

224th
ECS MEETING

San Francisco, CA
October 27–November 1, 2013
Hilton San Francisco

special meeting section



San Francisco Travel Association photo by P. Fuszard.



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Welcome to San Francisco! We are pleased to convene the 224th ECS Meeting in this great city, a leading center of science, technology, and industry. This major international conference will be centrally located in the Hilton San Francisco and will include more than 2800 technical presentations and the third international ECS Electrochemical Energy Summit (E2S). We invite you to take advantage of all this meeting has to offer by participating in as many technical and social events as time permits!

Featured Speakers



Plenary Session and ECS Lecture

Monday, October 28, 2013, 1700h
*Grand Ballroom A, Tower 2,
Grand Ballroom Level*

America's Energy Future: Science, Engineering, and Policy Challenges

by Mark S. Wrighton

MARK S. WRIGHTON was named the 14th Chancellor of Washington University in St. Louis in 1995, following more than two decades at the Massachusetts Institute of Technology, where he was Professor of Chemistry, head of the department, and later Provost. Chancellor Wrighton earned a bachelor's degree in chemistry from Florida State University and a PhD in chemistry from the California Institute of Technology. Active in public and professional affairs, he has served on numerous governmental panels, including service as Vice Chair of the NRC Committee on America's Energy Future.

In 2007 the National Research Council convened a committee to study America's Energy Future, and the report from the committee became public in the spring of 2009. This presentation will include a summary of important events and issues that have arisen since the report was issued, including expansion of the use of natural gas in the United States, the devastating impact from the tsunami in Japan at the Tokyo Electric Power Company's plant in Fukushima, international tensions surrounding the photovoltaic industry, and a rise in CO₂ concentration in the global atmosphere above the 400 ppm level in 2013.

Efforts are being made to assure that America's future energy needs are met at an affordable cost while minimizing adverse effects on the environment. However, to achieve this goal, many challenges must be overcome in a number of critical areas, many of which must be addressed by the science and engineering community. Other challenges require leadership on local, state, national, and international policy. The challenges and opportunities to meet America's future energy needs will be summarized.



ECS Olin Palladium Award Lecture

Monday, October 28, 2013, 1400h
*Grand Ballroom A, Tower 2,
Grand Ballroom Level*

Mathematical Modeling of Lithium Ion Cells and Batteries

by Ralph E. White

RALPH E. WHITE is a Professor of Chemical Engineering and a Distinguished Scientist at the University of South Carolina. He received his PhD from the University of California at Berkeley in 1977 under the direction of Professor John Newman. Dr. White taught at Texas A&M University for almost 16 years before moving to the University of South Carolina where he has served as the Chair of the Department of Chemical Engineering and the Dean of the college. Dr. White has authored or coauthored more than 320 peer-reviewed journal articles, primarily on electrochemical systems, and has graduated 50 PhD and 38 MS students. Currently, he and members of his research group are working on projects on batteries and numerical methods. Dr. White is a former Treasurer of ECS, and he is a Fellow of ECS, American

Institute of Chemical Engineers, and AAAS. He has received several awards including the 2000 AESF Scientific Achievement Award for mathematical modeling of the electrodeposition of alloys.

A physics-based model of a lithium ion cell can be used to make predictions of the voltage of the cell as a function of time for charge and discharge given the design parameters and operating conditions of the cell. Such a model enables cell designers to determine the effect of changing design parameters on cell performance before building the cell. This model can also be used to design a thermal management system to ensure that the heat generated in the cell is removed before causing overheating and thermal runaway of the cell. It could also be used to make predictions about the life of the cell given information about the anticipated operational conditions. This physics-based model of a lithium ion cell could also be extended to include multiple spatial dimensions to predict the temperature distribution in a lithium ion cell for a given set of conditions. It is now possible to use such physics-based models of lithium ion cells to simulate the performance of lithium ion battery packs.

These physics-based battery pack models can be used to design thermal management systems, balancing circuits to extend the life of the battery packs, and control algorithms to ensure successful operation of the battery pack over the life of the pack. A review of the development of physics-based lithium ion cell and battery pack models will be presented.

Featured Speakers *(continued)*



ECS Carl Wagner Memorial Award Lecture

Monday, October 28, 2013, 1450h
Grand Ballroom A, Tower 2,
Grand Ballroom Level

Multiple Proton-coupled Electron Transfer in Electrocatalysis: Theory vs. Experiment

by Marc T. M. Koper

MARC T. M. KOPER is Professor of Surface Chemistry and Catalysis at Leiden University, The Netherlands. He received his PhD in 1994 from Utrecht University, The Netherlands, in the field of electrochemistry with a thesis on electrochemical oscillations. He was an EU Marie Curie postdoctoral fellow at the University of Ulm, Germany and a Fellow of Royal Netherlands Academy of Arts and Sciences (KNAW) at Eindhoven University of Technology, before moving to Leiden University in 2005. Dr. Koper has also been a visiting professor at Hokkaido University, Japan. He is the recipient of various research grants of the Netherlands Organization

of Scientific Research (NWO), including a VICI grant in 2005 and a TOP grant in 2011. He was the recipient of a Japan Society for the Promotion of Science (JSPS) Long-Term Fellowship Award in 2011, and the Hellmut Fischer Medal of the German Society for Chemical Technology (DECHEMA) in 2012.

This talk will outline a simple but general theoretical analysis for multiple proton-electron transfer reactions, based on the microscopic theory of proton-coupled electron transfer reactions, recent developments in the thermodynamic theory of multi-step electron transfer reactions, and the experimental realization that many multiple proton-coupled electron transfer reactions feature decoupled proton-electron steps in their mechanism. It is shown that decoupling of proton and electron transfer leads to a strong pH dependence of the overall catalytic reaction, implying an optimal pH for high catalytic turnover, and an associated optimal catalyst at the optimal pH.

When more than one catalytic intermediate is involved, scaling relationships between intermediates may dictate the optimal catalyst and limit the extent of reversibility that may be achievable for a multiple proton-electron-transfer reaction. These scaling relationships follow from a valence-bond-type binding of intermediates to the catalyst surface. The theory is discussed in relation to the experimental results for a number of redox reactions that are of importance for sustainable energy conversion, primarily focusing on their pH dependence.

Meeting Events-at-a-Glance

Please visit the San Francisco meeting page for a list of Committee Meetings. Visit www.electrochem.org.

SUNDAY, OCTOBER 27

- 0800h..... Technical Sessions begin
(check Technical Program for exact time)
- 0900h..... Short Courses
- 1400h..... Professional Development Series:
Essential Elements for Employment Success
- 1500h..... ECS Electrochemical Energy Summit (E2S)

MONDAY, OCTOBER 28

- 0800h..... Technical Sessions begin
(check Technical Program for exact time)
- 0800h..... ECS Electrochemical Energy Summit (E2S),
featuring the Energy–Water Nexus Symposium (A3)
- 0800h..... Professional Development Series:
Essential Elements for Employment Success
- 0930h..... Technical Session Coffee Break
- 1200h..... Professional Development Series: Résumé Review
- 1400h..... *2013 Olin Palladium Award Lecture: Mathematical Modeling of Lithium Ion Cells and Batteries*
by Ralph White
- 1450h..... *2013 Carl Wagner Memorial Award Lecture: Multiple Proton-coupled Electron Transfer in Electrocatalysis: Theory vs. Experiment*
by Marc Koper
- 1700h..... The ECS Lecture—America’s Energy Future: Science, Engineering, and Policy Challenges
by Mark S. Wrighton
- 1830h..... Student Mixer (by invitation only;
contact meetings@electrochem.org for details)

TUESDAY, OCTOBER 29

- 0800h..... Technical Sessions begin
(check Technical Program for exact time)
- 0800h..... Professional Development Series: Résumé Review
- 0930h..... Technical Session Coffee Break
- 1300h..... Technical Exhibit
- 1700h..... ECS Publications–Author Information Session
- 1800h..... Technical Exhibit; General and Student Poster Sessions

WEDNESDAY, OCTOBER 30

- 0800h..... Technical Sessions begin
(check Technical Program for exact time)
- 0800h..... Professional Development Series: Résumé Review
- 0900h..... Technical Exhibit
- 0930h..... Technical Session Coffee Break in Exhibit Hall
- 1800h..... Student Poster Awards Presentation in Exhibit Hall
- 1800h..... Technical Exhibit and General Poster Session

THURSDAY, OCTOBER 31

- 0800h..... Technical Sessions begin
(check Technical Program for exact time)
- 0900h..... Technical Exhibit
- 0930h..... Technical Session Coffee Break in Exhibit Hall

FRIDAY, NOVEMBER 1

- 0800h..... Technical Sessions begin
(check Technical Program for exact time)

Short Courses and Workshops

Six Short Courses will be offered on Sunday, October 27, 2013, from 0900h to 1630h. The registration fee for the Short Courses is \$425 for ECS Members and \$520 for Nonmembers. Students may register for a Short Course at a 50% discount—ECS Student Members: \$212.50, and Nonmember Students: \$260.

The Short Course registration fee includes participation in the course, text materials, continental breakfast, luncheon, and refreshment breaks; the **Short Course Registration fee does not include or apply to the general Meeting Registration**, and it is not applicable to any other activities of the meeting. **Pre-registration for Short Courses is required—the deadline is September 27, 2013**

Please visit the San Francisco meeting page of the ECS website for full course descriptions and instructor biographies: www.electrochem.org.

SHORT COURSE #1

Advanced Impedance Spectroscopy

Mark E. Orazem, Instructor

This course is intended for chemists, physicists, materials scientists, and engineers with an interest in applying electrochemical impedance techniques to study a broad variety of electrochemical processes. The course is best suited for an attendee who has some experience with making impedance measurements and wants to develop a deeper understanding of the technique. The attendee will develop a basic understanding of the technique, the sources of errors in impedance measurements, the manner in which experiments can be optimized to reduce these errors, and the use of regression to interpret measurements in terms of meaningful physical properties.

SHORT COURSE #2

Fundamentals of Electrochemistry: Basic Theory and Kinetic Methods

Jamie Noël, Instructor

This course, fully revised to include more practical examples and a more manageable volume of material, covers the basic theory and application of electrochemical science. It is targeted toward people with a physical sciences or engineering background who have not been trained as electrochemists, but who want to add electrochemical methods to their repertoire of research approaches. There are many fields in which researchers originally approach their work from another discipline but then discover that it would be advantageous to understand and use some electrochemical methods to complement the work that they are doing.

SHORT COURSE #3

Polymer Electrolyte Fuel Cells

Hubert Gasteiger and Thomas Schmidt, Instructors

This course develops the fundamental thermodynamics and electrocatalytic processes critical to polymer electrolyte fuel cells (PEFCs, including direct methanol and alkaline membrane FCs). In the first part, the instructors will discuss the relevant half-cell reactions, their thermodynamic driving forces, and their mathematical foundations in electrocatalysis theory (e.g., Butler-Volmer equations).

In the second part of the course, the instructors will illuminate the different functional requirements of actual PEFC (incl. DMFC and AMFC) components and present basic *in situ* diagnostics (Pt surface area, shorting, H₂ crossover, electronic resistance, etc.). This will be used to develop an in-depth understanding of the various voltage loss terms that constitute a polarization curve. Finally, the instructors will apply this learning to describe the principles of fuel cell catalyst activity measurements, the impact of uncontrolled-operation events (e.g., cell reversal), and the various effects of long-term materials degradation.

To benefit most effectively from this course, registrants should have completed at least their first two years of a bachelor's program in physics, chemistry, or engineering; or have several years of experience with PEFCs.

Short Course Refund Policy: Written requests for Short Course refunds will be honored only if received at ECS headquarters by October 21, 2013. All refunds are subject to a 10% processing fee and requests for refunds must be made in writing and e-mailed to customer.service@electrochem.org. Refunds will not be processed until AFTER the meeting.

All courses are subject to cancellation pending an appropriate number of advance registrants. **Before making any flight or hotel reservations, please check to make sure the Short Course that you have selected is being offered.**

SHORT COURSE #4

Operation and Exploitation of Electrochemical Capacitor Technology

John R. Miller, Instructor

Electrochemical capacitors (ECs), often referred to by the product names supercapacitors or ultracapacitors, are receiving increased attention for use in power sources of many applications because they offer extraordinarily high reversibility, provide unexcelled power density, and have exceptional cycle-life.

This tutorial is targeted at technologists interested in understanding and exploiting electrochemical capacitor technology. Basics are first covered that describe the nature and significance of electric double layer charge storage, the general design of such products, and the similarities and differences between these devices and traditional capacitors and batteries. The goal is to provide basic understanding, necessary tools, and sufficient operating information to allow direct and successful advancement and/or exploitation of electrochemical capacitor technology.

SHORT COURSE #5

Introduction to Solid Oxide Fuel Cell Science and Technology

Stuart B. Adler and Nguyen Minh, Instructors

The objective of the course is to provide an introduction to Solid Oxide Fuel Cell (SOFC) science & technology, with emphasis in the following areas:

- Process/System Design and Integration
- Stack Design
- Cell Materials and Fabrication
- Performance and Other Operating Characteristics
- Cell Modeling and Diagnostics

To benefit most effectively from the course attendees should have completed the first two years of a Bachelor's program in physics, chemistry, engineering, or equivalent, and possess basic computer skills (spreadsheet calculations). Various course materials will be provided however, attendees should bring a laptop computer, hand calculator, writing implement, and note paper.

SHORT COURSE #6

Micro/Nanofabrication of Chemical and Biosensors

Peter J. Hesketh, Gary W. Hunter, and Zoraida P. Aguilar, Instructors

This course will cover micro/nanofabrication techniques for chemical and biosensors. Fabrication processes include physical vapor deposition, oxidation and diffusion in silicon, chemical vapor deposition, atomic layer deposition, plasma etching, in addition to photo and electron beam lithography. As nanotechnology is rapidly growing the methods for nanoscale fabrication of structures, including ion beam, electron beam, vapor-liquid-solid growth, and electroplating will be addressed.

Professional Development Workshops and Career Opportunities

Several targeted professional development workshops will be presented throughout the meeting (see Meeting Events-at-a-Glance on page 25). These important workshops will provide attendees with up-to-date information on enhancing career opportunities through resume refinement and networking.

The professional development workshops are open to all registered attendees at no additional cost.

We also invite you to visit the Redcat booth in the Exhibit Hall or redcatresearch.org to discover the latest career opportunities in electrochemistry and solid state science and technology.

Award Winners

See pages 24-25 for biographies of the Olin Palladium award winner and the Carl Wagner Memorial award winner. For additional information and schedule of award presentations, please see the General Meeting Program on the San Francisco page of the ECS website: www.electrochem.org.

2013 Class of ECS Fellows

Established in 1989, the designation of Fellow of The Electrochemical Society is awarded for individual contributions and leadership in the achievement of science and technology in the area of electrochemistry and solid state sciences and current active participation in affairs of ECS.



HECTOR ABRUÑA, Emile M. Chamot Professor of Chemistry, is the Director of the Energy Materials Center at Cornell (emc2) and the Center for Molecular Interfacing (cmi). He completed his graduate studies with Royce W. Murray and Thomas J. Meyer at the University of North Carolina at Chapel Hill in 1980 and was a postdoctoral research associate with Allen J. Bard at the University of Texas at Austin.

After a brief stay at the University of Puerto Rico, he came to Cornell in 1983. He was Chair of the Department of Chemistry and Chemical Biology from 2004-2008.

Dr. Abruña has received numerous awards including a Presidential Young Investigator Award, Sloan Fellowship, J. S. Guggenheim Fellowship and J. W. Fulbright Senior Fellow, the Electrochemistry Award for the American Chemical Society (2008), and the C. N. Reilley Award in Electrochemistry for 2007. He was elected Fellow of the American Association for the Advancement of Science in 2007, member of the American Academy of Arts and Sciences in 2007, and Fellow of the International Society of Electrochemistry in 2008. He received the ECS Physical and Analytical Electrochemistry Division David C. Grahame Award in 2009, the Faraday Medal of the Royal Society in 2011, and in 2013, the Brian Conway Prize of the International Society of Electrochemistry.

Dr. Abruña is the coauthor of 400 publications and has presented over 500 invited lectures worldwide. Out of the 43 students that, to date, have obtained a PhD under his direction, 12 have gone on to faculty positions.



NANCY DUDNEY is a distinguished researcher in the Materials Science and Technology Division at Oak Ridge National Laboratory. She received degrees from the College of William and Mary (BS, chemistry) and MIT (PhD, ceramic materials science and engineering) and began work at Oak Ridge National Laboratory as a Wigner Research Fellow in the Solid State Division. Dr. Dudney's research interests

include: lithium battery materials and architectures, thin film and composite electrolytes, thin film materials for batteries, and mixed ionic-electronic conduction in oxides. She helped pioneer the development of commercial thin-film lithium batteries and continues to utilize thin film processing and materials in her research toward the stabilization of battery interfaces. Her goal is to promote development of safe and efficient batteries for vehicles and renewable energy.

Dr. Dudney is an inventor with 12 issued and 11 pending patents. She authored more than 150 peer-reviewed journal publications and book chapters. Her inventions won four R&D 100 awards and three awards of Excellence in Technology Transfer by Federal Laboratory Consortium. Recognition was also awarded by the Association of Women in Science and YMCA's Tribute to Women.

Dr. Dudney is a dedicated ECS member and served various positions from member-at-large to chair on the executive board at the Battery Division. She organized numerous symposia and conferences. She also served for three decades as associate editor for the *Journal of the American Ceramic Society*. Her tireless service to professional societies facilitates the communications in the research community.



GARY HUNTER is the technical lead for the Chemical Species Gas Sensors Team and the lead for Intelligent System Hardware in the Sensors and Electronics Branch at NASA Glenn Research Center. Since his arrival at NASA Glenn, he has been involved with the design, fabrication, and testing of sensors, especially chemical species gas sensors. He has worked closely with academia and industry in

developing a range of sensor technologies and sensor systems using a number of different sensor materials and sensing approaches. This work has included the use of both micro- and nanotechnology as well as the integration of sensor technology into smart systems. Dr. Hunter's contributions range from research to technical management in fields including engine emissions, environmental monitoring, breath monitoring, fire detection, leak detection, and high temperature wireless sensors. He has been involved with development projects ranging from: producing a sensor for detecting fuel leaks for use on launch vehicles, a Venus seismometer to work on the planet's surface, and a new fabrication method for sensors based on nanotechnology.

Dr. Hunter has been active in the application of the resulting sensor technology both in NASA and industry. In 1995, he was co-recipient of an R&D 100 for the development of an Automated Hydrogen Leak Detection System used on the Ford automotive assembly line. The technology he has developed has been chosen, demonstrated, or applied in applications such as the Space Shuttle, NASA Helios Vehicle, International Space Station, Jet Engine Test Stands, and the Ford U Car. In 2005, he was co-recipient of an R&D 100 for a fire detection system that showed a zero false alarm rate in FAA testing.

In 2011, Dr. Hunter received the NASA Glenn Research Center Abe Silverstein Medal for pioneering research and commercialization of chemical gas sensor microsystems for NASA missions. He has served as Chair of the ECS Sensor Division, organized a number of symposia, taught short courses on chemical sensing, and has a significant number of papers, talks, and invited talks.



JIRI (ART) JANATA is Georgia Research Alliance Eminent Scholar in the School of Chemistry and Biochemistry, Georgia Institute of Science and Technology. Between 1991 and 1997, he was an Associate Director of Environmental Molecular Sciences Laboratory, Pacific Northwest National Laboratory, in Richland, Washington. Prior to that appointment, Dr. Janata was Professor of Materials Science and Professor of Bioengineering at the University of Utah for seventeen years. He came to Utah after leading an analytical development group at Corporate Laboratory of Imperial Chemical Industries, Ltd., in England for eight years. Born in Czechoslovakia, Prof. Janata received his PhD degree in analytical chemistry from the Charles University (Prague) in 1965. His academic training included postdoc position at the University of Michigan with Harry B. Mark Jr.

Dr. Janata has over 230 peer-reviewed publications to his credit, over 20 patents and 22 contributed book chapters. The main area of his research, chemical sensors, has been summarized in the popular graduate textbook *Principles of Chemical Sensors*, first published by Academic Press in 1989 and again in 2010 by Springer, as the updated 2nd Edition.

In the course of his academic career, Professor Janata trained over 80 PhD and numerous MSc and postdoctoral students. He held visiting professorships at Universität der Bundeswehr, EPFL Lausanne, Tokyo Institute of Technology, ETH Zurich and at the Weizmann Institute, Israel. He is recipient of Senior Scientist Prize from the Alexander von Humboldt Foundation, Creativity Award from the National

(continued on next page)

Award Winners—ECS Fellows

(continued from previous page)

Science Foundation (USA), and in 1994, was the first ECS Sensor Division Outstanding Research Award. In 2001, Dr. Janata was named an Honorary Member of the Czech Learned Society. Besides organizing numerous professional meetings, he has chaired three Gordon Research Conferences on Chemical Sensors and Interfaces, Energy and Environment and Electrochemistry, respectively. In 1995, he was the Plenary Speaker at the Electrochemical Society Meeting in Reno.

Dr. Janata's general interests include interfacial chemistry and radioanalytical chemistry. His current hot topic is the synthesis of new materials for chemical sensors and catalysis, based on composites of organic semiconductors and atomic metals.



JOHNA LEDDY holds a BA from Rice University, a PhD from the University of Texas, and completed a postdoctoral appointment in the Fuel Cell Program at Los Alamos National Labs. She was Assistant Professor at Queens College, Graduate Program of the City University of New York. In 1991, she moved to the Chemistry Department, University of Iowa where she has thus far mentored 15 PhD

graduates. Their work on magnetoelectrocatalysis in fuel cells, batteries, solar cells, breath sensors, electrochemical ammonia generation with cyanobacteria, and sonoelectrochemistry have generated numerous patents and patent applications.

Dr. Leddy's research interests include magnetic effects on electron transfer reactions and electrocatalysis. Magnetoelectrocatalysis improves energy storage and generation systems that include batteries, fuel cells, hydride storage, dye sensitized solar cells, and photogeneration of hydrogen on p-Si. Magnetic fields facilitate electron transfer reactions for adsorbates such as CO oxidation on platinum. Magnetic microparticles on and in electrodes are used to introduce magnetic fields. Models for magnetic effects on electron transfer characterize results of temperature dependent experiments. In essence, to transfer an electron, it is necessary to transfer the charge and the spin. Magnetic fields interact with the spin. Other research interests include physical manipulation of electrocatalysis with sound energy, electrochemical energy systems, voltammetric characterization of films on electrodes, electroanalysis, and electrochemical modeling.

Dr. Leddy has been actively involved with ECS. She has served on the Executive Committee of the Physical and Analytical Electrochemistry Division (PAED) and more than half of the Standing Committees of the Society. She recently completed a term as Secretary of the Society. Professor Leddy has also served as President of the Society for Electroanalytical Chemistry.



SHELLEY MINTER is a USTAR Professor in both the Departments of Chemistry and Materials Science and Engineering at the University of Utah. She received her PhD in Analytical Chemistry at the University of Iowa in 2000 under the direction of Professor Johna Leddy. After receiving her PhD, she spent 11 years as a faculty member in the Department of Chemistry at Saint Louis University before moving to the University of Utah in 2011.

During both her time at Saint Louis University and University of Utah, Dr. Minter has been involved with ECS, including roles as Chair, Vice-Chair, Secretary-Treasurer, and Member-at-Large of the Physical and Analytical Electrochemistry Division (PAED), as well as being a member of the Honors & Awards Committee, the New Technology Subcommittee, and the Symposium Planning Subcommittee. She is currently a Technical Editor for the *Journal of The Electrochemical Society* and *ECS Electrochemistry Letters*.

Professor Minter has published more than 150 publications and over 250 presentations at national and international conferences. She has won several awards including the Missouri Inventor of

the Year, International Society of Electrochemistry Tajima Prize, and the Society of Electroanalytical Chemists' Young Investigator Award. In 2003, she cofounded Akermin, Inc. with her previous graduate student, which has focused on the commercialization of her biobattery technology and has moved on to carbon capture technology. Her research research interests are focused on electrocatalysis and bioanalytical electrochemistry. She has expertise in bioelectrochemistry and bioelectrocatalysis for biosensors and biofuel cells.



SANJEEV MUKERJEE is a professor in the Department of Chemistry and Chemical Biology, Northeastern University, where he has been since September 1998. He also heads the newly-created center for Renewable Energy Technology at Northeastern University and its subset the Laboratory for Electrochemical Advanced Power (LEAP).

Dr. Mukerjee's research on charge transfer dynamics at both two and three dimensional electrochemical interfaces encompasses materials development, *in situ* synchrotron spectroscopy and electroanalytical methods. In addition, new computational initiatives are in progress involving both molecular modeling and simulation of multiple electron scattering in the context of *in situ* synchrotron XANES method.

The current projects of the group include materials development for new electrocatalysts, polymer electrolyte membranes, and high energy density (and capacity) cathode materials for aqueous and non-aqueous storage cells. Fundamental understanding of structure property relationships are in concert with applications. In this context two startup companies which the group helped found, Encite Corp, Burlington, MA and Protonex Corp., Westboro, MA are notable.

In addition, partnerships with de Nora, and BASF, Proton Onsite and Automotive Fuel Cell Corporation (Canada) are ongoing for developing a number of fuel cell and electrolyzer technologies. Federal funding comes from the Army Research Office, Department of Energy, National Science Foundation, Air Force Office of Scientific Research and National Institute of Technology-Advanced Technology Program. Professor Mukerjee is an author of 106 peer-reviewed publications with an h-factor of 45.



ELIZABETH OPILA is an associate professor in materials science and engineering at the University of Virginia in Charlottesville, where she has been since 2010. Prior to that, she was Materials Research Engineer at the NASA Glenn Research Center in Cleveland, OH for 19 years, where she worked primarily on ceramics for applications in turbine engines, rocket engines, hot structures for thermal protections

systems, and other power and propulsion applications.

Dr. Opila's primary research focus includes understanding thermodynamics and kinetics of material degradation reactions in extreme environments, development of life prediction methodology based on understanding of fundamental chemical reaction mechanisms, and materials development for protection of materials from extreme environments. Additional research areas of interest include defect chemistry of functional oxides.

Dr. Opila received her BS in ceramic engineering from the University of Illinois, her MS in materials science from the University of California Berkeley, and her PhD in materials science from the Massachusetts Institute of Technology. She is currently a consultant for the NASA Engineering and Safety Center—Materials Technical Discipline Team. She is a member of ECS and past chair of the High Temperature Materials Division. She is also a member of the American Ceramic Society, TMS (The Minerals, Metals & Materials Society), and the Materials Research Society. She has over 100 publications as well as six patents.



JAN ROBERT SELMAN is currently the University Distinguished Research Professor at the Illinois Institute of Technology (IIT), Chicago. He has served on the faculty of IIT since 1975 and retired from teaching in 2002. He received his Ingenieur (chem.tech.) diploma in 1961 in chemical technology from Delft Technical University in the Netherlands, and completed graduate studies in chemical engineering at the

University of Wisconsin at Madison (MS, 1962) and the University of California at Berkeley (PhD, 1971). After working at Argonne National Laboratory in high-temperature batteries, he joined IIT and established a graduate research program focusing on high temperature batteries and fuel cells (in particular MCFC and SOFC). Since retirement from teaching, his research is focused on fundamentals of wetting by molten carbonate and on the technology of the Direct Carbon Fuel Cell (DCFC), as well as SOFC component fabrication issues. [In the experimental part of this work he is cooperating closely with Dr. John Cooper (Direct Energy, Inc.), and professors Philip Nash and Leon Shaw (IIT)].

More than 30 doctoral dissertations, 40 master's theses, and 150 journal articles were a result of Professor Selman's research program at IIT, and most of his former graduate students are now working in energy research, industry, or on the faculty of colleges or universities. With his group he authored or coauthored more than 150 scholarly articles (of which 45 are in the *Journal of The Electrochemical Society* or other ECS publications). He coedited 12 books or proceedings volumes. The most notable of his contributions to electrochemistry and electrochemical engineering have been in molten carbonate fuel cell technology and engineering, and in the thermal analysis and heat management of lithium-ion batteries. He is co-inventor on a dozen U.S. patents, among which are basic patents for thermal management of lithium-ion batteries by phase change materials. He works together with his former student and colleague Said Al-Hallaj (UIC, Chicago) on commercializing heat management and thermal run-away control of lithium-ion batteries (AllCell Technologies LLC).

Prof. Selman's contributions within ECS were recognized earlier by the Energy Technology Research Award (2002) and his international contributions by the Grove Medal 2010 in Fuel Cell Science and Technology.



KALPATHY SUNDARAM is a senior professor and the graduate coordinator in the Department of Electrical and Computer Engineering at the University of Central Florida. He received his BSc (Special) degree in physics from University of Kerala, India, in 1970. He received the BE degree in electrical and communication engineering from Indian Institute of Science, Bangalore, in 1973, and completed his MTech

and PhD degrees in electrical engineering from Indian Institute of Technology, Bombay, in 1975 and 1980 respectively. In 1981, Professor Sundaram joined McMaster University, Hamilton, Canada, as Post-Doctoral Research Fellow. He joined the Opto-Electronics Inc., Oakville, Canada, as a Research Scientist in 1984. Later in 1987, he joined the Department of Electrical and Computer Engineering at the University of Central Florida.

Spanning more than two decades of continuous research, Professor Sundaram has provided the foundation of thin film technology for low dielectric constant and high-k dielectric materials. His technical contributions in non-traditional low-k materials such as silicon carbon nitride (SiCN), silicon carbon boron nitride (SiCBN), and boron carbon nitride (BCN) are cited as the original works. In addition, his research contribution in the area of non-traditional high-k materials such as SiN, SiON and CeO₂ for metal-oxide-semiconductors (MOS) structures are well known and highly regarded by both academic and industrial researchers and engineers for solving fundamental problems in high-k materials. In particular, his contributions to the systematic comparison of work functions for various combinations of Pt-Ru binary alloys for replacement of the poly-Si gate in p-MOS

with a high-k gate dielectrics and studies on zinc oxide (ZnO) films for transparent conducting electrode applications in photovoltaics are highly considered by both the national and international scientific and engineering communities.

Professor Sundaram has served in various leadership roles in the Dielectric Science and Technology Division of ECS including Award Chair, Treasurer, Secretary, Vice-Chair, and Chair. Professor Sundaram has published more than 130 papers. His efforts in education have resulted in three University for Excellence in Teaching awards given by the Board of Trustees and the IEEE Region three Outstanding Engineering Educator Award.



ENRICO TRAVERSA is currently a professor of materials science and engineering at the King Abdullah University of Science and Technology (KAUST). He received his "Laurea" (Italian Doctoral Degree) Summa cum Laude, in chemical engineering from the University of Rome La Sapienza in 1986. Professor Traversa joined the University of Rome Tor Vergata in 1988, and since 2000, is a professor of materials

science and technology (now on leave of absence). During his tenure at the University, he was the Director of the PhD Course of Materials for Health, Environment and Energy from 2001-2008.

From 2009 to 2012, Dr. Traversa was a principal investigator at the International Research Center for Materials Nanoarchitectonics (MANA) at the National Institute for Materials Science (NIMS), Tsukuba, Japan, leading a unit on Sustainability Materials. In 2012-2013, he was the Director of the Department of Fuel Cell Research at the International Center for Renewable Energy, Xi'an Jiaotong University, China.

Professor Traversa is an author of more than 490 scientific papers (more than 300 of them published in refereed international journals) and 16 patents, and edited 28 books and special journal issues. He is listed in the Essential Science Indicators/Web of Science as a highly-cited researcher, both in the Materials Science and Engineering categories, and his h-index is 42.

Elected in 2007 in the World Academy of Ceramics, Dr. Traversa was also elected to its Advisory Board (2010-2014). In 2011, he was recipient of the Ross Coffin Purdy Award of the American Ceramic Society for the best paper on ceramics published in 2010. He was recipient of a "1000 Talent" Scholarship from the Government of China in 2011. He served on several ECS committees, and was Chair of the High Temperature Materials Division (2009-2011). From 2003 to 2009, he was Member of the International Relations Committee of the Materials Research Society (MRS). He is currently Editor-in-Chief of *Materials for Renewable and Sustainable Energy* and an Associate Editor for the *Journal of Nanoparticle Research*. He is one of the Volume Organizers of *MRS Bulletin* for 2014.



MARTIN WINTER has been researching in the field of electrochemical energy storage and conversion for more than 20 years. His focus has been on the development of new materials, components, and cell designs for batteries and supercapacitors, in particular lithium-ion batteries. Professor Winter is professor of applied materials science for electrochemical energy storage and conversion at the Institute of

Physical Chemistry at Münster University, Germany. The full professorship developed from an endowed professorship funded by the companies Volkswagen, Evonik Industries, and Rockwood Lithium from 2008 to 2012.

Currently, Professor Winter is the scientific head of the MEET Battery Research Center at Münster University. MEET (Münster Electrochemical Energy Technology) combines outstanding equipment with an international team of about 130 scientists working on the research and development of innovative electrochemical energy storage devices.

(continued on next page)

Award Winners—ECS Fellows

(continued from previous page)

Professor Winter graduated from Münster University. After obtaining his PhD, he worked as post-doctoral research fellow at the Paul Scherrer Institute in Switzerland and later as University Assistant at the University of Technology (TU) in Graz, Austria. Martin Winter then held a full professorship at the Institute of Chemical Technology of Inorganic Materials at the TU Graz. In 2008, he returned to Münster and initialized the process of founding the MEET Battery Research Center.

Professor Winter has been a member of ECS since 1997, a (JES) Associate Editor, from 2004-11, and since 2011, is a technical editor for the *Journal of The Electrochemical Society* and *ECS Electrochemical Letters*. He is also the spokesperson of the Innovation Alliance LIB 2015, which was initialized by the German Federal Ministry of Education and Research. He is now an associate of the National Platform E-Mobility (NPE), which consults to the German chancellor and government. Dr. Winter is also the head of the research council of the Battery Forum Germany, which advises the German Ministry of Science and Education in the field of electrochemical energy storage.

Professor Winter has received the ECS Battery Technology Award and the Research Award of the International Battery Materials Association, among other honors. He has published more than 350 articles in journals, books and proceedings, filed 26 patents and 40 patent applications, and been invited to give more than 300 keynote and plenary presentations during his scientific career.

2012 Norman Hackerman Young Author Awards

The Norman Hackerman Young Author Awards were established in 1928 for the two best papers published in the Journal of The Electrochemical Society—one for a paper in the field of electrochemical science and technology, and the other for solid state science and technology.

In the category of Electrochemical Science & Technology (EST), the winners were K. Skyes Mason and Kiersten C. Horning, for “Investigation of a Silicotungstic Acid Functionalized Carbon on Pt Activity and Durability for the Oxygen Reduction Reaction” (JES, Vol. 159, No. 12, p. F871).



KELLY “SYKES” MASON, completed his bachelor's degree in chemical and biochemical engineering at the Colorado School of Mines (CSM) in May of 2010. He continued into the graduate program for chemical engineering at CSM to research Pt-based fuel cell cathode catalysts, specifically with regards to catalyst support functionalization with heteropoly acid. He will be graduating in December 2013 and is

currently exploring possible career paths.



KIERSTEN HORNING began attending Colorado School of Mines (CSM) in the fall of 2010, where she studied to obtain a chemical engineering degree. In her sophomore year, she started working as a research assistant for Kelly S. Mason, a graduate student in Andrew Herring's Electrochemistry group. After being trained in microscopy, she analyzed Mason's fuel cell catalysts. She left CSM and will begin

studying nutritional science at Colorado State University this fall.

In the category of Solid State Science & Technology (SSST), the winner was Balavinayagam Ramalingam, for “Multi-Layer Pt Nanoparticle Embedded High Density Non-Volatile Memory Devices” (JES, Vol. 159, No. 4, p. H393).



BALAVINAYAGAM RAMALINGAM (Bala) is currently pursuing a PhD in electrical and computer engineering at the University of Missouri, Columbia (UMC) under the guidance of Shubhra Gangopadhyay. His research focuses on the development of sub-2 nm platinum nanoparticles for varied applications. He has identified a unique technique in the sputtering process; where use of low metal atom density

regions result in ultra-fine metal nanoparticles with homogeneous size distribution. He has also worked on probing these nanoparticles for size dependent properties in solid state devices and electronic sensors. Over four years, his work has aided in publishing nine articles in renowned journals. He also worked toward developing intelli switch for radar applications, with Justin Legarsky at UMC, and received his master's degree in 2009. He earned his bachelor's degree in engineering from India in 2007. Before resuming graduate school he joined the Indian Space Research Organization (ISRO) as a research assistant.

Battery Division Research Award



DORON AURBACH is a professor in the department of chemistry, a Senate member, and the director of the Clean-Tech Center at the Bar-Ilan University Institute of Nanotechnology and Advanced Materials (BINA). He is the leader of the Israel National Research Center for Electrochemical Propulsion (INREP), which includes 14 research groups from four leading academic institutions. He leads the

electrochemistry group (more than 40 people), which is the largest group of its kind at BIU and in Israel. He also serves as the chair of Israel National Labs Accreditation Authority. He was the chair of the Department of Chemistry during 2001-2005.

Professor Aurbach has directed more than 20 post-doctoral fellows, and 35 PhD students, and 45 MSc students have received their degrees under his supervision, several of whom have already developed very successful academic careers. He has published more than 430 papers in leading electrochemistry, materials science, and physical chemistry journals.

He is a Fellow of ECS (since 2008), ISE (since 2010), and MRS (since 2012), and serves the electrochemistry and power sources R&D community as technical or associate editor of three journals: *Journal of The Electrochemical Society*, *ECS Electrochemistry Letters*, and *Journal of Solid State Electrochemistry*. Dr. Aurbach has won several prizes, including the Kolthoff prize for excellence in chemistry (2013), the Israel Chemical Society (ICS) Prize of Excellence (2012), Landau Prize for Green Chemistry (2011), the Edwards Company Prize of the Israel Vacuum Society (IVS) for Research Excellence (2007), and the Technology Award of the ECS Battery Division (2005).

The scope of Professor Aurbach's research includes all aspects of non-aqueous electrochemistry, and many kinds of batteries: Li, Li ion, Mg, metal (Li,Al) air, Li sulfur and lead acid systems, super and pseudo capacitors, electronically conducting polymers, and water desalination by electrochemical means. The research work is systematic, includes intensive mechanistic studies and makes use of a very wide scope of electrochemical, microscopic, spectroscopic and structural techniques in order to reach full understanding of the correlation among surface chemistry, morphology, and structure of complicated electrochemical systems, related to the field of power sources.

Battery Division Technology Award



KARIM ZAGHIB received his MS (1987) and PhD (1990), both in electrochemistry, from the Institut National Polytechnique de Grenoble, France under the direction of Bernadette Nguyen. In 2002, he received the HDR (Habilitation a Diriger la Recherche) in materials science from the Université de Pierre et Marie Curie, Paris, France. From 1986 to 1990, Dr. Zaghib developed Al-Mn alloys as negative electrodes in molten salts for Li-ion batteries and Cu/Zn reaction displacement. In 1990, Dr. Zaghib published a new method to enhance the electrodeposition of metals. From 1990-1995, he was a post-doctoral fellow investigating chemical lithiation of graphite under a Saft-DGA contract. Then from 1992 to 1995, Dr. Zaghib was guest researcher for the Japanese Ministry of International Trade and Industry (METI); and in 1995 he was instrumental in introducing Li-ion technology to HydroQuébec, where he is currently the Director of the Conversion and Storage of Energy Department.

At Hydro-Québec, Dr. Zaghib initiated research collaborations, with Michel Armand on new materials and solid polymer electrolytes, and with Kim Kinoshita at LBNL to understand the oxidation and irreversible capacity loss of a range of particle sizes of natural graphite. During the past 18 years, Dr. Zaghib has actively collaborated with John Goodenough (University of Texas, Austin), and Christian Julien and Alain Mauger (Paris 6 University, France) to develop the olivine LiFePO₄ and Li-Ti-O electrode materials for Li-ion batteries. His current research activities include developing new battery technologies beyond Li-ion, such as solid state (Li-S, Li-air, Na, Mg, Ca) batteries.

Dr. Zaghib has published 240 refereed papers and has 164 international patents. In addition, he has served as editor or coeditor of 17 books. He was organizer or co-organizer of 50 symposia, meetings, workshops. In June 2010, he was the General Chair of the International Meeting on Lithium Batteries (IMLB) in Montréal, Québec. Dr. Zaghib is very active in ECS, and served as the Chair of the Energy Technology Division (2007-2009). Dr. Zaghib has received the International Electric Research Exchange (IERE) Research Award (2008) in Iguacu, Brazil, the International Battery Association (IBA) Research Award (January 2010), and was an elected ECS Fellow in 2011.

Corrosion Division H. H. Uhlig Award



MÁRIO FERREIRA received his degree in chemical engineering from Instituto Superior Técnico (Technical University of Lisbon), Portugal, and his PhD in corrosion science and engineering from UMIST-The University of Manchester Institute of Science and Technology, UK, in 1981. In 1993, he received his "Agregação" (Habilitation) title in chemical engineering, from Instituto Superior Técnico.

He was a professor at Instituto Superior Técnico from 1981 to 2001, when he moved to University of Aveiro where he is currently full professor of the Department of Materials and Ceramic Engineering (DEMaC). In 2011, he was nominated Director of DEMaC. From 2001 to 2009, he was also adjunct full professor of the chemical engineering department of Instituto Superior Técnico. Between 2003-2007, Dr. Ferreira served as Deputy Director-General for Higher Education in Portugal.

Dr. Ferreira is a member of several scientific societies, including ECS, the Portuguese Order of Engineers, Portuguese Materials Society, Portuguese Society of Electrochemistry (cofounder), Institute of Corrosion (UK), International Society of Electrochemistry, National Association of Corrosion Engineers (NACE), and Matsumae International Foundation (Japan). He is also a member of

the European Federation of Corrosion, currently serving as a member of its Board of Administrators, and of the International Corrosion Council where he is the Portuguese delegate.

Dr. Ferreira's main scientific interests are focused on the study of materials degradation, protection self-healing coatings, semiconducting properties of passive films, development of advanced materials, and ecological processes for surface treatments. He has edited four scientific books, published 10 book chapters and more than 250 articles on scientific journals (h-index = 43), and has presented more than 300 communications at conferences. He was responsible for 55 R&D projects, totally or for the Portuguese participation, co-financed by several national entities, by the European Commission (namely Framework Programmes), and NATO. He served in different scientific and advisory committees related to teaching and science management at national and international levels.

Electrodeposition Division Research Award



DANIEL LINCOT graduated from the French engineering School ESPCI-Paristech. He started his research in the field of photovoltaics, in 1978, with a PhD in the field of cadmium telluride solar cells at the solid state physics laboratory of CNRS. After his PhD, he joined CNRS in 1980 as permanent researcher in the laboratory of electrochemistry and analytical chemistry of Ecole Nationale Supérieure de Chimie de Paris (Chimie-Paristech) and carried out a Doctorat es Sciences in the field of semiconductor's photoelectrochemistry.

At CNRS, Dr. Lincot also focused on the electrodeposition of semiconductors thin films with cadmium telluride, copper indium gallium diselenide and zinc oxide, with a focus on mechanistic studies in relation with material's properties. He also carried out research on chemical bath deposition of sulfide semiconductors. These methods were successfully applied in the field of photovoltaics and led to the creation of the Institute of Research and Development of Photovoltaic Energy in 2005, which is now one of the most advanced research centers in the field of thin film photovoltaics.

Dr. Lincot received the silver medal of CNRS in 2004. In 2011, he received the Charles Eichner Prize of the French Society of Metallurgy and Materials (SF2M) for his achievements. He has published about 250 papers in international journals, given about 200 invited conferences, and deposited numerous patents.

High Temperature Materials Division J. Bruce Wagner, Jr. Award



PAUL E. GANNON grew up in Montana and earned BS and PhD degrees in chemical engineering at Montana State University (MSU) in 2002 and 2007, respectively. During his degree programs, he also held undergraduate and post-graduate research fellowships at Pacific Northwest National Laboratory in Richland, Washington, and worked as a research associate at Arcomac Surface Engineering, LLC

in Bozeman, Montana. In 2008, he accepted a faculty position in the Chemical and Biological Engineering (ChBE) department at MSU, where he has remained since.

At MSU Paul founded and directs the High-Temperature Materials Laboratory (HTML) within the ChBE department. The HTML supports both fundamental and applied research into the behavior of materials in extreme environments relevant to energy conversion systems. Projects include: high-temperature corrosion of metallic, ceramic and composite components within fuel cells, gas turbines, boilers, batteries and related systems; high-temperature corrosion protection via thin film surface coatings; and, high-temperature corrosion within ultra-purity poly-crystalline silicon production

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Award Winners—Divisions

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environments—upstream of photovoltaic and other semiconductor device manufacturing. Since 2008, the HTML at MSU has supported a full-time research engineer, one post-doc, six graduate students, six international visiting students, and over 30 undergraduate students. The HTML has also generated over \$1.2M in research funding from various federal, state and industry sources, and published over 20 research manuscripts in peer-reviewed journals.

Dr. Gannon has instructed over 1,200 students at MSU since 2009. He developed and instructs a 200-level university science core course, “Energy and Sustainability”, which grew from 48 to 180 students per semester. He authored a textbook to facilitate this course, and similar courses elsewhere entitled, *Introduction to Energy, Environment and Sustainability, 2nd Ed.*, published by Kendall Hunt in 2013. He also instructs “Chemical Engineering Thermodynamics” and “Materials Properties and Structures.” Dr. Gannon earned the MSU Excellence Award for Undergraduate Research Mentorship in 2011, a Certificate of Teaching Enhancement in 2012, and was nominated for the MSU Provost’s Awards for Excellence in Teaching and Undergraduate Research Mentoring in 2012 and 2013. He has also been a long-standing member of the ECS High Temperature Materials Division, and recently initiated an ECS student chapter at MSU.

Europe Section Heinz Gerischer Award



ARTHUR J. NOZIK is a Senior Research Fellow Emeritus (as of 2012) at the U.S. DOE National Renewable Energy Laboratory (NREL), a Research Professor in the Department of Chemistry and Biochemistry at the University of Colorado, Boulder, and a founding Fellow of the NREL/University of Colorado Renewable and Sustainable Energy Institute. He served as Associate Director of a DOE LANL/NREL

Energy Frontier Research Center (Center for Advanced Solar Photophysics (2009-12). Between 2006 and 2009 he was scientific director of the Colorado Center for Revolutionary Solar Photoconversion.

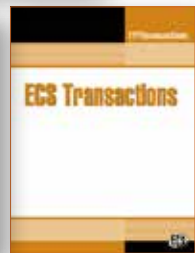
Dr. Nozik received a BChE from Cornell in 1959 and a PhD in Physical Chemistry from Yale in 1967. Before joining NREL in 1978, then known as the Solar Energy Research Institute (SERI), he conducted basic materials chemistry research in industry. Dr. Nozik’s research interests include size quantization effects in semiconductor nanocrystals and quantum wells, including multiple exciton generation from a single photon in quantum dots and via singlet fission in molecules; next generation solar photon conversion to electricity and solar fuels; photogenerated hot carrier effects and relaxation dynamics photomaterials; photoelectrochemistry of semiconductor-molecule interfaces; photoelectrochemical energy conversion; photocatalysis; optical, magnetic, and electrical properties of solids; and Mössbauer spectroscopy.

Dr. Nozik has published over 250 papers and book chapters in these fields, written or edited five books, holds eleven U.S. patents, and has delivered over 350 invited talks at universities, conferences, and symposia. He has served on numerous scientific review and advisory panels, chaired and organized many international and national conferences, workshops, and symposia. He has received several awards in solar energy research, including the 2013 Heinz Gerischer Award from the Europe Section ECS, 2011 ACS Gustavus Esselen Award at Harvard University, the 2008 Eni Award (hosted by the President of Italy), and the 2002 ECS Energy Technology Division Research Award.

Dr. Nozik has been a Senior Editor of *The Journal of Physical Chemistry* (1993-2005) and is on the editorial advisory board of the *Journal of Energy and Environmental Sciences and Nanoenergy*. A Special Festschrift Issue of *The Journal of Physical Chemistry* honoring Dr. Nozik’s scientific career appeared in the December 21, 2006 issue. He is a Fellow of the American Physical Society, the American Association for the Advancement of Science, and the Royal Society of Chemistry; he is also a member of ECS, the American Chemical Society, and the Materials Research Society.

Meet ECS Editors and Staff at the ECS Publications – Author Information Session

Tuesday, October 29, 2013, 1700-1800h
ECS Fall Meeting, San Francisco, CA
Yosemite B, Tower 2, Ballroom Level



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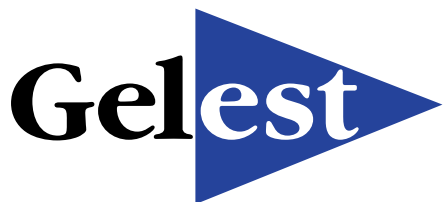
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This two-day summit is designed to foster an exchange between leading policy makers and energy experts about societal needs and technological energy solutions.

Sunday, October 27

Programs and Events

Afternoon



Robert Glass, Senior Scientist in the Physical and Life Sciences Directorate at Lawrence Livermore National Laboratory, will introduce three invited speakers and coordinate corresponding Questions & Answers.

Speakers



Congressman Jerry McNerney, (invited), 9th District of California, is the only renewable energy expert in Congress and sits on the U.S. House Committee on Energy & Commerce, as well as several subcommittees.



Heather Cooley, Co-Director of the Pacific Institute's Water Program, will speak about *The Water-Energy Nexus: Opportunities and Challenges*.



Meredith Younghein, State Water Resources Control Board and the Energy Division of the California Public Utilities Commission, will focus on *Program and Policy Innovations at the Water-Energy Nexus*.

Late afternoon–Early evening

**Energy Research Group Showcase, Student Poster Session,
and Reception with light refreshments**

An up-close look at the research that professional groups and students are conducting in all areas of energy efficiency. With an estimated 65% of the work of the ECS community focused on sustainability issues, our researchers and engineers play an important and relevant role in discovering solutions for current energy challenges.



www.electrochem.org

Monday, October 28

The Energy–Water Nexus Symposium (A3)

The morning program will include invited speakers who will examine the role of electrochemistry in addressing the energy–water nexus, from policy considerations to scientific breakthroughs.

Moderators



Eric Wachsman, Director of the University of Maryland Energy Research Center (UMD), is the William L. Creutz Centennial Chair in Energy Research with appointments in both the Department of Materials Science and Engineering and the Department of Chemical Engineering at UMD.



Carl Hensman joined the Water, Sanitation, and Hygiene team within the Global Development Program of the Bill & Melinda Gates Foundation in January 2012. Prior to joining the foundation, Dr. Hensman was an Energy Program Manager for King County, Washington (Seattle) focusing on resource recovery in the Wastewater Treatment Division.

Speakers and Presentations



Water and Energy Nexus

Mike Hightower, Distinguished Member of the Technical Staff, Energy Surety Engineering and Analysis Department at Sandia National Laboratories.



Effects of Climate Change on Water Availability

Antonio Busaliacchi, Earth System Science Interdisciplinary Center, University of Maryland, and Presidential Rank Meritorious Executive Award recipient.



Technical and Economic Opportunities for Water Purification and Sensing for WHO Development Goals

Amul Tevar, U.S. Department of Energy and ARPA-E Fellow.



Development of a Self-Contained, PV-Powered Domestic Toilet and Wastewater Treatment System

Michael Hoffman, California Institute of Technology, and 2012 Distinguished Visiting Fellow of the Royal Academy of Engineering, Global Vision Scholar at Tsinghua University.



Energy–Water Nexus Research and NSF

Bruce Hamilton, Program Director, National Science Foundation (NSF), and recipient of the NSF Director's Award for Meritorious Service.

The mid-day program will include a panel discussion and complimentary lunch with the moderators and invited speakers.

The afternoon program will include all of the scheduled A3 Technical Sessions.

The early evening program will include the **Plenary Session & The ECS Lecture**



America's Energy Future: Science, Engineering, and Policy Challenges

Mark S. Wrighton, 14th Chancellor of Washington University, St. Louis, and Past Provost of the Massachusetts Institute of Technology.

Technical Exhibit

The ECS Technical Exhibit is always the talk-of-the-meeting—technical exhibits offer a popular networking opportunity as attendees gather together with colleagues and meet new contacts. The exhibitors in San Francisco will showcase instruments, materials, systems, publications, and software, and other products and services, and many will provide demonstrations. Complimentary coffee breaks are scheduled on Wednesday and Thursday at 0930h in the Exhibit Hall. In addition, the Poster Sessions and receptions will be held in the Exhibit Hall on Tuesday and Wednesday evenings, beginning at 1800h.

Exhibit Hours

Grand Ballroom, Grand Ballroom Level

Tuesday, October 29

Daytime..... 1300-1600h
Evening, *includes the General & Student
Poster Sessions and Reception*..... 1800-2000h

Wednesday, October 30

Daytime, *includes morning Coffee Break*..... 0900-1400h
Evening, *includes the General Poster Session
and Reception*..... 1800-2000h

Thursday, October 31 0900-1200h
includes morning Coffee Break

ECS welcomes our Exhibitors*

ALS Co., Ltd.

Booth 113

Katsunobu Yamamoto
Yamamoto@bas.co.jp
www.als-japan.com

Applied Spectra, Inc.

Booth 202

Lisa Riddel
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www.appliedspectra.com

Beijing Mikrouna Mech. Tech. Co., Ltd.

Booth 414

Sam Cai
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www.mikrouna.cn

Biologic, USA

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David Carey
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ChemTrace, a Quantum Global Technologies, LLC

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Princeton Applied Research/Solartron Analytical

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Toshima

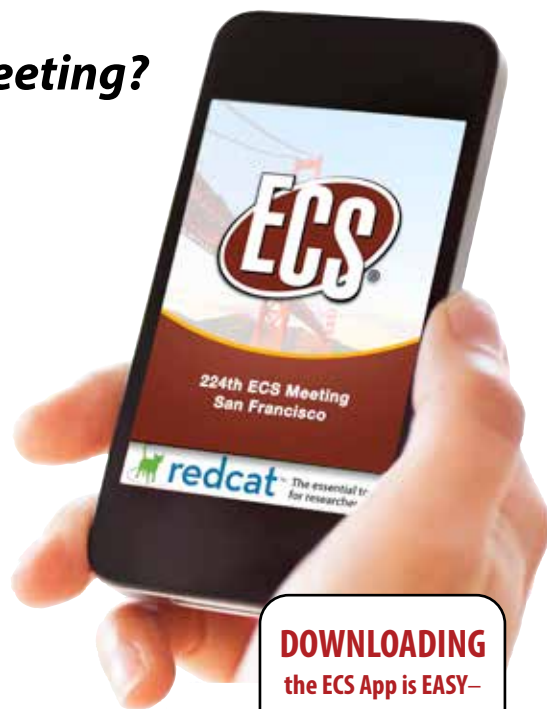
Booth 301
Hidefumi Motobayashi
motobayashi@material-sys.com
www.material-sys.com

**Exhibitor information available at press time*

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Symposium Topics and Organizers

A — General Topics

A0 — Special Lectures (M)

A1 — General Student Poster Session (T) – V. Subramanian, V. Chaitanya, M. P. Foley, and K. B. Sundaram
All Divisions

A2 — Nanotechnology General Session (Tu-W) – O. Leonte, Z. Aguilar, F. Chen, J. Li, and W. Mustain
All Divisions / New Technology Subcommittee

A3 — The Energy-Water Nexus (M-Th) – E. Wachsman, J. Burgess, M. Carter, C. Hensman, B. Y. Liaw, S. Minteer, W. Mustain, P. Natishan, and B. Stoner
All Divisions / New Technology Subcommittee

B — Batteries, Fuel Cells, and Energy Conversion

B1 — Energy Technology/Battery Joint General Session (M-Th) – A. Manivannan, G. Amatucci, G. Jain, B. Y. Liaw, and S. R. Narayanan
Battery Division / Energy Technology Division

B2 — Battery Chemistries Beyond Lithium Ion (M-F) – C. Johnson, M. Doeff, A. Manthiram, S. Mukerjee, J. Muldoon, and K. Zaghib
Battery Division / Energy Technology Division

B3 — Battery Safety (W) – D. H. Doughty, G. Botte, and C. J. Orendorff
Battery Division / Industrial Electrochemistry and Electrochemical Engineering Division

B4 — Computational Science of Battery Materials (Tu-W) – S. Meng, D. Bedrov, L. Chen, K. Persson, M. S. Islam, and V. Subramanian
Battery Division / Industrial Electrochemistry and Electrochemical Engineering Division / Physical and Analytical Electrochemistry Division

B5 — Electrochemical Capacitors: Fundamentals to Applications (M-Th) – T. Brousse, D. Bélanger, P. Kumta, J. Long, P. Simon, and W. Sugimoto
Battery Division / Energy Technology Division

B6 — Electrochemical Synthesis of Fuels 2 (M-Th) – X. D. Zhou, G. Brisard, M. Mogensen, W. Mustain, J. Staser, and M. C. Williams
High Temperature Materials Division / Energy Technology Division / Industrial Electrochemistry and Electrochemical Engineering Division / Physical and Analytical Electrochemistry Division **HC**

B7 — High Temperature Experimental Techniques and Measurements (Tu-W) – G. Jackson, A. Manivannan, T. Markus, E. Opila, P. Trulove, and R. Walker
High Temperature Materials Division / Energy Technology Division / Physical and Analytical Electrochemistry Division **HC**

B8 — Intercalation Compounds for Rechargeable Batteries (Tu-F) – M. M. Doeff, S. Meng, C. Masquelier, A. Yamada, K. Zaghib, and G. G. Botte
Battery Division / Industrial Electrochemistry and Electrochemical Engineering Division

B9 — Interfacial Phenomena in Battery Systems (Tu-W) – R. Kostecki, Y. Xing, and N. Balke
Battery Division / Physical and Analytical Electrochemistry Division

B10 — Lithium-ion Batteries (M-F) – R. V. Bugga, M. Smart, and A. Manthiram
Battery Division

B11 — Polymer Electrolyte Fuel Cells 13 (Su-F) – H. Gasteiger, F. N. Büchi, C. Coutanceau, M. Edmundson, J. Fenton, T. Fuller, D. Hansen, D. Jones, R. Mantz, S. Mitsushima, S. R. Narayanan, K. A. Perry, V. Ramani, T. J. Schmidt, K. Shinohara, P. Strasser, K. Swider-Lyons, H. Uchida, and A. Weber
Industrial Electrochemistry and Electrochemical Engineering Division / Battery Division / Corrosion Division / Energy Technology Division / Physical and Analytical Electrochemistry Division **CD**

B12 — Stationary and Large Scale Electrical Energy Storage Systems 3 (Tu-W) – T. V. Nguyen, S. Mukerjee, V. D. Noto, and B. Y. Liaw
Battery Division / Energy Technology Division / Industrial Electrochemistry and Electrochemical Engineering Division

D — Corrosion, Passivation, and Anodic Films

D1 — Corrosion General Poster Session (Th) – R. Buchheit
Corrosion Division

D2 — Atmospheric Corrosion (W-Th) – D. Hansen, R. Calhoun, R. Kelly, C. Leygraf, and A. Nishikata
Corrosion Division / Physical and Analytical Electrochemistry Division

D3 — Degradation of Carbon Structural Materials (Tu) – D. Hansen and L. Hihara
Corrosion Division / New Technology Subcommittee

D4 — Mass Transport Phenomena in Localized Corrosion (M) – S. Lillard and R. Kelly
Corrosion Division

D5 — Oxide Films: A Symposium in Honor of Dr. Clive Clayton on his 65th birthday (M-W) – S. Fujimoto, D. Baer, D. Chidambaram, G. P. Halada, M. Jaime-Vasquez, and D. F. Roeper
Corrosion Division

D6 — Biodegradable and Bioabsorbable Metals and Materials (Tu) – R. Bucheit, M. Bayachou, and B. A. Shaw
Corrosion Division

E — Dielectric and Semiconductor Materials, Devices, and Processing

E1 — Solid State Topics General Session (W) – K. Sundaram, X. Wang, O. Leonte, H. Iwai, R. Todi, and K. Shimamura
Dielectric Science and Technology Division / Electronics and Photonics Division / Energy Technology Division

E2 — Atomic Layer Deposition Applications 9 (W-F) – F. Roozeboom, S. D. Gendt, A. Delabie, J. W. Elam, A. Londergan, and O. Van Der Straten
Dielectric Science and Technology Division / Electronics and Photonics Division **HC**

E3 — GaN and SiC Power Technologies 3 (M-Th) – K. Shenai, M. Bakowski, M. Dudley, and N. Ohtani
Electronics and Photonics Division / Dielectric Science and Technology Division **HC**

E4 — Low-Dimensional Nanoscale Electronics and Photonic Devices 6 (M-W) – M. Suzuki, S. Albin, M. Carter, L. J. Chou, Y. L. Chueh, S. Jin, M. H. Jo, and R. J. Martin-Palma
Electronics and Photonics Division / Dielectric Science and Technology Division / Sensor Division **HC**

E5 — Nonvolatile Memories (M-W) – S. Shingubara, H. Akinaga, Z. Karim, Y. B. Kim, K. Kobayashi, K. J. Lee, B. Magyari-Kope, T. Ohyanagi, A. Sebastian, Y. Suzuki, and N. Takaura
Dielectric Science and Technology Division / Electronics and Photonics Division **HC**

E6 — Photovoltaics for the 21st Century 9 (Tu) – M. Tao, C. Claeys, H. (Lili) Deligianni, J. M. Fenton, M. E. Overberg, J. G. Park, K. Rajeshwar, and M. Sunkara
Dielectric Science and Technology Division / Electrodeposition Division / Electronics and Photonics Division / Energy Technology Division / Industrial Electrochemistry and Electrochemical Engineering Division **SC**

E7 — Processing, Materials, and Integration of Damascene and 3D Interconnects 5 (M-W) – K. Kondo, R. Akolkar, D. P. Barkey, W. P. Dow, M. Hayase, M. Koyanagi, G. S. Mathad, P. Ramm, F. Roozeboom, and S. Shingubara
Dielectric Science and Technology Division / Electrodeposition Division / Electronics and Photonics Division / High Temperature Materials Division

E8 — Semiconductor Cleaning Science and Technology 13 (SCST 13) (M-W) – J. Ruzyllo, T. Hattori, P. Mertens, and R. E. Novak
Electronics and Photonics Division **HC**

E10 — Semiconductors, Dielectrics, and Metals for Nanoelectronics - 11 (M-W) – S. Kar, M. Houssa, H. Jagannathan, K. Kita, D. Landheer, D. Misra, and S. V. Elshocht
Dielectric Science and Technology Division / Electronics and Photonics Division **HC**

E11 — State-of-the-Art Program on Compound Semiconductors (SOTAPOCS) 55 (M-Tu) – C. O'Dwyer, E. Douglas, J. H. He, and S. Jang
Electronics and Photonics Division **HC**

E12 — ULSI Process Integration 8 (M-W) – C. Claeys, S. Deleonibus, H. Iwai, J. Murota, and M. Tao
Electronics and Photonics Division **HC**

F — Electrochemical / Chemical Deposition and Etching

F1 — Current Trends in Electrodeposition - An Invited Symposium (W) – C. Bonhote
Electrodeposition Division

Symposium Topics and Organizers (continued)

F2 — Emerging Materials and Processes for Energy Conversion and Storage (W-Th) — Y. Fukunaka, H. (Lili) Deligianni, C. Johnson, T. V. Nguyen, and P. Vereecken
Electrodeposition Division / Battery Division

F3 — Fundamentals and Applications of Electrophoretic Deposition (M) — J. Talbot, J. Dickerson, and J. Fransaer
Electrodeposition Division

F4 — Fundamentals of Electrochemical Growth: From UPD to Microstructures 3 (Tu-Th) — S. Brankovic, Y. Fukunaka, T. Homma, M. Innocenti, and N. Vasiljevic
Electrodeposition Division

F5 — Emerging Opportunities in Electrochemical Deposition for Nanofabrication (M-W) — R. Akolkar, M. Anderson, M. Buck, and T. Moffat
Electrodeposition Division / Physical and Analytical Electrochemistry Division

G — Electrochemical Synthesis and Engineering

G1 — Alkaline Electrolyzers (W) — G. Botte, K. Ayers, B. Y. Liaw, S. Mukerjee, and V. Ramani
Industrial Electrochemistry and Electrochemical Engineering Division / Battery Division / Energy Technology Division / Physical and Analytical Electrochemistry Division

G2 — Synthesis and Electrochemical Engineering General Session (W) — G. Botte and J. Staser
Industrial Electrochemistry and Electrochemical Engineering Division

H — Fullerenes, Nanotubes, and Carbon Nanostructures

H1 — Carbon Nanostructures 4 - Fullerenes to Graphene (M-Tu) — D. Guldi, P. Atanassov, M. Carter, H. Martin, and K. Zaghib
Fullerenes, Nanotubes, and Carbon Nanostructures Division / Dielectric Science and Technology Division / Energy Technology Division / Physical and Analytical Electrochemistry Division / Sensor Division

I — Physical and Analytical Electrochemistry

I1 — Physical and Analytical Electrochemistry Division General Session (M-Tu) — P. Kulesza
Physical and Analytical Electrochemistry Division

I2 — Invitational Symposium in Honor of Adam Heller on his 80th Birthday (M-W) — S. C. Barton, P. Atanassov, E. J. Cairns, and S. Minteer
Physical and Analytical Electrochemistry Division / Battery Division / Energy Technology Division / Organic and Biological Electrochemistry Division

I3 — Photoelectrochemistry and Photoassisted Electrocatalysis (M-W) — T. Zawodzinski, E. McFarland, R. Subramanian, J. Turner, and H. Wang
Physical and Analytical Electrochemistry Division

I4 — Physical and Analytical Electrochemistry in Ionic Liquids 3 (M) — H. Delong, M. Carter, J. Fransaer, R. Mantz, and P. Trulove
Physical and Analytical Electrochemistry Division / Battery Division / Electrodeposition Division / Sensor Division

I5 — Processes 8 (Tu) — A. Hillier and J. Prakash
Physical and Analytical Electrochemistry Division / Energy Technology Division

J — Sensors and Displays: Principles, Materials, and Processing

J1 — Sensors, Actuators, and Microsystems General Session (M-Tu) — M. Carter, Z. Aguilar, B. Chin, G. Hunter, and P. Sekhar
Sensor Division

J2 — Impedance Techniques, Diagnostics, and Sensing Applications (Tu) — V. Lvovich, D. Hansen, A. Khosla, M. E. Orazem, M. Smiechowski, and P. Vanýsek
Sensor Division / Corrosion Division / Industrial Electrochemistry and Electrochemical Engineering Division / Physical and Analytical Electrochemistry Division

J3 — Luminescence and Display Materials: Fundamentals and Applications (M-W) — J. Collins, U. Happek, C. Hunt, K. Mishra, and A. Setlur
Luminescence and Display Materials Division

J4 — Microfluidic MEMS/NEMS, Sensors and Devices (M-W) — P. Vanýsek, D. Cliffler, P. Hesketh, and A. Khosla
Sensor Division / Physical and Analytical Electrochemistry Division / New Technology Subcommittee

J6 — Sensors for Agriculture (Tu) — B. Chin, P. Hesketh, S. Minteer, and A. Simonian
Sensor Division / Physical and Analytical Electrochemistry Division

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CD **Compact Disc (CD)** editions will be available for purchase and pick-up at the meeting; or you may pre-order your CD ECST issue on the meeting registration form (page 9) or when registering online. The CD edition of B11 (PEFC 13) will also include a 1 gigabyte USB drive containing the complete issue.

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e **Electronic (PDF)** editions will be available ONLY via the ECS Digital Library (www.ecsdl.org). Electronic editions of the San Francisco “at” meeting issues will be available for purchase beginning October 18, 2013. Please visit the ECS website for all issue pricing and ordering information for the electronic editions.

Reserve Hotel Accommodations Early

Hotel discounts are available through September 27, 2013 or until the block sells out!

The 224th ECS Meeting will be held at the meeting headquarters hotel, the Hilton San Francisco (333 O'Farrell Street, San Francisco, CA 94102). We strongly encourage you to stay at this hotel to ensure an enjoyable and convenient meeting experience.

Hotel reservations at the Hilton may be made online for the special discounted meeting rate of \$179. The deadline for reservations is September 27, 2013. Reservations placed after September 27 will be accepted on a space and rate availability basis only.

Registration Information

Meeting Registration—The meeting registration area will be located in the Hilton San Francisco Hotel, in the East Lounge, Ballroom Level. Registration will open on Saturday evening and the technical sessions will be conducted Sunday through Friday.

Registration Hours

Saturday, October 26	1600-1900h
Sunday, October 27	0700-1900h
Monday, October 28	0700-1900h
Tuesday, October 29	0700-1730h
Wednesday, October 30	0800-1600h
Thursday, October 31	0800-1600h
Friday, November 1	0800-1200h

Registration Information & Fees—All participants and attendees are required to pay the appropriate registration fee listed below. Register online at www.electrochem.org, or download the registration form from the website and fax your completed form to 1.609.737.2743. If you send a registration by fax, please do not send another copy by e-mail, as this may result in duplicate charges. Make check or money order payable to ECS. Payments must be made in U.S. funds drawn on a U.S. bank; MasterCard, Visa, American Express, or Discover are also accepted.

The deadline for Early-Bird Registration is September 27, 2013. Regular registration rates are in effect online after September 27, 2013 and at the meeting.

	Early-Bird (through Sept. 27)	Regular Rate (after Sept. 27)
ECS Member	\$450	\$550
Nonmember	\$620	\$720
ECS Student Member	\$160	\$260
Student Nonmember	\$195	\$295
One Day ECS Member	\$280	\$380
One Day Nonmember	\$370	\$470
Nontechnical Registrant	\$ 25	\$ 30
ECS Emeritus or Honorary Member	Gratis	Gratis

Travel Companions/Nontechnical Registrants—Travel companions of attendees are invited to register for the 224th ECS Meeting as a "Nontechnical Registrant." The nontechnical registrant registration Early-Bird fee of \$25 (increases to \$30 after September 27) includes

admission to non-ticketed social events; use of an exclusive Get-together Lounge with beverage service and light refreshments, Monday through Friday, 0800-1000h; and a special "Welcome to San Francisco" orientation presented by San Francisco Travel on Monday, October 28 at 0900h in the lounge. Please note that online registration is not available for Nontechnical Registrants.

Information for Students—All students must present a current, dated student ID card, or for postdocs, a letter from a professor stating that you are a full or part-time student, when you pick up your registration materials at the meeting.

Financial Assistance—Financial assistance is limited and generally governed by the symposium organizers. Individuals may inquire directly to the symposium organizers of the symposium in which they are presenting their paper to see if funding is available. Individuals requiring an official letter of invitation should write to the ECS headquarters office; such letters will not imply any financial responsibilities of ECS.

ECS Meeting Abstracts—are always right at hand and as always, are FREE with registration. Registrants may easily access them through wireless Internet, which will be available at the meeting; view them on the ECS Meeting App; or download them directly from the 224th ECS Meeting website. Paper editions of meeting abstracts are no longer distributed; attendees who require paper should download the abstracts and print them in advance of the meeting.

General Meeting Information

Key Locations in the Hilton San Francisco Hotel

Meeting Registration	East Lounge, Ballroom Level
Information/Message Center	East Lounge, Ballroom Level
ECS Headquarters Office	California Room, Ballroom Level
AV Tech Table	Located outside select symposium rooms
Technical Exhibit	Grand Ballroom

ADA Accessibility—Special accommodations for disabled attendees will be handled on an individual basis provided that adequate notice is given to the ECS Headquarters Office.



Photography and Recording is not permitted—By attending the ECS meeting, you agree that you will not record any meeting-related activity, without the express, written consent from ECS. Recording means any audio, visual, or photographic methods. Meeting-related activity means any presentation

(oral or poster) or social event directly related to the meeting. You may photograph your own personal, non-meeting related activity, but you must obtain permission from all involved parties before photographs can be taken of other people or displays at the meeting or exhibit. Press representatives must receive media credentials and recording permission from the ECS Headquarters Office. If you violate this policy, you will be removed from the meeting. Your registration will be revoked and you will lose all access to the meeting. In this case, you will not receive a refund of the registration fees. ECS also reserves the right to deny your attendance at future ECS or ECS sponsored meetings.



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225th ECS Meeting

ORLANDO, FL

May 11-16, 2014

Hilton Orlando Bonnet Creek

General Topics

Abstract Deadline: November 15, 2013*

- Batteries, Fuel Cells, and Energy Conservation
- Chemical and Biological Sensors
- Corrosion Science and Technology
- Electrochemical/Electroless Deposition
- Electrochemical Engineering
- Fuel Cells, Electrolyzers, and Energy Conversion
- Organic and Bioelectrochemistry
- Physical and Analytical Electrochemistry, Electrocatalysis, and Photoelectrochemistry
- Carbon Nanostructures and Devices
- Dielectric Science and Materials
- Electronic Materials Processing
- Electronic and Phototonic Devices and Systems
- Luminescence and Display Materials, Devices, and Processing
- Physical Sensors

*Please carefully check the symposium listings; some abstracts may have alternate submission deadlines.

Don't miss the deadlines . . .

Now Open . . .

Discounted hotel rates start at \$205 and are now available at the meeting headquarters hotel, the Orlando Bonnet Creek Hotel. The early-bird reservation deadline is April 11, 2014, or as soon as the block sells out!

November 2013

Abstracts are due NO LATER than November 15, 2013. Please carefully check each symposium for any alternate abstract submission deadlines.

January 2014

Early-bird registration opens – Deadline is April 11, 2014.

Travel grants are available for student attendees, and for young faculty and early career attendees. Applications are due January 1, 2014.

April 2014

Early-bird registration and hotel discounts are available until April 11, or until the block sells out! Reserve early!

More . . .

- **Short Courses** are tentatively planned for the meeting: Basic Impedance Spectroscopy, Fundamentals of Electrochemistry, Grid Scale Energy Storage, Solar Energy Conversion, Battery Safety, Chemical/Biological Sensors, and Survey of Materials Characterization Techniques. Please check the ECS website for the final list of offerings.
- Full papers presented at ECS meetings will be published in *ECS Transactions*. Visit the ECS website for more details.

Please visit the Orlando Meeting page for more information:

www.electrochem.org/meetings/biannual/225/