitic spheres with Pt nanoparticles encapsulated in the mesoporous framework

This sintering-resistant character of HGS was found decisive to achieve the alloying of two metals (Pt and Ni) at high temperature (850°C) without losing valuable active surface area (ECSA of 110 m^2/g_{Pt}). The resulting catalyst shows a remarkable mass activity (1.0 A/g_{Pt}, significantly exceeding the 2020 US-DoE targets) which is retained, thanks to the beneficial pore-confinement effect provided by the support, up to 10000 cycles (0.4-1V, $1Vs^{-1}$). In order to clarify the influence of the HGS morphology, especially its spherical shape and hollow-shell structure, on the catalyst layer stability during single-cell degradation tests, we also studied the performance of comparable carbon nanostructures (full and hollow spheres, for instance), which share all the features of the HGS system at the nano-scale level, but have different textural properties.

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Porous silicon/cytochrome c biosensor for the detection of the superoxide anion

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An electrochemical biosensor based on cytochrome c immobilized onto porous silicon (*Cyt c*/pSi) for the detection of superoxide anion was developed. *Cyt c* (MW 12,400) is primarily known as an electron carrying protein [1]. When *Cyt c* is used as a modifier of electrodes, different kind of nanomaterials have been employed as “tiny conducting wires” to efficiently achieve the direct electron transfer between the protein and the electrode surface [2]. In the present work, pSi has been used as a substrate for the immobilization of *Cyt c*. This nanomaterial presents several advantages such as enhanced surface area (400-800 m^2/g), and biocompatibility [3]. In this work the strategy to immobilize the protein used was based on the covalent binding between *Cyt c* and APTES/GTA chemically modified pSi microcavity structure electrode, in order to preserve its enzymatic activity. The pSi was synthesized by electrochemical oxidation of crystalline silicon wafer (cSiw), and characterized by specular reflectance UV-Vis spectroscopy and HR-SEM [4]. The changes in electrical impedance upon pSi samples allowed us to know the approximate surface area of the microcavities. The presence of the protein on pSi was confirmed by FTIR and its redox activity by cyclic voltammetry. The biosensor was used in superoxide radical´s detection by electrochemical techniques. The radical was generated by the redox reaction between Xanthine and O_2. The sensitivity of the biosensor was compared between the pSi microcavity and flat electrode (cSiw) in the presence of the anion superoxide in solution.

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Electrogenerated Ru(II)-metallopolymer with intercalating properties for HIV DNA photoelectrochemical detection

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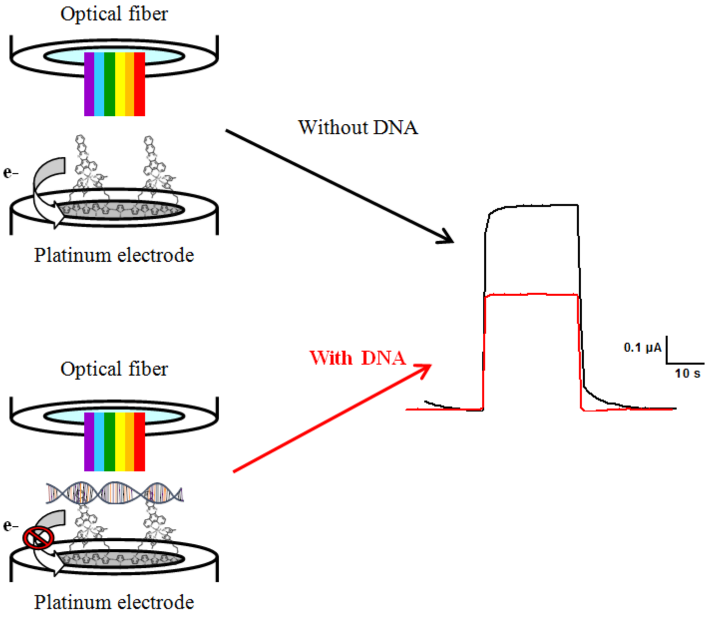
Photoelectrochemical biosensors are able to exploit optical and electrochemical properties for DNA detection[1]. A new design of photo-active functionalized electrodes was elaborated for the detection of double stranded DNA target. An original multifunctional metallo-polymer ($[Ru(bpy\text{-}pyrrole)_2(dppn)]^{2+}$) (bpy = bpy2-2'-bipyridine, dppn = benzo[i]dipyrido-[3,2-a:2'.3'-c]phenazine) complex was synthesized and characterized. The metallo-polymer layer was formed on platinum electrodes by oxidative electropolymerization of pyrrole groups. Thanks to the photoelectrochemical properties of the Ru(II) complex[2] and the intercalating abilities of the dppn ligand [3], the electrogenerated polymer can interact with a double-strand (Human Immunodeficiency Virus) HIV-DNA target which is photoelectrochemically–detected after visible irradiation. The photocurrent generation was correlated to the concentration of double-stranded DNA which interacts with the metallointercalator polymer. Low detection limits of 2.5fmol L^{-1} were measured, demonstrating excellent sensitivity of the electrodes towards duplex DNA detection.



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High performance, low Pt-on-carbon nanofibers catalyst loading MEAs for low temperature PEMFC

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One factor that still limits the large-scale commercialization of polymer electrolyte membrane fuel cells (PEMFC) is the durability of their components. Specifically, catalyst degradation in the cathode of the membrane electrode assemblies (MEAs) has a great influence on the performance (*V-j*) and durability of the fuel cell, limiting its useful life below what is considered acceptable for practical automotive and stationary applications. In this context, new Pt based electrocatalysts have been synthesized using carbon nanotubes, aerogels, nanofibers, graphene, etc. [1] as catalyst support to replace the typically used carbon blacks and active carbons, more prone to corrosion. The structure and composition of these new materials contribute to increase the corrosion resistance and the overall durability of the catalyst, but the textural and morphological properties of some of them can adversely affect the fuel cell performance. Therefore, it is necessary to develop catalyst supports that ultimately increase the fuel cell durability, without having any detrimental effect on its performance.

Carbon nanofibers are a specific family of carbons formed from the interaction of finely divided metal catalyst particles, such as Ni, Co, Fe, etc. with carbon containing gases at elevated temperatures, which have shown good resistance to corrosion in fuel cell environment [2]. Furthermore, it is possible to adjust the deposition of and interaction with the supported metal nanoparticles [3]. In this work, Pt-on-carbon nanofibers have been synthesized and utilized as catalyst in MEAs for low temperature PEMFC. Durability and performance tests have been carried out in situ, emphasizing the corrosion resistance of the catalyst support in the fuel cell cathode. Promising results show that when the total Pt content in the MEA decreases from 0.80 to 0.25 mg cm^{-2} the *j* remains practically constant at around 1.0 A cm^{-2} (0.60 V) at 80 °C. In addition, the application of an accelerated degradation test (1.20 V at 80 °C) to the cathode of a MEA with total Pt loading of 0.25 mg cm^{-2} reveals a decrease of the electrochemically active surface (ECSA) of around 35 % after 200 h of testing, whereas in the case of a MEA containing Pt/Vulcan®XC72R in the cathode, the ECSA decreases roughly 90 % after 24 h of testing.

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Comparative Study of Planar vs. Si Nanowire Electrode for Bacterial Cells Sensing Using Electrochemical Impedance Spectroscopy

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Electrochemical Impedance Spectroscopy (EIS) technique is one of the preferable methods in biological detection since it offers label-free, real time, and non-invasive detection. It can also identify the electrical properties of the biological reactions, and it can be integrated into miniature structures [1, 2]. Moreover, EIS technique can obtain quantitative regarding the number of cell in solution[3].

The electrode geometry is an important factor for the devices sensitivity; different structures are used today, such as planar electrodes, octagonal ring electrodes, multi-islands electrodes, ring array electrodes, and 3-D electrodes. Another factor is the material of the electrode. Few of the common electrodes materials are carbon (C), indium tin oxide (ITO), and gold (Au), and the most common material is silicon (Si) [4-6].

Si Nanowires (SiNWs) are promising materials in the field of biosensors because of i. the expected enhanced sensitivity due to their high surface/volume ratios, ii the possibility to functionalize them with biomolecules and iii. integration with common silicon technology and flexible electronics. Despite this, there are no EIS studies using electrodes with SiNWs for biological sensing.

This work presents a comparative study of planar vs. SiNWs electrodes for biological sensing using EIS technique. We will focus on detecting bacterial cells by measuring samples dipped into biological solution, e.g. Phosphate Buffer Saline (PBS) contains bacterial cells.

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Localized Nanoscale Imaging of Molecular and Ion Fluxes at Living Cells using Multifunctional Electrochemical Probes

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The ability to probe chemical fluxes at living cell surfaces is essential towards understanding the behaviour of cells. Among a variety of scanning probe techniques developed for the localized investigation of cells, scanning ion conductance microscopy (SICM) is particularly attractive for nanoscale measurments[1]. The SICM technique uses an ion conductance based feedback mechanism to control the probe-surface distance, enabling electrochemical sensor measurements close to surfaces with high spatial resolution. However, hitherto, SICM has largely been a topographical technique, but the incorporation of further sensor electrodes into the end of the SICM probe opens up the possibility of local flux measurements.[2,3] Herein we present new probes comprising an SICM channel along with amperometric and potentiometric sensing elements, for simultaneous high resolution electrochemical imaging of surfaces and interfaces. This report advances the SICM technique and probes into a multifunctional imaging for the investigation of ion and molecular fluxes at cell surfaces. The capability of this technique for simultaneous amperometric, potentiometric and topographic surface imaging is demonstrated by mapping the surface electrochemical activity of human pre-adipocyte cells in different physiological environments.

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Hierarchical Nanoporous Carbon Materials as Active Support of Electrocatalytic Nanoparticles

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Fuel cell electrodes are made of catalytic nanoparticles supported on different kinds of carbon.[1] While commercial (e.g. Vulcan XC72) carbon are usually used, carbon materials with a more controlled porosity could have better perfomance.[2]
It has been shown that hierarchical nanoporous carbon (HnPC) materials could be synthesized using a hard template method, which can be used as support of PtRu nanoparticles.[3]
In the present communication, we describe the synthesis of different HnPCs and its use as support of electrocatlytic nanoparticles. The three dimensional carbon porosity is examined using focused ion beam combined with scanning electron microscopy (FIB-SEM). The electrochemical properties of the HnPCs are studied using cyclic voltammetry, AC impedance, chronoamperometry and Probe Beam Deflection (PBD).[4] Chronoamperometry and AC impedance measurements of HnPC seems to fit a transmission line model. PBD data show evidence of local pH changes inside the pores, during double layer charging.
The HnPCs are used as active support for metal (Pt/Ru and Pt/Pd) nanoparticles. Additionally, Pt decorated magnetite (Fe_3O_4) nanoparticles are produced inside the HnPC by galvanic displacement. The materials are used for the electrocatalysis of the oxidation/reduction of different reactants (CO, HCOOH, CH_3OH, O_2). The electrocatalytic activity is measured using rotating disk voltammetry.
A catalyst made by chemical deposition of PtPd nanoparticles on a HnPC300 (produced using 300 nm silica nanoparticles), present better perfomance for HCOOH and CH_3OH oxidation than a commercial (ETEK) catalyst.
The electrodes made with FePt nanoparticles show good activity for oxygen reduction reaction (ORR), while having a high tolerance to methanol.
Both in the case of PtPd and FePt based electrocatalysts, the nanoparticles supported on HPC present higher activity than those deposited on planar glassy carbon. The electrocatalytic activity increases when the pore size is diminished.

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Stable and Low Voltage Operated Miniaturized Nongassing Electroosmotic Pump for the Drug Delivery

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Electroosmotic pumps are the simplest among all the pumps, consisting of two electrodes separated by a porous membrane. In the present work we are developing an insulin patch which consists of a miniaturized nongassing EOP; the purpose of the insulin patch is to deliver insulin with reliable, cheap and easy way. The flow rate of the EOP in insulin patch is easily controlled by the applied voltage, duration time and solution composition for pumping. A steady flow rate of 20 $\mu L\ min^{-1}$ is obtained with 2 mm thickness and 8 mm diameter EOP when the pump operates continuously for 2 h or intermittently 15 times for 5 min over a 1 month period. The pump can deliver the small basal amount by the pulsed operation. It is demonstrated that the pump fits for the insulin delivery system for type 1 diabetes.

Photo-electrochemical Communication between *Rhodobacter capsulatus* and Electrode for Harnessing Solar Energy

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All forms of life require energy that originates from the sun via a naturally tuned process called photosynthesis. Higher plants, algae and photosynthetic bacteria convert solar energy into organic chemical energy. Photo-microbial fuel cells can be exploited to meet the growing demand for sustainable energy [1]. The metabolically versatile purple *R. capsulatus* is a potential candidate to study the electrogenic activity in the presence of light. The use of flexible osmium redox polymers gained attention for their efficient electron transfer properties both with redox enzymes [2] and with bacterial cells [3, 4] including heterotrophically grown *R. capsulatus* [5].In this communication, photo-heterotrophically grown *R. capsulatus* cells electrostatically bound in the osmium polymer matrix demonstrated efficient electrical "wiring" with the electrodes and were able to generate a significant current ≈10 μAcm^{-2} with malate/lactate as substrate. The cells trapped in the polymer matrix were exited with visible light and the subsequent photosynthetic electron transfer takes place onto the electrode recorded in both chronoamperometric and cyclic voltammetric measurements. In addition to the photocurrent generation, this study demonstrates the development of the possibility of other photo-bioelectrochemical devices based on *R. capsulatus*.

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The role of different graphene supports in ORR activity of Pt catalyst in PEMFC; Ionic liquid exfoliation of graphite vs. microwave assisted reduction of graphene oxide

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The choice of an appropriate catalyst support material has always been a challenge in the field of fuel cells. In fact, a good support material should fulfill simultaneously a range of requirements, such as high specific surface area, high electrochemical stability under fuel cell operating conditions and high conductivity. In this regard, carbon based materials have always been an attractive candidate and graphene, as the youngest member of the family [1] has been the subject of intense interest. In this work, two different techniques of graphene preparation were used; one based on ionic liquid exfoliation of graphite [2] (Exf. G), and the other based on microwave assisted reduction of graphene oxide [3] (RGO). The resulting materials were then used as the Pt support for PEMFC. Pt was successfully synthesized on graphene by a microwave assisted polyol process. Microstructure and chemistry of the materials were characterized by TEM, TGA and XPS and the electrocatalytic activity toward oxygen reduction reaction was measured using a rotating disc electrode set-up.

Fig. 1a and 1b show the TEM images of the Pt nanoparticles on Exf. G and RGO, respectively, demonstrating a lower particles size for Exf. G, 1.8 nm vs. 3 nm for RGO. The superior behavior of Exf. G is also revealed in ECSA and ORR plots showing a higher active surface area and oxygen reduction current (see Table 1 for the review of electrochemical parameters, mass-specific (I_m) and area-specific activities (I_s) for ORR).

Fig.1

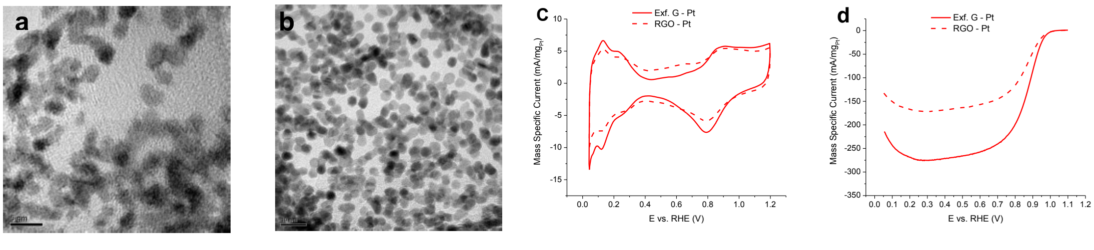

Table.1

Parameters / Samples	ECSA ($m^2\ g_{Pt}^{-1}$)	I_m (0.90 V), 20 mV/s ($A\ mg_{Pt}^{-1}$)	I_s (0.90 V), 20 mV/s ($\mu A\ cm^{-2}{}_{Pt}$)
Exf.G-Pt	28.71	-0.118	-390.39
RGO-Pt	14.70	-0.052	-321.10

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A novel carbon nanotube modified scaffold creates an efficient biocathode material for improved microbial electrosynthesis

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Microbial electrosynthesis (MES) is a novel strategy for the renewable production of organic commodities from the microbial reduction of carbon dioxide [1]. Successful optimization of microbial electrosynthesis processes and scale-up to practical applications requires significant performance improvement while maintaining low costs. Here we report on a novel biocompatible, highly conductive three-dimensional cathode synthesized by direct growth of multi-wall carbon nanotubes (CNT) on reticulated vitreous carbon, NanoWeb-RVC [2], for the improvement of MES. The CNT surface appears as a fine roughness on the surface.

NanoWeb-RVC allows for an enhanced bacterial attachment and biofilm development within its hierarchical porous structure. Moreover, 1.65 and 2.6 fold higher current density (0.29 mA cm^{-2}) and acetate bioproduction rate (0.103 mM cm^{-2} day^{-1}) normalized by the total surface area within the porous macrostructure were reached on NanoWeb-RVC versus flat carbon plate control, for the microbial reduction of carbon dioxide by a mixed culture at -0.85 V vs. SHE. To the best of our knowledge, this is the first study showing better intrinsic efficiency (normalization by total surface area) for a three-dimensional biocathode versus a flat electrode. Unmodified reticulated vitreous carbon lacking the nanostructure was also tested and found to be far less efficient for MES. The combination of the macrostructured RVC with the nanostructured surface modification creates significant advantages. The high surface area to volume ratio of the macroporous RVC maximizes the available biofilm area while ensuring effective mass transfer to and from the biocatalysts. The carbon nanostructure, in turn, enhances the microbe-electrode interaction and microbial extracellular electron transfer. When normalized by projected surface area, very high cathodic current density (3.72 mA cm^{-2}) and acetate production rate (1.325 mM cm^{-2} day^{-1}) were reached which makes the NanoWeb-RVC an extremely efficient material from an engineering perspective as well. This current density and acetate production rate are the highest reported to date for a cathodic MES.

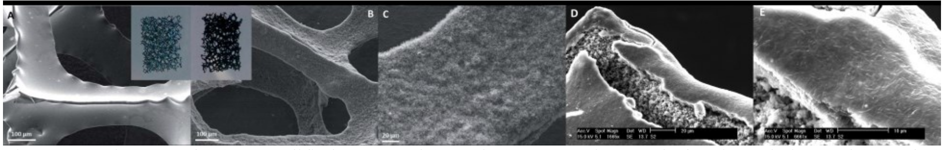

Fig. 1. SEM images of (A) unmodified-RVC and (B and C) NanoWeb-RVC before inoculation and (D and E) of an electroactive biofilm grown on NanoWeb-RVC, at different magnifications.

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Microbial Electrocatalysis of CO_2 reduction for acetate and ethanol production

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Microbial Electrosynthesis (MES) prospects the concept of the electro-reduction of carbon dioxide (CO_2) to multi carbon organic compounds by chemolithotrophs using electrons from the electrode. Conversion of CO_2 to chemicals through microbial electrocatalysis of CO_2 reduction was investigated by using a mixed culture dominated by selected acetogenic and carboxydotrophic bacteria like *Sporomusa* and *Clostridium sps.* as biocathode. CO_2 reduction could occur via direct extracellular electron transfer from the electrode or indirectly via mediators or via hydrogen at more reductive potential. Predominantly, volatile fatty acids were produced while applying -1.1 V (vs Ag/AgCl) cathode potential along with hydrogen evolution using a mixed culture in a two chambered reactor. Up to 60% of bicarbonate (dissolved CO_2) was recovered as acetic acid and the maximum production rate reached 40 $g/m^2/day$. Very low quantities of ethanol were also detected sporadically but did not remain stable due to consumption in unknown reactions. Ethanol could be formed either from acetate or directly from CO_2. In a preliminary experiment in a single chamber reactor, ethanol was produced even at -0.6 V vs Ag/AgCl from the reduction of either acetate or bicarbonate. In two chamber reactor, acetone was also formed along with ethanol at -1.1 V vs Ag/AgCl. These results suggest that mixed culture enriched with acetogenic bacteria can catalyze electro-reduction of CO_2 into number of chemicals and electrofuels through direct or indirect electron transfer.

Key words : Microbial electrosynthesis, CO_2 reduction, Microbial electrocatalysis, Biocathode, electrofuel

Modeling Solid-Electrolyte Interfacial Reactions of Li-Ion Batteries

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A critical problem that affects the performance of Li-ion batteries is the formation of a solid-electrolyte interphase (SEI) layer on the surface of the anode (cathode) due to reduction (oxidation) of the electrolyte components. Depending on its physico-chemical properties the SEI film could sometimes be protective of the mechanical and chemical stability of the electrode. Thus, understanding its nucleation and growth and its evolution during battery cycling is essential for interpretation of experimental data related to electrode capacity changes especially during the initial cycles. Further, if one is able to identify the relationships between electrolyte composition and SEI film characteristics, improved electrolyte designs may be sought. In this talk we will discuss our efforts to investigate surface reactions occurring due to the electrochemical instability of the electrolyte, using density functional theory and ab initio molecular dynamics simulations. We focus on reductions of aprotic organic solutions in contact silicon anodes, under various degrees of lithiation and chemical nature of the exposed surface. We characterize the reduction of the main solvent: ethylene carbonate (EC), and its mixtures with linear carbonates such as di-ethyl carbonate (DEC), as well as that of a typical salt: $LiPF_6$. Then we analyse the similarities and differences between the reduction of additives vinylene carbonate (VC) and fluoroethylene carbonate (FEC) that have shown to improve the cycling behaviour of the battery. Finally we investigate possible aggregation behaviour among SEI products and subproducts that may lead to the observed “mosaic” structure of the SEI layer. Implications of our results in relation to performance of Si anodes will be discussed.

“I know it when I see it”—AFM meets a nanoelectrode

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The rapid progress in nanoelectrochemistry enabled the transition from studies of large ensembles of nanostructures (e.g., metal particles, droplets or nuclei) to probing individual nanometer-sized objects. The focus of this paper is on the use of electrochemical nanoprobes, scanning electrochemical microscopy (SECM) and atomic force microscopy (AFM) for high-resolution imaging and quantitative studies of individual nanoparticles and electrodeposited nanostructures. The possibility of SECM experiments with the spatial resolution approaching that of the AFM is discussed. Another issue of interest is establishing the correspondence between the visualized surface features and their electrochemical properties.

Single-Enzyme Fluorescence Electrochemistry Studies of a Heme-Copper Oxidase Proton Pump

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Respiratory heme-copper oxidases reduce oxygen to water and couple this to the transfer of protons across the lipid membrane, where the resulting proton-motive force is used to drive ATP synthesis. Ever since the discovery that protons are ‘pumped’ by the heme-copper oxidase, the molecular mechanism of this pump has been the focus of intense research. We have visualised the proton pumping activity on the single-enzyme level by coupling electrochemistry with quantitative fluorescent microscopy on surface-immobilized proteoliposomes loaded with pH sensitive fluorescent reporters (Fig. 1). The activity of ubiquinol oxidase from *Escherichia coli*, present in the proteoliposomes at a ratio of << one per vesicle, is electrochemically controlled via the ubiquinol pool, while proton pumping is monitored via the intravesicular pH changes. Our findings reveal that this pump displays a plethora of interconverting long-lived (minutes) functional states, with various pumping rates. Comparison with a mutant oxidase in which the proton-channel is disrupted reveal that the pump, during turn-over, stochastically can enter a state that allows passive proton translocation (a ‘leak’ state).

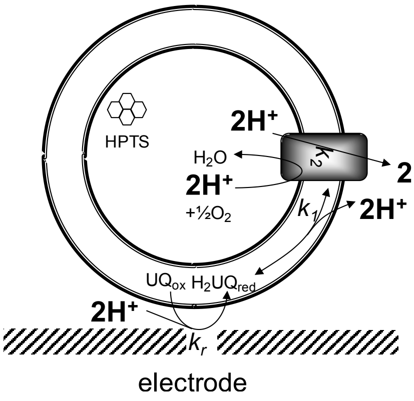

Fig. 1: Illustration of the experimental setup used

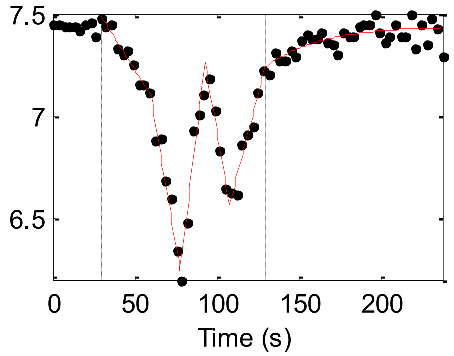

Fig. 2: A single-enzyme proteoliposome that shows various pumping and leak states. Between 0-30 s, the potential is off and the ubiquinol oxidase is inactive. Between 30-130 s, the ubiquinone is electrochemically reduced and the pH changes with time due to interconverting proton pumping and leaking states. At 130 s, the potential is switched off and the intravesicular pH returns slowly to the starting pH. Red lines are fits from an automated analysis.

Towards improved and sustainable ORR electrocatalysis with Pt “hollow” nanoparticles

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This paper describes the synthesis and the characterization of “hollow” Pt-rich/C nanocrystallites (Figure 1A) for the oxygen reduction reaction (ORR). Their specific activity reach a 3-fold (Figure 1B) and 5-fold enhancement over conventional “solid” Pt/C nanocrystallites of the same size in liquid electrolyte and during real proton-exchange membrane fuel cell (PEMFC) testing, respectively. More importantly, the “hollow” nanoparticles can sustain this level of performance during accelerated stress tests in both liquid and solid electrolyte. The average contraction of the Pt lattice by 1 % (Figure 1C) and the Pt coordination number ($N_{Pt} = 7.5$) point towards the presence of vacancies in the Pt-rich shell, which may account for their improved catalytic properties.

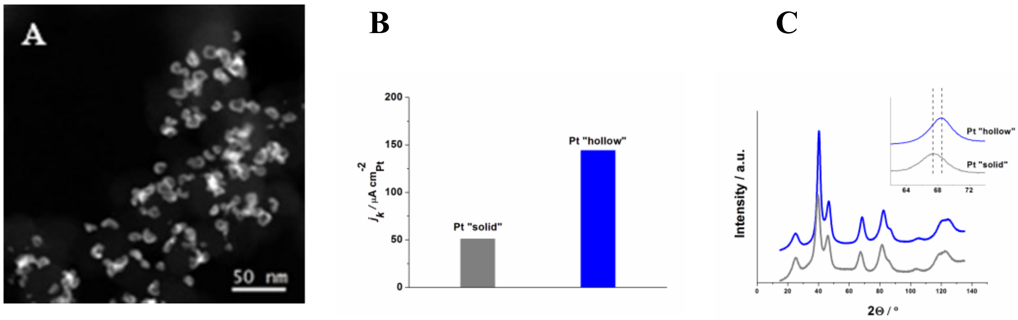

Figure 1 : (A) Aberration-corrected high resolution high angle annular dark field scanning transmission electron microscopy of the “hollow” Pt-rich/C nanoparticles (B) ORR specific activity measured at 0.90 V *vs*. the reversible hydrogen electrode (RHE) in 0.1 M H_2SO_4 and (C) X-ray diffraction pattern of the “hollow” Pt-rich/C and of the reference “solid” Pt/C nanoparticles.

Electrochemical Characterization of Respiratory Complex I Reconstituted on a Supported Biomimetic Membrane over a Gold Electrode

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NADH: quinone oxidoreductase, which is also known as respiratory complex I, is a membrane-bound enzyme that has an essential function in cellular energy production. It couples NADH:quinone oxidoreduction to translocation of protons across the cellular (in prokaryotes) or mitochondrial membranes. Therefore, complex I contributes to the establishment and maintenance of the proton motive force required for ATP synthesis, transport and motility. In addition, by reducing the quinone pool inside the membrane, the enzyme allows electron transport to the next enzymatic complex of the respiratory chain.[1,2]

We have developed a strategy for reconstituting the structure and functionality of the bacterial complex I from *Rhodothermus marinus*[3] onto a biomimetic membrane supported on gold electrodes modified with a thiol self-assembled monolayer (SAM). We show that this modified electrode allows us to study both the electron transfer and the proton translocation by the enzyme, simulating the *in vivo* conditions, using electrochemical methods.

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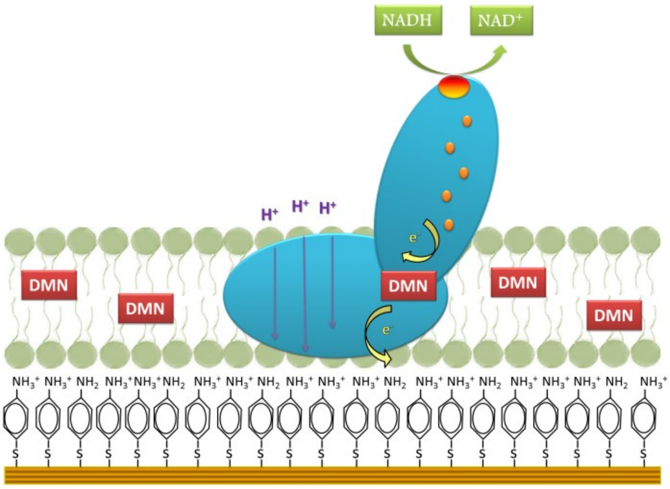

Electrocatalytic Activity for Oxygen Reduction Reaction of Pt/Au/CB catalyst with Different Core Sizes

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Pt nanoparticles (NPs) loaded-carbon black (Pt/CB) is often used as the cathode catalyst in polymer electrolyte fuel cells (PEFCs). However, it is important to improve electrocatalytic activity per unit mass of Pt (mass activity; MA) for oxygen reduction reaction (ORR) in order to the reduction of Pt consumption. Au core/Pt shell (Pt/Au) catalyst can reduce the amount of Pt consumption to a limit, and have high MA [1]. Recently, two kinds of Au-PVA/CB [2] and Au-G/CB [3] catalysts with mean sizes of *ca*. 3.3 nm and *ca*. 2.5 nm have been prepared by using CO as a reducing agent in $KAuCl_4$ aqueous solutions containing polyvinyl alcohol (PVA) and glutathione (GSH) as a stabilizer, respectively. These catalysts were heat-treated in order to carbonize stabilizers ($Au_{3.5}$/CB-HT and $Au_{2.8}$/CB-HT), and their particle size was 3.5 ± 0.7 nm and 2.8 ± 0.5 nm, respectively [2, 3]. The size of Au NPs for Au-G/CB is slight increased during heat-treatment. On the other hand, MA at 0.9 V vs. RHE of Pt/$Au_{2.8}$/CB-HT electrode was higher than the Pt/$Au_{3.5}$/CB-HT electrode. In this study, in order to remove GSH with keeping the size of the Au NPs, we tried electrochemical treatment (ET). In addition, ORR activity of Pt/$Au_{2.5}$/CB-ET was evaluated by rotating disk electrode (RDE) method.

The content of Au in the Au/CB was ca. 19 wt. %. ET of an Au-G/CB electrode was carried out by 20 potential cyclings between 0.05 V and 1.7 V in an Ar-saturated 0.1 M $HClO_4$ aqueous solution to oxidize adsorbed GSH. The size of Au NPs after ET was 2.5 ± 0.5 nm. A Pt monolayer was deposited on Au NPs by Cu-underpotential deposition and the following galvanic replacement. During 20 potential cyclings between 0.05 and 1.2 V in Ar before ORR, specific surface area (SSA) of the Pt/$Au_{2.5}$/CB-ET was decreased due to the formation of PtAu solid solution. In contrast, the SSA was not decreased during the potential cycling in O_2. For the Pt/$Au_{2.5}$/CB-ET, the reduction peak at ca. 1.2 V almost disappeared and the peaks for hydrogen adsorption/desorption peak at below 0.4 V appeared. The ORR at the Pt/Au_G/CB-ET occurred in 4-electron mechanism. The MA at 0.9 V vs. RHE for Pt/$Au_{2.5}$/CB-ET was ca. 1.3 and 6.6 times as high as that for the Pt/$Au_{2.8}$/CB-HT and commercial Pt/CB, respectively. Such the increase in MA could be ascribed to that in specific activity. According to density functional theory, reducing the size of Au NPs can increase the compressive strain in their surface [1], leading to the improvement of ORR activity.

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Electrochemistry of Quinone/Hydroquinone-Functionalized Biointerfaces

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Here we investigated the electrochemical properties of quinone/hydroquinone (Q/HQ)-functionalized biointerfaces. A series of ubiquinone analogues and bis-ubiquinone compounds were synthesized. These unique compounds have been investigated to explore their electron-transfer processes and electronic communications. We fabricated a biomimetic membrane system in which redox-active ubiquinone was embedded in hybrid bilayer membranes (HBMs) that contained NADH. Reversible NADH/NAD$^+$ interconversion could be mediated by ubiquinones in the biomimetic membrane. By this method, we constructed a valuable electrochemical platform to investigate the electron-transfer processes of redox biomolecules using biomimetic HBMs that was assembled on gold electrodes (Figure 1).[1] Thus, the electron-transfer processes between redox molecules and target biomolecules can be achieved by mimicking the redox cycling processes in natural membranes.

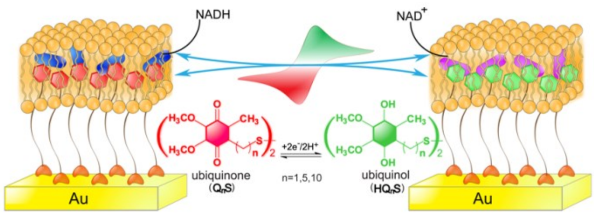

Figure 1. Biomimetic membrane containing ubiquinones and NADH/NAD$^+$.

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Probing the potential energy surface for the proton equilibrium on gold

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One major challenge for the investigation of the proton transfer from aqueous solution to a metal electrode lies in the correct description of the charged species, since a free proton cannot exist in water. Instead, complexes such as the Hydronium, Eigen or Zundel ions are formed. An adequate description of the structure and interconversion between these species and the subsequent discharge (i. e. proton transfer to the surface) can be reached through reactive force fields such as an empirical valence bond model [1].

In this work we determine the necessary set-up for an adequate description of the potential energy surface of the proton transfer from a Hydronium ion (H_3O^+) to gold (111) surface where we use a simplified model which excludes any additional solvent. We probe the potential energy surface using the *ab initio* program VASP [2]. We discuss not only total energies but also structural properties, possible discharge pathways and other features of the PES.

Similar investigations were performed for the H_2O molecule and the Zundel ion. Thereafter, functionals were fitted from this data, describing the interaction of the species with the gold surface. These functionals, together with well-known functionals as for the H_2O-H_2O interaction, were employed in an EVB scheme. This work is part of the Cluster of Excellence Ruhr Explores Solvation (RESOLV) (EXC 1069) funded by the Deutsche Forschungsgemeinschaft.

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Bimetallic Platinum-Gold Nanoparticle Netlike Assembly with High Activity and Durability for Oxygen Reduction Reaction

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The aggregation and dissolution of Pt nanoparticles and the corrosion of support are the key issues causing the performance fading decrease of the cathode catalysts in proton exchange membrane fuel cells (PEMFCs)[1,2]. Due to the minimum total surface energy, netlike architecture is superior to independent nanoparticle, nanosheet and nanowire to maintain structure characteristics. Therefore, netlike catalyst with nano/micro-hybrid architectures is an efficient way to improve the performance of catalyst because of avoiding the aggregation of independent nanoparticle and stack of nanosheet and nanowire catalyst. Herein we report a new strategy of the synthesis of nanoparticle netlike assembly (NNA) catalysts that presents high activity and stability for oxygen reduction reaction (ORR). Based on previous work[2], mutiwalled carbon nanotube (CNT) supported platinum-gold nanoparticle netlike assembly (PtAu-NNA/NCT) was prepared. SEM (Figure 1) and TEM (insert chart in Figure 1) results illustrate that netlike assembly of PtAu nanoparticles has been successfully obtained. EDS analysis clearly indicates that Pt and Au simultaneously exist in the as-synthesized PtAu-NNA/CNT, and the ratio of Pt to Au is consistent with the theoretical value. As compared with commercial catalyst of Pt/C(JM) in Fig.2, the PtAu-NNA/CNT exhibits much higher ORR catalytic activity and durability, ascribed to the distinctive netlike structure and stabilizing effect of the gold. The results illustrates that the nanoparticle netlike assembly that ensures nano/micro-hybrid architectures is excellent catalyst with high activity and durability for fuel cell applications.

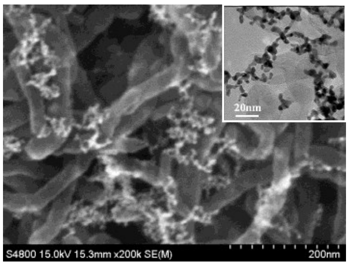

Fig.1 SEM and TEM images of PtAu-NNA/CNT

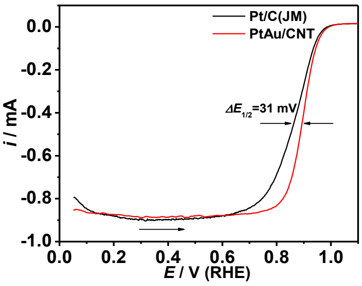

Fig.2 ORR and durability results of PtAu-NNA/CNT and commercial Pt/C(JM)

Acknowledgments: This work was supported by NSFC(21229301, 21321062).

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In-situ Video STM Studies of Dynamic Processes at Metal/Ionic Liquid Interfaces

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Room temperature ionic liquids (RTILs) have a promising combination of properties including low vapour pressure, wide electrochemical window, and tunable polarity, which make them very attractive compounds in the field of electrochemistry, e.g. in electrodeposition, batteries and solar cells. [1] Accordingly, it is of great interest to understand both the structure and dynamic processes at these metal/RTIL interfaces to provide insight into the structure–reactivity correlation. [2-5] However, detailed data on the atomic/molecular scale are still largely missing so far. In a few selected systems the structure of static adsorbate layers on electrode surfaces in RTILs has been obtained by conventional in-situ STM, [3, 6] but the important case of a more dynamic interface structure has not been investigated up to now. As we have shown previously, the latter is possible by in-situ Video-STM, which allows direct atomic/molecular scale studies of dynamic processes on electrode surfaces at significantly higher temporal resolution (up to the millisecond range). [7, 8]

In the present work, we present first results of in-situ Video-STM studies of molecular scale dynamic processes at the interface of imidazolium-based ionic liquids containing Cl^- anions and Au (111) electrodes. The structural arrangement and dynamic fluctuations of cations in the adlayer at cathodic potentials (Figure 1) and of the anions in the more positive potential regime was observed. Furthermore, the dynamic processes on the electrode surface during the electrochemical phase transformation will be discussed.

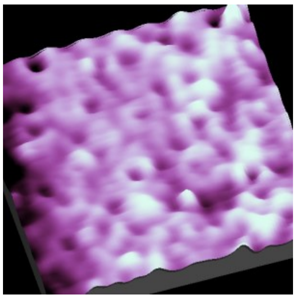

Figure 1: 3D STM image of HMI^+ cations on Au (111) in the cathodic potential regime. (Scan size: 5.7 x 5.7 nm^2).

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Structure sensitivity of electrochemical reactions from first principles: applications to nitrogen and water cycles

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Nitrogen cycle electrochemistry is an emerging area of interest in the electrocatalysis community, with applications ranging from removal of nitrates from wastewater streams to the development of fundamental understanding of NO electrochemistry. In spite of a significant amount of fundamental research for this chemistry on single crystal surfaces, however, the mechanistic details of the reactions are not fully known, and even such basic information as the nature of the rate-limiting step is not understood.

In this work, we apply some of the innovations in theoretical electrochemistry that have emerged over the past 5-10 years to the study of NO and nitrate reduction on transition metal surfaces. We begin with a simple Density Functional Theory analysis of direct NO reduction in acid on Pt(111), Pt(100), and Pt(211) surfaces, and we identify potential- and rate-determining steps on each surface, using extensive ab-initio molecular dynamics simulations to estimate the impact of the aqueous environment on surface thermodynamics and kinetics. We then generalize our analysis to include dimeric pathways at high NO coverages and nitrate to NO conversion, and we predict likely product distributions as a function of electrode potential. Finally, we extend these analyses to alternative transition metals, including copper and gold, and we comment on the possibility of selecting optimal alloy catalysts to tune the activity and selectivity of this chemistry at appropriate electrode potentials.

If time permits, we will briefly describe some additional work on the development of structural and catalytic reactivity models at the interface between thin hydroxyoxide films and precious metal platinum substrates. We will examine the kinetics of the hydrogen evolution reaction as a function of the structure and oxidation state of these interfaces and will demonstrate that the bifunctional nature of the interfaces plays a key role in their electrocatalytic properties.

Local Deposition of Shape Controlled Nano-Objects by Scanning Electrochemical Microscopy (SECM)

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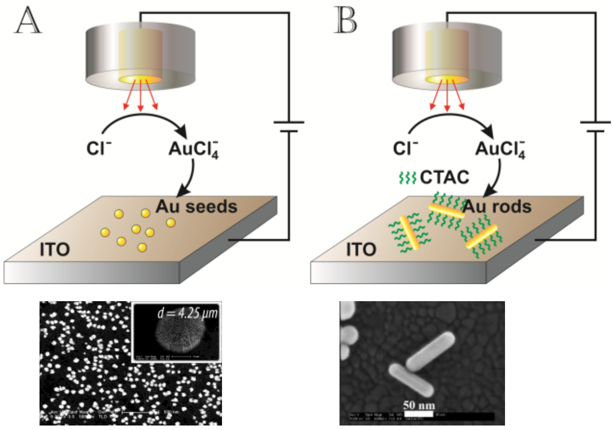
The formation of anisotropic nano-objects such as nanorods and nanoprisms have gained substantial interest due to their interesting size and shape-dependent properties, which can be used in a variety of applications such as photovoltaic cells, surface enhance Raman spectroscopy and many other fields. This has motivated the development of various synthetic approaches by which the aspect ratio and shape can be controlled. Metallic anisotropic nano-object, and in particular those made of gold, have attracted much of these efforts. Numerous approaches have been described, among them are seed mediated growth method with different modifications, photochemical, template, electrochemical and sonochemical methods. These synthetic methods with combination of modern extraction techniques have enabled achieving high efficiency in the formation of nano-objects with controlled size and aspect ratio.

Once these nano-objects are made the challenge is to place them onto surfaces in either repetitive structures or locally in order to form nanostructures that could be used later as catalysts, sensors, etc.

We have been using scanning electrochemical microscopy (SECM) as a means of patterning surfaces with nanoparticles. We have developed different approaches for the local deposition of nano-objects such as metallic nanoparticles. More recently we have addressed the challenge of locally depositing anisotropic nano-objects such as nanorods. The latter are grown locally by controlling the flux of metal ions and their chemical or electrochemical reduction. We will discuss different approaches such as using self-assembled monolayers and the addition of surfactant as a means of controlling the local growth of nano-objects.



Unification of Extracellular Electron Transport Mechanisms in *Shewanella* and *Geobacter* Species

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Iron-reducing bacteria, e.g., *Shewanella oneidensis* MR-1 and *Geobacter sulfurreducens* PCA, are capable of extracellular electron transport (EET), i.e., the transport of electrons to extracellular insoluble electron acceptors via several multi-heme *c*-type cytochromes (*c*-Cyts) that function in unison as a biological “electron conduit” to transport electrons across the outer membrane (OM) to the cell exterior. While EET processes for the two model microbes occur via OM *c*-Cyts, distinct EET mechanisms have been proposed for each strain. Replacing a supernatant solution with fresh medium in electrochemical system with anode biofilm, the current production (j_c) of *S. oneidensis* MR-1 showed 80% prompt decrease, but that of *G. sulfurreducens* sustained. This clear difference in j_c response to supernatant replacement suggests that cell-secreted soluble redox molecules contained in the supernatant take a crucial role in the EET of MR-1, but not in that of PCA. Thereby, it has been widely accepted that a shuttling process of self-secreted soluble flavin dominates the EET process in MR-1, but direct electron transport via *c*-Cyts on OM or bacterial nano filament is instead a predominant EET pathway in PCA. However, we recently discovered that MR-1 strain uses self-secreted flavin compound not only for shuttling mechanism, but also as a redox cofactor bound to OM *c*-Cyts[1]. Moreover, this flavin binding to the scaffold of OM *c*-Cyts was found to facilitate a one-electron redox reaction via semiquinone, resulting in a 10^3- to 10^5-fold enhancement of the EET rate compared to soluble flavin shuttling. Based on this finding, we speculated that PCA cells might also use self-secreted redox molecules as redox cofactors to promote EET. If true, the excreted molecules should not act as a diffusion-based electron shuttling in PCA. In this contribution, we report that *G. sulfurreducens* PCA secrete flavin that contributes to EET at the cell/electrode interface, highlighting the crucial role of flavin redox cycling for efficient EET in this species[2]. Furthermore, about 10 nM of dissociation constant (K_d) for flavin binding in *Geobacter* strain estimated from *in-vivo* electrochemical data indicates that 80 % of OM *c*-Cyts is occupied by flavin even at the flavin concentration of 50 nM in a minimum growth media. On the other hand, MR-1 has K_d of approximately 10 µM, indicating only 5 % of OM *c*-Cyts associates with flavin without exogenous flavin addition. These results fit with the observations in supernatant replacement experiments for both strains, and thus the bound flavin model unifies the EET of *S. oneidensis* MR-1 and *G. sulfurreducens* PCA. We will show evidences for flavin excretion to enhance the EET processes in PCA, and also discuss about the model to calculate the K_d value *in-vivo* in detail.

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Oxygen Reduction on Mass-selected Pt_xGd Nanoparticles as Model Catalysts for Fuel Cells

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The sluggish kinetics of the oxygen reduction reaction (ORR) hinders the commercialization of proton exchange membrane fuel cells (PEMFC). The ORR activity could be enhanced by combining Pt with late transition 3d metals (i.e. Fe, Co, Ni, and Cu). However, such alloys are often not stable enough in the corrosive PEMFC environment and suffer from dealloying [1]. In contrast, a recent publication from our group reported the high ORR activity and stability of polycrystalline sputter-cleaned Pt_5Gd [2]. In this work we present for the first time the experimental results of mass-selected Pt_xGd nanoparticles synthesized by gas aggregation after sputtering of an alloy target in an ultrahigh vacuum (UHV) system. The Pt_xGd nanoparticles with nominal sizes of 3, 5, 7, and 9 nm were selected using time-of-flight mass filtering and deposited on glassy carbon (GC) disk electrodes. The samples were mounted in a rotating ring disk electrode (RRDE) setup and tested in a three-electrode glass cell containing 0.1 M $HClO_4$ as supporting electrolyte. The ORR measurements carried out in O_2-saturated electrolyte confirmed the greater catalytic activity of the Pt_xGd nanoparticles compared to pure Pt nanoparticles [3]. The ORR specific activity increases with the nanoparticle size and approaches the activity of the extended surface; a maximum mass activity of is achieved with the 5 nm sample, ~2.0 A/mg Pt at 0.9 V. X-ray absorption spectroscopy measurements suggest that the high ORR activity is due to a compressive strain exerted by the alloy core onto the Pt surface atoms.

By investigating such well-defined nanoparticles, we can gain valuable scientific insight into the relationship between their structure and functionality. On the basis of this insight, we can develop even better catalysts for oxygen electroreduction.

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Three-dimensional carbon felt decorated with carbon nanotubes and/or reduced graphene oxide for direct electron transfer of glucose oxidase.

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The third generation of electrochemical glucose biosensors has been advanced in order to promote a direct electronic communication between glucose oxidase (GOx) and the electrode. This situation is very attractive to improve biosensor selectivity and minimize problems related to the instability of mediators [1]. However, due the fact that FAD moiety of GOx is considerable embedded within the protein, allowing an efficient direct electron transfer is a challenge to be overcome. Strategies for that can be performed in order to create a full conductive pathway able to transport the electron between the FAD and the electrode. This connection can be achieved using carbon nanotubes (CNTs) or graphene based materials [2]. However, independently of employing CNTs or graphene derivatives, direct electron transfer can only occur for a monolayer of enzymes immobilized with a favorable orientation. [3] Because that, the utilization of electrodes with larger active surface areas is a key aspect to improve the results obtained so far in this field. A very attractive material for this approach consists on using a compact three-dimensional felt formed by several micrometric and electric conductive carbon fibers decorated with cup stacked carbon nanotubes (felt/CSCNT) [4] and/or reduced graphene oxide sheets (felt/RGO; felt/CSCNT/RGO). Regarding the superficial area available for GOx immobilization, the felt/CSCNT offers considerable advantages over the felt/RGO, improving the obtained faradaic currents. However, circular dichroism spectrum indicates that GOx acquires a less compact conformation when it is immobilized on felt/RGO, improving kinetic parameters involved in the transfer. Interestingly, the results achieved after immobilizing glucose oxidase on felt/CSCNT/RGOs suggests that not only the conformational changes can improve the kinetic results, but also an efficient electrical interaction between RGO and electronic substrate through the CSCNT.

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Effect of Adsorbed ClO_4^- and Oxygen Species on the Oxygen Reduction Activities of Pt_3Co Alloy Electrode

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Analyses of the oxygen reduction reaction (ORR) mechanism on Pt and Pt-alloy are essential to improve the performances of cathode catalysts for fuel cells. We have recently analyzed the effects of ClO_4^- anion adsorption on the activities for the oxygen reduction reaction (ORR) at Pt and Pt_3Co (Pt-skin/Pt_3Co) film electrodes in electrolyte solutions ($HClO_4$ and HF at various concentrations) by using an electrochemical quartz crystal microbalance (EQCM) and a rotating disk electrode (RDE).[1, 2]

The adsorption of ClO_4^- on the Pt_3Co alloy, which was fitted well with a Frumkin-Temkin adsorption isotherm, was found to be stronger than that on bulk-Pt. It was also found that the specific adsorption of ClO_4^- anions was negligible in 0.01 M $HClO_4$ solution. As shown in Fig. 1, the kinetically-controlled current density j_k for the ORR at 0.85 V vs. RHE on the Pt_3Co−RDE was about 9 times larger than that of the Pt−RDE in air-saturated 0.01 M $HClO_4$, but the j_k values on Pt_3Co decreased with increasing $HClO_4$ concentration more steeply than in the case of Pt, due to the blocking of the active sites by the specifically adsorbed ClO_4^-.

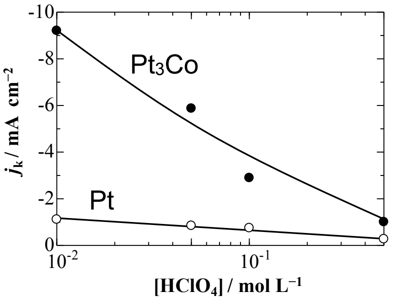

Fig. 1 Plots of the kinetically-controlled current densities j_k (per unit electrochemical surface area) for the ORR on the Pt and Pt_3Co electrode at 0.85 V as a function of *log* [$HClO_4$].

We have succeeded in detecting reversible mass changes for adsorbed oxygen-containing species (Ox = O_2, O, OH, H_2O) on the Pt_3Co−EQCM and Pt−EQCM in O_2-saturated and He-purged 0.01 M $HClO_4$ solutions. The coverages of oxygen species θ_{Ox} on the Pt_3Co at E = 0.86 to 0.96 V in the O_2-saturated solution were found to be larger than those on pure Pt, providing strong evidence that the higher ORR activity on the Pt_3Co is correlated with higher θ_{Ox}, well consistent with our results with use of EC-XPS[3, 4] but contrary to the conventional view of "suppression of OH-poisoning".

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Design of Pt-based bimetallic alloys for H_2O_2 oxidation: A combined computational and experimental approach

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Using a combined computational and experimental approach to develop a noble metal based catalyst for H_2O_2 oxidation reaction. A methodology based on density functional theory (DFT) calculations was proposed to search for an optimal Pt-M bimetallic catalyst, which was then verified experimentally. Based on the bi-functional mechanism, a series of Pt-M bimetallic systems were first chosen as possible candidates due to the binding strength of the OH group on the second metal (M). The surface Pt ε_d and the energy barrier with respect to the dehydrogenation kinetics of the chosen bimetallic systems were calculated and used to find an optimal catalyst. A volcano-type relationship between the Pt ε_d and the energy barrier was found, which implied that a shift in the d-band of surface Pt atoms strongly influences the dehydrogenation kinetics of H_2O_2. This suggests that an appropriate Pt-based catalyst for H_2O_2 oxidation should correlate moderate OH adsorption with the middle of the Pt ε_d. From the inspiration given by the computation results, different carbon-supported Pt-M catalysts were synthesized using a modified Watanabe process and tested for H_2O_2 oxidation. It was found that Pt-Pd/C demonstrated excellent catalytic activity. The experimental results were in good agreement with computational predications suggesting that the methodology developed for designing Pt-based bimetallic catalysts provides a fast approach to exploring new catalysts.

Electrochemical Imaging of Rough and Tilted Samples: How to Drive Commercial SECM at Constant Current Mode

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Scanning Electrochemical Microscopy (SECM) imaging of samples whose topographic features are high compared to the probe dimension is hardly achievable using constant height mode without continuous control of tip-to-sample distance. An additional problematic aspect of SECM working in constant height mode is the sample alignment parallel to the microscope scanning plane. Precise positioning of sub-micrometer size probes requires isothermal conditions to minimize thermal drift.[1] Finally, interpretation of current images recorded at constant height is often ambiguous due to variable height convolution. Approaches to overcome these problems by the distance control such as shear force[2] or AFM-SECM[3] are used in a few laboratories. Probe current can be also used as an input signal to a PID feedback loop controlling probe height.[4] Hopping probe SECM imaging of topography and activity of living cells has recently been reported.[5].

Here, we present a simple software[6] approach to SECM imaging based on hopping probe. It is usable for any kind of samples comprising areas exhibiting both high (positive feedback) and low (negative feedback) activity. Samples possessing vertically protruding high aspect ratio topographic features can be also analyzed.

Another approach for SECM imaging with nanoelectrode probes is a constant current mode controlled by an analog operational amplifier very similar to a potentiostat. This system allows rapid positioning of nanometer-size probes close to the sample and relatively fast imaging.

These approaches are implemented on custom made systems, but implementation to a common commercial SECM instrument will be also presented.

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Effect of ordering of $PtCu_3$ electrocatalyst structure on the stability for oxygen reduction reaction

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With carefully planned synthesis procedure we can obtain samples of $PtCu_3$ alloyed nanoparticles embedded in graphitized carbon support with the identical platinum, copper and carbon composition, particle dispersion and size distribution yet with different degree of structural ordering. Systematic stability study, employing RDE, ICP-MS, HR-TEM and IL-TEM measurements reveals that partially ordered sample consistently exhibits higher ORR activity and Cu content upon dealloying and electrochemical degradation treatments. For the first time we show a direct proof that ordered structure increases $PtCu_3$ electrocatalyst stability for ORR activity. Together with the formation of Pt-skin [1] this could have a groundbreaking impact on future rational design of active and stable platinum alloyed oxygen reduction reaction electrocatalysts.

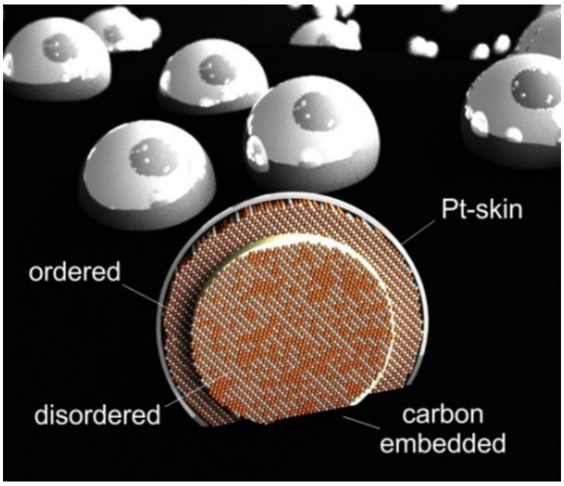

Figure 1: Schematic representation of a cross-section of the ordered PtCu3/C sample.

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Soft microelectrode arrays vs. finger probe arrays – joining the concepts for ultra-soft scanning

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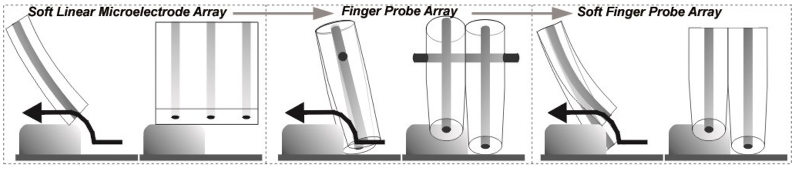
Since the introduction of the first type of soft microelectrodes (MEs), the Soft Stylus Probe that enabled contact mode SECM of tilted and curved substrates [1], the development in particular of Soft Linear Microelectrode Arrays made great progress [2,3]. These soft array probes are made of carbon paste as electrode material and thin flexible polymeric layers, *e.g.* PET and Parylene C, which ensure a defined flexibility and stiffness and allow scanning in a brushing-like manner over even delicate samples such as self-assembled monolayers [3]. The MEs are embedded in one polymeric block that follows the main topography of the sample as a single unit keeping a constant working distance. However, in case of obstacles and depressions smaller than the probe body individual sensors might lose the initial close proximity to the substrate.

These limitations have recently been overcome by the Finger Probe Microelectrode Array [4], which consists of conventional Pt MEs inside a borosilicate glass body that are mounted in curved indentations of a home-made holder and held by magnetic forces. This enables finger-like movements of the individual MEs. Large and complex polymeric 3D samples can be investigated free of significant topographic artifacts. Moreover, Pt as electrode material is superior over carbon paste with respect to the electrochemical response and potential window. However, the glass probes are not gentle enough to slide over delicate samples without inducing scratches.

In this contribution, the advantages and limitations of both approaches are compared with each other by means of SECM imaging of extended 3D samples specifically prepared for these experiments by multilayer inkjet printing. Finally, the combination of both concepts, the Soft Finger Probe Microelectrode Array, will be presented for the first time. Such probe arrays are composed of Pt MEs coated with a thin layer of a soft polymeric material such as Parylene C allowing ultra-soft, finger-like scanning of complex and delicate surface structures.



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Identifying Trapped Electronic Holes at the TiO_2 Water Interface

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Trapping of photo-generated holes near or at the surface is a crucial step in photocatalytic reactions on TiO_2, e.g. the oxidation of water and organic pollutants. The identity of the trapped holes is still under debate, and some experimental interpretations even appear conflicting. In this talk, I will present our recent calculations of the trapped holes at aqueous rutile $TiO_2(110)$ surface using ab initio molecular dynamics based on the hybrid functional HSE06. We found that the reactive surface trapped holes as the $OH^{\bullet}$ on five-coordinated terminal Ti and its deprotonated $O^{\bullet-}$. I will also discuss the alignment of both the vertical and adiabatic electronic energy levels of the trapped holes The vertical levels are what electronic spectroscopies (e.g. photoemission and transition adsorption) measure. The thermodynamic stabilities (or reversely activities) of the holes are however determined by the adiabatic levels (i.e. redox free energies). The confusions between these two often lead to the conflicting interpretations. Their differences are reorganization energies, which can be on the order of 1-2 eV and are important for the electron transfer kinetics according to Marcus theory. We also observe an asymmetry in reorganization energies owing to the pinning of the valence band of TiO_2. This has important implications for the understanding of the heterogeneous electron transfer kinetics driving photo-oxidation.

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Selective Chemosensing with Molecularly Imprinted Polymers of Thiophenes

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A universal strategy of molecular imprinting was adopted for devising and fabricating new recognition materials for selective chemosensing of chosen biogenic amines. This strategy used electronically conducting molecularly imprinted polymers (MIPs) of thiophene derivatives. It involved, first, designing and preparing a "library" of bis(2,2'-bithien-5-yl)methane derivatives as cross-linking monomers and those functional bearing different recognition sites. With the B3LYP/3-21G(*) density functional theory, we then optimized structures of pre-polymerization complexes of the analytes with different functional monomers and calculated negative gains of the Gibbs free energy, ΔG, due to formation of these complexes. This computer modeling allowed us to select functional monomers with recognition sites most strongly interacting with binding sites of the analytes and, therefore, most suitable for imprinting. Next, we allowed for formation of these complexes in solutions and experimentally confirmed the calculated ΔG values by determining the complex stability constants by the fluorescence or UV-vis spectroscopy titration. In subsequent oxidative electropolymerization under potentiodynamic conditions, the analytes were used as templates of imprinting. This electropolymerization resulted in deposition of the analyte-templated conducting molecularly imprinted polymers (MIP) films on different electrodes. After successive template extraction (monitored by XPS or UV-vis spectroscopy, or DPV), vacant molecularly imprinted cavities were left in MIPs. These cavities, complementary in volume, contour, and orientation of their binding places to those of the templating molecules, selectively recognized the respective analytes. Availability of the imprinted cavities to the analyte molecules was governed by suitable adjustment of the film viscosity and porosity using appropriate cross-linking monomers and ionic liquids, respectively. With simultaneous measurements of piezoelectric microgravimetry at EQCM and chronoamperometry, we selectively determined redox analytes by discriminating electroinactive interferences. Differences in selectivity to the analyte and interferences were interpreted by modeling complexation of the analyte molecule and, separately, the interferences by the imprinted molecular cavity.