



# CALL FOR PAPERS



## 240th ECS Meeting ORLANDO, FL October 10-14, 2021

*Orange County Convention Center*

**Abstract Submission Deadline: April 9, 2021**  
[www.electrochem.org/240](http://www.electrochem.org/240)

# 240TH ECS MEETING

## General Information

The 240th ECS meeting will be held in Orlando, Florida, from October 10-14, 2021, at the Orange County Convention Center. This international conference will bring together scientists, engineers, and researchers from academia, industry, and government laboratories to share results and discuss issues on related topics through a variety of formats, such as oral presentations, poster sessions, panel discussions, tutorial sessions, short courses, professional development workshops, a career fair, and exhibits. The unique blend of electrochemical and solid state science and technology at an ECS Meeting provides an opportunity and forum to learn and exchange information on the latest scientific and technical developments in a variety of interdisciplinary areas.

## Abstract Submission

To give an oral or poster presentation at the 240th ECS Meeting, you must submit an original meeting abstract for consideration via the ECS website, <https://ecs.confex.com/ecs/240/cfp.cgi> **no later than April 9, 2021**. Faxed, e-mailed, and/or late abstracts will not be accepted. Meeting abstracts should explicitly state objectives, new results, and conclusions or significance of the work.

Once the submission deadline has passed, the symposium organizers will evaluate all abstracts for content and relevance to the symposium topic, and will schedule all acceptable submissions as either oral or poster presentations.

In June 2021, Letters of Acceptance/Invitation will be sent via email to the corresponding author of all accepted abstracts, notifying them of the date, time, and location of their presentation. Regardless of whether you requested a poster or an oral presentation, it is the symposium organizers' discretion to decide how and when it is scheduled.

## Paper Presentation

Oral presentations must be in English; LCD projectors and laptops will be provided for all oral presentations. **Presenting authors MUST bring their presentation on a USB flash drive to be used with the dedicated laptop that will be in each technical session room.** Speakers requiring additional equipment must make written request to [meetings@electrochem.org](mailto:meetings@electrochem.org) at least one month prior to the meeting so that appropriate arrangements may be worked out, subject to availability, and at the expense of the author.

Poster presentations must be displayed in English, on a board approximately 3 feet 10 inches high by 3 feet 10 inches wide (1.17 meters high by 1.17 meters wide), corresponding to their abstract number and day of presentation in the final program.

## Meeting Publications

**ECS Meeting Abstracts**—All meeting abstracts will be archived in the ECS Digital Library, copyrighted by ECS, and all abstracts become the property of ECS upon presentation.

**ECS Transactions**—Select symposia will be publishing their proceedings in *ECS Transactions* (ECST). Authors presenting in these symposia are strongly encouraged to submit a full-text manuscript based on their presentation. Issues of ECST will be available for sale on a pre-order basis, as well as through the ECS Digital Library and the ECS Online Store. Please see each individual symposium listing in this call for papers to determine if your symposium will be publishing an ECST issue. Please visit the ECST website for additional information, including overall guidelines, author and editor instructions, a downloadable manuscript template, and more.

**ECSarXiv**—All authors are encouraged to submit their full-text manuscripts, posters, slides, or data sets to ECS's preprint service, ECSarXiv. For more information on this offering, visit the ECSarXiv website. Please note that submission to ECSarXiv does not preclude submission to ECST.

**ECS Journals**—Authors presenting papers at ECS meetings, and submitting to ECST or ECSarXiv, are also encouraged to submit to the Society's technical journals: *Journal of The Electrochemical Society* and *ECS Journal of Solid State Science and Technology*. Although there is no hard deadline for the submission of these papers, it is considered that six months from the date of the symposium is sufficient time to revise a paper to meet the stricter criteria of the journals. Author instructions are available on the ECS website.

## Short Courses

Four short courses will be offered on Sunday, October 10, 2021, from 0800-1630h. Short courses require advanced registration and may be cancelled if enrollment is under 10 registrants in the respective course. The following short courses are scheduled: 1) Advanced Impedance Spectroscopy, 2) Fundamentals of Electrochemistry: Basic Theory and Kinetic Methods and 3) Battery Safety and Failure Modes, and 4) Operation and Exploitation of Electrochemical Capacity Technology. Registration opens June 2021.

## Technical Exhibit

The 240th ECS Meeting will include a Technical Exhibit, featuring presentations and displays by dozens of manufacturers of instruments, materials, systems, publications, and software of interest to meeting attendees. Coffee breaks are scheduled in the exhibit hall along with evening poster sessions.

Interested in exhibiting at the meeting with your company? Exhibitor opportunities include unparalleled benefits and provide an extraordinary chance to present your scientific products and services to key constituents from around the world. Exhibit opportunities can be combined with sponsorship items and are customized to suit your needs. Please contact [sponsorship@electrochem.org](mailto:sponsorship@electrochem.org) for further details.

## Meeting Registration

**All participants—including authors and invited speakers—are required to pay the appropriate registration fees.** Meeting registration information will be posted on the ECS website as it becomes available. **The deadline for discounted early registration is September 13, 2021.**

## Hotel Reservations

The 240th ECS meeting will be held at the Orange County Convention Center. Please refer to the meeting website for the most up-to-date information on hotel availability and information about the blocks of rooms where special rates have been reserved for participants attending the meeting. The hotel block will be open until **September 13, 2021 or until it sells out.**

## Letter of Invitation

In June 2021, Letters of Invitation will be sent via email to the corresponding author of all accepted abstracts, notifying them of the date, time, and location of their presentation. Anyone else requiring an official letter of invitation should email [abstracts@electrochem.org](mailto:abstracts@electrochem.org); such letters will not imply any financial responsibility of ECS.

## Financial Assistance

ECS divisions and sections offer travel grants to students, postdoctoral researchers, and young professionals to attend ECS biannual meetings. Applications are available beginning April 9, 2021, at [www.electrochem.org/travel-grants](http://www.electrochem.org/travel-grants) and must be received no later than the submission deadline of June 29, 2021. Additional financial assistance is very limited and generally governed by symposium organizers. Individuals may inquire directly to organizers of the symposium in which they are presenting to see if funding is available.

For general travel grant questions, please contact [travelgrant@electrochem.org](mailto:travelgrant@electrochem.org).

## Sponsorship Opportunities

ECS biannual meetings offer a wonderful opportunity to market your organization through sponsorship. Sponsorship allows exposure to key industry decision makers, the development of collaborative partnerships, and potential business leads. ECS welcomes support in the form of general sponsorship at various levels. Sponsors will be recognized by level in the Meeting Program, meeting signage, and on the website. In addition, sponsorships are available for the plenary, meeting keepsakes, and other special events. Advertising opportunities for the Meeting Program as well as in *Interface* magazine are also available. Please contact [sponsorship@electrochem.org](mailto:sponsorship@electrochem.org) for further details.

ECS also offers specific symposium sponsorship. By sponsoring a symposium your company can help offset travel expenses, registration fees, complimentary proceedings, and/or host receptions for invited speakers, researchers, and students. Please contact [francesca.spagnuolo@electrochem.org](mailto:francesca.spagnuolo@electrochem.org) for further details.

## Contact Information

If you have any questions or require additional information, contact ECS.



The Electrochemical Society  
65 South Main Street, Pennington, NJ, 08534-2839, USA  
tel: 1.609.737.1902, fax: 1.609.737.2743  
[meetings@electrochem.org](mailto:meetings@electrochem.org)  
[www.electrochem.org](http://www.electrochem.org)

# 240TH ECS MEETING

## A—Batteries and Energy Storage

- A01—New Approaches and Advances in Electrochemical Energy Systems
- A02—Sodium and Lithium Intercalation Chemistry for Rechargeable Batteries - Special Symposium in Honor of Claude Delmas
- A03—Lithium Ion Batteries
- A04—Fast Charging in Electrochemical Systems - Batteries and Supercapacitors

## B—Carbon Nanostructures and Devices

- B01—Carbon Nanostructures: From Fundamental Studies to Applications and Devices Nanocarbons

## C—Corrosion Science and Technology

- C01—Corrosion General Poster Session
- C02—Critical Factors in Localized Corrosion 9
- C03—Corrosion Mechanisms and Methods

## D—Dielectric Science and Materials

- D01—Semiconductors, Dielectrics, and Metals for Nanoelectronics 18
- D02—Photovoltaics for the 21st Century 17: New Materials and Processes
- D03—Processing Materials and Integration of Damascene and 3D Interconnects 10
- D04—The Science and Applications of Topological and Correlated Materials 2
- D05—Water-Energy Nexus Research Relating to Semiconducting Materials
- D06—Atmospheric Pressure Plasma Processing

## E—Electrochemical/Electroless Deposition

- E01—Current Trends in Electrodeposition - An Invited Symposium
- E02—Additive Manufacturing by Electro- and Electroless Deposition
- E03—Electrodeposition of Reactive Metals and Compounds 2 (No Water Allowed)

## F—Electrochemical Engineering

- F01—Advances in Industrial Electrochemistry and Electrochemical Engineering
- F02—Electrochemical Separations and Sustainability 4
- F03—Electrochemical Conversion of Biomass 3
- F04—Pulse and Reverse Pulse Electrolytic Processes 3
- F05—Reduction of CO<sub>2</sub>: From Laboratory to Industrial Scale 2
- F06—Process Intensification Using Electrochemical Routes

## G—Electronic Materials and Processing

- G01—Atomic Layer Deposition Applications 17
- G02—Semiconductor Process Integration 12
- G03—Thermoelectric and Thermal Interface Materials 7

## H—Electronic and Photonic Devices and Systems

- H01—State-of-the-Art Program on Compound Semiconductors 64 (SOTAPOCS-64)
- H02—Low-Dimensional Nanoscale Electronic and Photonic Devices 14
- H03—Gallium Nitride and Silicon Carbide Power Technologies 11

## I—Fuel Cells, Electrolyzers, and Energy Conversion

- I01—Polymer Electrolyte Fuel Cells & Electrolyzers 21 (PEFC&E 21)
- I02—Materials for Low Temperature Electrochemical Systems 7
- I03—Renewable Fuels via Artificial Photosynthesis or Heterocatalysis 7
- I04—Crosscutting Materials Innovation for Transformational Chemical and Electrochemical Energy Conversion Technologies 4
- I05—Advanced Manufacturing for High-Temperature Materials and Devices

## J—Luminescence and Display Materials, Devices, and Processing

- J01—Luminescence: Fundamentals and Applications
- J02—Ultraviolet and Infrared Luminescent Materials: Development and Applications

## K—Organic and Bioelectrochemistry

- K01—Advances in Organic and Biological Electrochemistry

## L—Physical and Analytical Electrochemistry, Electrocatalysis, and Photoelectrochemistry

- L01—Physical and Analytical Electrochemistry, Electrocatalysis, and Photoelectrochemistry General Session
- L02—Advanced Techniques for In Situ Electrochemical Systems 4
- L03—The Brain and Electrochemistry 3
- L04—Education in Electrochemistry 3
- L05—Electrochemical Water Remediation
- L06—Nitrogen Reduction
- L07—Electrochemical Luminescence and Fluorescence
- L08—Pulsed Electroanalytical Techniques
- L09—Electrochemistry of Two-Dimensional Materials
- L10—Supramolecular Materials

## M—Sensors

- M01—Recent Advances in Sensors Systems
- M02—Biosensors and Nanoscale Measurements: A Symposium in Honor of Professors Nongjian Tao and Stuart Lindsay

## Z—General

- Z01—General Student Poster Session
- Z02—Electrochemistry in Space 2
- Z03—Electrochemical and Solid State Science and Engineering Applied to COVID Issues
- Z04—Electrochemical Recovery, Recycling, and Sustainability of Critical and Value Added Materials
- Z05—Electrochemical and Solid State Data Science Showcase and Software Sprint

## Important Dates and Deadlines

Meeting abstracts submission deadline.....April 9, 2021  
 Notification to corresponding authors of  
 abstract acceptance or rejection .....June 14, 2021  
 Technical program published online..... May 10, 2021  
 Meeting registration opens.....June 2021  
*ECS Transactions* submission site opens .....June 18, 2021  
 Travel grant application deadline .....June 28, 2021  
 Meeting sponsor and exhibitor deadline  
 (for inclusion in printed materials) ..... July 30, 2021  
*ECS Transactions* submission deadline ..... July 16, 2021  
 Travel grant approval notification.....August 23, 2021  
 registration deadlines..... September 13, 2021  
 Release date for *ECS Transactions* ..... on or before October 1, 2021



# 240TH ECS MEETING

## A—Batteries and Energy Storage

### A01 New Approaches and Advances in Electrochemical Energy Systems Energy Technology Division; Battery Division

The symposium focuses on “outside of the box” approaches and developments in materials, components, and systems for addressing the grand challenges in the area of electrochemical energy systems. Of particular interest are innovations in materials, methods, designs, and analytical strategies for realizing sustainable and efficient energy conversion, storage, and transmission, not limited to fuel cells, batteries, capacitors, PEC, and photovoltaics. Contributions to new methods to characterize, model, and analyze interfaces, cell, and system performances in aqueous and non-aqueous environments are of particular interest. The symposium features oral presentations, posters, and invited talks from subject-matter experts.

This symposium's proceedings will be published in *ECS Transactions* and available at the meeting. Authors accepted for presentation are strongly encouraged to submit their full text manuscript for the issue no later than July 16, 2021. Submit all manuscripts online in either MS Word or PDF format.

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Ayyakkannu Manivannan**, Global Pragmatic Materials, email: manigpm1@outlook.com; **S. R. Narayan**, University of Southern California, email: sri.narayan@usc.edu; **Hui Xu**, Giner, Inc., email: hxu@ginerinc.com; **Brett Lucht**, University of Rhode Island, email: blucht@chm.uri.edu.

### A02 Sodium and Lithium Intercalation Chemistry for Rechargeable Batteries - Special Symposium in Honor of Claude Delmas Battery Division

This symposium honors Prof. Claude Delmas for his outstanding contributions to understanding sodium and lithium intercalation materials for electrochemical energy storage, which led to the success of rechargeable Na-ion and Li-ion batteries. The organizers invite contributions on topics related to sodium and lithium electrochemistry in fundamental and applied research including but not limited to:

- (1) Intercalation materials/chemistry for Li-ion, Na-ion batteries;
- (2) The interfacial reactions between intercalation materials and electrolyte;
- (3) Electrode architectures built on fast-charging intercalation materials;
- (4) Characterization and simulation of intercalation phenomena across length and time scales.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Dany Carlier**, ICMCB du CNRS, email: carlier@icmcb-bordeaux.cnrs.fr; **Ying Shirley Meng**, University of California San Diego, email: shirleymeng@ucsd.edu; **Chao (Gilbert) Liu**, Shell Technology Center, email: chao.liu@shell.com; **Shinichi Komaba**, Tokyo University of Science, email: komaba@rs.tus.ac.jp; **Dominique Guyomard**, Universite de Nantes, email: dominique.guyomard@cnrs-imn.fr; **Vito Di Noto**, Universita degli Studi di Padova, email: vito.dinoto@unipd.it.

### A03 Lithium Ion Batteries Battery Division

Lithium intercalation/deintercalation into/from host lattices is the basis of current lithium ion battery technology. Lithium ion batteries have revolutionized the portable electronics market, and are being intensively pursued for vehicle and stationary storage applications. This symposium provides a forum for recent advances in intercalation compounds that serve as cathode or anode materials in lithium ion batteries or other rechargeable systems. Additional topics include electrolytes, interfaces/interphases, separators, and electrochemical testing of lithium ion batteries.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Gabriel Veith**, Oak Ridge National Laboratory, email: veithgm@ornl.gov; **Jie Xiao**, University of Arkansas, Pacific Northwest National Lab, email: jie.xiao@pnnl.gov; **Ozgur Capraz**, Oklahoma State University, email: ocapraz@okstate.edu.

### A04 Fast Charging in Electrochemical Systems - Batteries and Supercapacitors Battery Division

Fast charging batteries and supercapacitors are enabling technologies for a broad range of applications, from portable electronics to electric vehicles. The process of fast charging and discharging raises significant scientific and engineering challenges. This symposium provides a forum to discuss recent progresses in these high power systems. Topics of interests include but are not limited to:

- (1) Materials for fast charging batteries involving chemistries of lithium-ion and beyond;
- (2) New materials and concepts for electrochemical capacitors;
- (3) Analysis and diagnostics to understand battery and capacitor aging during fast charging;
- (4) Modeling of electrochemical processes to enable fast charging;
- (5) New concepts for system architectures to enable fast charging, e.g., battery/capacitor hybrids;
- (6) System considerations for application of fast charging, e.g., thermal control and safety.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Ping Liu**, University of California, San Diego, email: piliu@eng.ucsd.edu; **Jagjit Nanda**, Oak Ridge National Laboratory, email: nandaj@ornl.gov; **Srikanth Allu**, Oak Ridge National Laboratory, email: allus@ornl.gov; **Chunsheng Wang**, University of Maryland, email: cswang@umd.edu; **Ethan Self**, Oak Ridge National Laboratory, email: selfec@ornl.gov; **Johanna Nelson Weker**, SLAC National Accelerator Laboratory, email: jlnelson@slac.stanford.edu; **Andrew Colclasure**, National Renewable Energy Laboratory, email: Andrew.Colclasure@nrel.gov.

# 240TH ECS MEETING

## B—Carbon Nanostructures and Devices

### B01 Carbon Nanostructures: From Fundamental Studies to Applications and Devices Nanocarbons

Nanocarbons Division; Physical and Analytical Electrochemistry Division

This broad symposium includes fundamental and applied studies of fullerenes, carbon nanotubes, graphene, and related materials. Papers are invited in the areas of chemistry, physics, and materials science. Relevant topics include the synthesis and preparation of nanocarbon samples, and characterization of their mechanical, thermal, chemical, electrochemical, optical, or electronic properties. Also welcome are papers concerning nanocarbon applications in areas such as electrochemistry, electronic and opto-electronic devices, sensing, energy conversion and storage, and biomedicine.

This symposium's proceedings will be published in *ECS Transactions* and available at the meeting. Authors accepted for presentation are strongly encouraged to submit their full text manuscript for the issue no later than July 16, 2021. Submit all manuscripts online in either MS Word or PDF format.

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **H. Imahori**, Kyoto University, email: imahori@sci.kyoto-u.ac.jp; **J. Blackburn**, National Renewable Energy Laboratory, email: Jeffrey.Blackburn@nrel.gov; **A. Boghossian**, Ecole Polytechnique Federale de Lausanne, email: ardemis.boghossian@epfl.ch; **D. Cliffel**, Vanderbilt University, email: d.cliffel@vanderbilt.edu.

## C—Corrosion Science and Technology

### C01 Corrosion General Poster Session Corrosion Division

Poster presentations concerning all aspects of corrosion and associated phenomena in liquid and gaseous phases are welcome. Theoretical analyses, experimental investigations, descriptions of new techniques for the study of corrosion, and analyses of corrosion products and films are of interest.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **J.J. Noel**, The University of Western Ontario, email: jjnoel@uwo.ca; **Dev Chidambaram**, University of Nevada, Reno, email: dcc@unr.edu.

### C02 Critical Factors in Localized Corrosion 9 Corrosion Division

The symposium deals with all aspects of localized corrosion. The purpose of the symposium is to provide a forum for discussion of recent advances in fundamental and applied aspects of breakdown of passivity, techniques to study initiation and propagation of localized corrosion, the effect of

microstructure, advanced materials, as well as mitigation methods for localized corrosion. Papers presenting experimental and theoretical approaches on localized corrosion are welcome.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **S. Virtanen**, FAU, Institute of Surface Science and Corrosion, email: virtanen@ww.uni-erlangen.de; **John Scully**, University of Virginia, email: jrs8d@virginia.edu; **R. Buchheit**, University of Kentucky, email: Rudolph.Buchheit@uky.edu; **Eiji Tada**, Tokyo Institute of Technology, email: tada.e.aa@m.titech.ac.jp; **Rajeev Kumar Gupta**, NC State University, email: rk Gupta2@ncsu.edu.

### C03 Corrosion Mechanisms and Methods Corrosion Division

This symposium focuses on recent progress in analytical methods and applications to the investigation of corrosion mechanisms. The purpose of this symposium is to bring together scientists from various research fields regarding corrosion science and engineering. Contributions related to fundamentals and applications are encouraged. Topics of interest include, but are not limited to:

- (1) Anodic and cathodic reaction mechanisms in corrosion;
- (2) Mass transfers in corrosion;
- (3) Corrosion monitoring;
- (4) Corrosion sensors;
- (5) Numerical simulation for corrosion phenomena;
- (6) Development of electrochemical methods;
- (7) Transient techniques including impedance measurement;
- (8) Combination of electrochemical and other analytical methods, and
- (9) scanning probe technique for surface analysis.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Masayuki Itagaki**, Tokyo University of Science, email: itagaki@rs.noda.tus.ac.jp; **J.J. Noel**, University of Western Ontario, email: jjnoel@uwo.ca; **Michael Rohwerder**, Max Planck Institut fuer Eisenforschung GmbH, email: m.rohwerder@mpie.de; **Eric Schindelholtz**, Ohio State University, email: schindelholtz.2@osu.edu; **Yoshinao Hoshi**, Nagoya Institute of Technology, email: hoshi.yoshinao@nitech.ac.jp; **Yaiza Gonzalez-Garcia**, TU Delft, email: Y.GonzalezGarcia@tudelft.nl.

## D—Dielectric Science and Materials

### D01 Semiconductors, Dielectrics, and Metals for Nanoelectronics 18 Dielectric Science and Technology Division; Electronics and Photonics Division

The following are indicative topical areas to be covered by the symposium:

- (1) SiGe, SiGe:C, Ge, GeSn, and III-V high mobility channels; SiC and GaN channels: surface/interface modeling; band offsets; surface cleaning, surface passivation; high-k gate dielectrics; contact engineering; transistor characteristics;

# 240TH ECS MEETING

- (2) 2D semiconductors and applications: MoS<sub>2</sub>, WSe<sub>2</sub>, other metal dichalcogenides, graphene, silicene, germanene: growth, characterization, and modeling; high-k gate dielectrics; ohmic contacts; transistor characteristics;
- (3) Volatile and non-volatile memory: resistive RAM; ferroelectric RAM; phase-change RAM; magnetic RAM; conductive-bridging RAM; spin-transfer torque RAM; flash memories.
- (4) Interfaces, traps, and reliability: semiconductor/dielectric, dielectric/dielectric, dielectric/metal interfaces; interface and bulk dielectric defects/traps; electrical characterization, dielectric wear out, SILC; NBTI and PBTI; TDDB;
- (5) High-k gate dielectrics for high mobility channels: high-k gate dielectrics on Si, SiGe, Ge, III-V compounds, SiC, etc. High-k dielectrics on nanowires, nanotubes, and graphene.
- (6) Nanoelectronics and nanotechnology: FinFET, multi-gate MOSFETs, nanotubes, nanowires, quantum dots, spintronics, plasmonics, tunnel FETs;
- (7) Metal gate electrodes metals and ohmic contacts: threshold and flat band voltage control, metal gate electrodes for transistors with alternative substrates, metal contacts to nanowires, nanotubes, graphene, MoS<sub>2</sub>, etc.

This symposium's proceedings will be published in *ECS Transactions* and available at the meeting. Authors accepted for presentation are strongly encouraged to submit their full text manuscript for the issue no later than July 16, 2021. Submit all manuscripts online in either MS Word or PDF format.

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Durgamadhab Misra**, New Jersey Institute of Technology, email: [dmisra@njit.edu](mailto:dmisra@njit.edu); **Stefan DeGendt**, IMEC, email: [Stefan.DeGendt@imec.be](mailto:Stefan.DeGendt@imec.be); **Koji Kita**, University of Tokyo, email: [kita@scio.t.u-tokyo.ac.jp](mailto:kita@scio.t.u-tokyo.ac.jp); **Steve Kilgore**, NXP Semiconductor, email: [steve.kilgore@nxp.com](mailto:steve.kilgore@nxp.com); **Kuniyuki Kakushima**, Tokyo Institute of Technology, email: [kakushima.k.aa@m.titech.ac.jp](mailto:kakushima.k.aa@m.titech.ac.jp).

**D02**

## Photovoltaics for the 21st Century 17: New Materials and Processes

Dielectric Science and Technology Division; Energy Technology Division

This symposium provides a forum for the discussion of terawatt-capable solar-to-electrical conversion technologies that have the potential to scale to meet the global energy demand and become an impactful source of energy in the 21st century. To achieve terawatt scale photovoltaics, it is necessary to focus on the scalability and sustainability of photovoltaics. In addition to lowering the cost and improving the efficiency, research is needed in earth-abundant raw materials, energy-efficient fabrication, recycling of waste solar modules, and storage of intermittent solar electricity.

Electrochemical and solid state sciences have major roles to play in removing many of these barriers to terawatt solar photovoltaics. This symposium invites contributions in current and emerging areas of solar photovoltaic research and covers a whole spectrum of cell technologies from silicon to thin-films and emerging technologies. Sample topics of interest include, but are not limited to:

- (1) Scalable and green solution-based processing technologies for solar cells;
- (2) Emerging perovskite, organic, quantum dot, and hybrid solar cells;
- (3) Devices and materials for scalable manufacturing, stability and performance;
- (4) Earth-abundant solar materials: synthesis and properties;
- (5) Device degradation and reliability for current and future solar modules;
- (6) Cost-effective approaches to recycle current and future waste solar modules;
- (7) Sustainable practices of waste treatment in solar cell and module fabrication processes;

- (8) Innovative applications and systems that match the characteristics of solar energy.

Invited speakers from industry and academia provide an overview on the current status and explore future directions of solar photovoltaics.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Zhi Chen**, University of Kentucky, email: [zhi.chen@uky.edu](mailto:zhi.chen@uky.edu); **Thad Druffel**, University of Louisville, email: [thad.druffel@louisville.edu](mailto:thad.druffel@louisville.edu); **Meng Tao**, Arizona State University, email: [meng.tao@asu.edu](mailto:meng.tao@asu.edu); **Hiroki Hamada**, Kinki University, email: [h.hamada@ele.kindai.ac.jp](mailto:h.hamada@ele.kindai.ac.jp).

**D03**

## Processing Materials and Integration of Damascene and 3D Interconnects 10

Dielectric Science and Technology Division; Electrodeposition Division; Electronics and Photonics Division

This symposium focuses on issues pertinent to advances in traditional damascene interconnects, and new materials and integration methods for 3D interconnects. An emerging technology or device architecture called 3D integration is based on the system performance gains that can be achieved by stacking and vertically interconnecting distinct device layers. The 3D concept of replacing long 2D interconnects with shorter vertical (3D) interconnects has the potential to alleviate the well-known interconnect (RC) delay problem facing the semiconductor industry today. Additional benefits of the 3D process include reduced die size and the ability to optimize distinct technologies (analog, logic, RF, etc.) on separate vertically interconnected layers. An application area where large performance gains can be obtained is high-density device/sensor arrays where processing power is placed within each individual device.

Damascene copper interconnects, introduced at the 0.25  $\mu\text{m}$  node, have spanned six technology nodes, and are expected to be used for the foreseeable future. Despite the history of success, there are new challenges including increases in effective resistivity, electromigration and stress migration resistance, and the integration of porous low-k dielectrics and air gaps.

This symposium brings together researchers to discuss the challenges and solutions to extend damascene copper interconnects well beyond the 45 nm node. The aim of this symposium is to discuss the proposed architectures and applications of 3D integration, and the various enabling materials and processes that are required to bring the technology into full commercialization. Broadly, the enabling process technologies include wafer/die thinning, wafer/die bonding, and vertical interconnect fabrication. Each of these process technologies will leverage novel materials, and much of the emphasis of this symposium is was on the materials science of these 3D integration materials. Ideally, this symposium will bring together researchers to discuss the various merits of the presented 3D device architectures, materials, and fabrication methodologies.

Topics of interest include, but are not limited to:

- (1) Methods to reduce increases in effective resistivity;
- (2) Methods to mitigate electromigration and stress migration issues;
- (3) Advanced barrier/seed processes including ALD and electroless films;
- (4) Porous low-k ILDs and air gap processing (including deposition and etching);
- (5) Novel electrodeposition and CMP processes;
- (6) 3D process integration methodologies;
- (7) 3D design and architectures;



# 240TH ECS MEETING

- (8) Simulation and modeling of 3D integrated devices;
- (9) Materials and techniques for die and wafer bonding;
- (10) Processing and handling of thin wafers and dice;
- (11) Materials for temporary die and wafer bonding;
- (12) Vertical interconnect fabrication technology;
- (13) Materials for vertical interconnects: insulators, barriers, and metals;
- (14) Reliability of 3D interconnects;
- (15) Novel test and measurement of 3D integrated devices;
- (16) Thermal management in 3D integrated devices;
- (17) Epitaxial and recrystallization approaches to 3D integration;
- (18) 3D integration of heterogeneous materials;
- (19) Thermomechanical reliability and electromigration in 3D integrated devices.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Oana Leonte**, Berkeley Polymer Technology, email: [odleonte@comcast.net](mailto:odleonte@comcast.net); **Gautam Banerjee**, Micron Technology Inc, email: [gbanerje@gmail.com](mailto:gbanerje@gmail.com); **Yaw Obeng**, National Institute of Standards and Technology, email: [yaw.obeng@nist.gov](mailto:yaw.obeng@nist.gov); **John C. Flake**, email: [john.flake@gmail.com](mailto:john.flake@gmail.com); **Fred Roozeboom**, Eindhoven University of Technology, email: [f.roozeboom@tue.nl](mailto:f.roozeboom@tue.nl); **Peter Georg Ramm**, Fraunhofer EMFT, email: [peter.ramm@emft.fraunhofer.de](mailto:peter.ramm@emft.fraunhofer.de); **Kazuo Kondo**, Fine Feature Electrodeposition Research Laboratory, email: [kkondo828@gmail.com](mailto:kkondo828@gmail.com); **Mitsumasa Koyanagi**, Tohoku University, email: [koyanagi@bmi.niche.tohoku.ac.jp](mailto:koyanagi@bmi.niche.tohoku.ac.jp).

## **D04** The Science and Applications of Topological and Correlated Materials 2

Dielectric Science and Technology Division

The field of topological and correlated materials is expanding rapidly. The symposium acts as a platform for gathering the most recent developments in topological materials and their applications, e.g., optic, magnetism, and nanoelectronics, to move the field forward. This symposium brings researchers in this field together to share their latest findings and insights with each other in order to foster collaborations. The organizers seek work related to topological properties insulators and periodic photonic crystals, metamaterials, meta-surfaces, and optoelectronic materials. We encourage submissions of theoretical works in developing new concepts, and experimental works in applying topological and correlated materials. Topics include, but are not limited to:

- (1) Classification of topological phases is extended and candidates of higher-order topological materials;
- (2) Bosonic topological insulators;
- (3) Experimental realization of topological device systems;
- (4) Methods in defining spin-1 topological invariants in systems;
- (5) Extension of topological studies to non-Hermitian systems (e.g., parity-time symmetry);
- (6) Optical properties of electronic topological materials, including 2D materials, plasmons in electronic topological insulators, and topological phase transitions in superconductors.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Yaw Obeng**, NIST, email: [yaw.obeng@nist.gov](mailto:yaw.obeng@nist.gov); **Uros Cvelbar**, Jozef Stefan Institute, email: [uros.cvelbar@ijs.si](mailto:uros.cvelbar@ijs.si); **Gautam Banerjee**, Micron Technology Inc, email: [gbanerje@gmail.com](mailto:gbanerje@gmail.com).

## **D05** Water-Energy Nexus Research Relating to Semiconducting Materials

Dielectric Science and Technology Division

Production of renewable energy requires large quantities of water, and supply of fresh water needs energy. Semiconductors play a huge role in disrupting, to some extent, this interdependence. For example, semiconductor-assisted photocatalysis and plasma-assisted processes are highly useful in the removal of pollutants, dyes, and harmful microorganisms from water. Contextually, this symposium aims to bring together researchers interested in studying semiconductors, materials, and processes for water remediation, such as the removal of pollutants, dyes, and harmful microorganisms from water. Also encouraged for submission are: semiconductor materials useful for the removal of emerging contaminants, such as pharmaceuticals; papers describing synthesis/fabrication and assembly of materials useful for the simultaneous removal of pollutants from water, along with its desalination; and papers describing the large-scale production of materials for water remediation are also encouraged.

This symposium will be organized/scheduled in close collaboration with symposium L04, "Electrochemical Water Remediation."

This symposium's proceedings will be published in *ECS Transactions* and available at the meeting. Authors accepted for presentation are strongly encouraged to submit their full text manuscript for the issue no later than July 16, 2021. Submit all manuscripts online in either MS Word or PDF format.

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Sreeram Vaddiraju**, Texas A&M University, email: [sreeram.vaddiraju@tamu.edu](mailto:sreeram.vaddiraju@tamu.edu); **Uros Cvelbar**, Jozef Stefan Institute, email: [uros.cvelbar@ijs.si](mailto:uros.cvelbar@ijs.si); **Mahendra Sunkara**, Conn Center for Renewable Energy Research, email: [mahendra@louisville.edu](mailto:mahendra@louisville.edu); **Vimal Chaitanya**, New State Mexico University, email: [vimalc@nmsu.edu](mailto:vimalc@nmsu.edu).

## **D06** Atmospheric Pressure Plasma Processing

Dielectric Science and Technology Division

Atmospheric pressure plasma processing (APP) has received significant attention due to its combination of simplicity and a wide range of possibilities in surface treatments and modifications. Furthermore, atmospheric pressure plasma has a prominent technical significance due to its low-cost manufacturing and operations in contrast to a low-pressure plasma or even high-pressure plasma. This makes it an extremely versatile tool for any material processing and an emerging topic which will in future transform the plasma processing and related industry.

Therefore, this symposium features the latest developments in APP design and applications. Furthermore, it was demonstrated that APPs could be successfully applied in materials science. For this reason, the papers related to atmospheric pressure plasma processing ranging from manufacturing to the deposition of coatings, surface modifications, and other treatments will be considered. This also includes the applications of atmospheric pressure plasma processing for nanofabrication, etching, conversion, or similar. Finally, the aim of this symposium is to lead and be at the forefront of research of atmospheric pressure plasma processing for all topics connected to The Electrochemical Society.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Davide Mariotti**, Ulster University, email: [d.mariotti@ulster.ac.uk](mailto:d.mariotti@ulster.ac.uk); **Mohan R Sankaran**, Case Western Reserve University, email: [mohan@case.edu](mailto:mohan@case.edu); **Uros Cvelbar**, Jozef Stefan Institute, email: [uros.cvelbar@ijs.si](mailto:uros.cvelbar@ijs.si).

# 240TH ECS MEETING

## E—Electrochemical/Electroless Deposition

### E01 Current Trends in Electrodeposition - An Invited Symposium Electrodeposition Division

This symposium provides a forum for the presentation of new and exciting research in the area of epitaxial thin-film growth, and electrochemical materials fabrication.

This single half-day session is comprised of 40-minute invited lectures that highlight the most recent advances and trends in electrodeposition that touch on fundamentals and different areas of applications.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizer: **Stanko Brankovic**, University of Houston, email: [srbranko@central.uh.edu](mailto:srbranko@central.uh.edu).

### E02 Additive Manufacturing by Electro- and Electroless Deposition Electrodeposition Division; Industrial Electrochemistry and Electrochemical Engineering Division

Additive Manufacturing (AM) is changing the standard by which metallic, ceramic, and polymeric parts are designed and made. Prevailing methods such as laser powder bed fusion or directed energy deposition are often used to form macroscopic parts via layer-by-layer melting and successive solidification. However, these same methods are severely limited in the design of materials that are reactive, brittle, exhibiting low melting point or low partial pressure. Electrochemical and electroless deposition methods, in contrast, are capable of generating 2D and 3D patterns of metallic, metal oxides, and composites through a variety of procedures, such as jet electrodeposition, laser-stimulated growth, electroforming or lithographic patterns. In recent years, thanks to additive technologies able to operate at the microscale, new possibilities have been individuated in fields like microrobotics, MEMS, and metamaterials fabrication, especially through the AM of polymeric materials. Electrochemical processing, such as electroless or electrodeposition, offers unique possibilities of integrating different materials in micro- and nanodevices. Magnetic and functional layers can be conveniently obtained surpassing the quality of those obtained by other techniques such as e-beam evaporation or sputtering.

This symposium focuses on current and emerging methods to synthesize and control microstructure and properties of a wide set of materials, as well as on generating structured materials across length scales, from macro- to submicron size.

Topics include, but are not limited to:

- (1) AM of metals, alloys, and composites;
- (2) Microstructure and properties control;
- (3) Modeling and design, including process control;
- (4) Applications

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Luca Magagnin**, Politecnico di Milano, email: [luca.magagnin@polimi.it](mailto:luca.magagnin@polimi.it); **Giovanni Zangari**, University of Virginia, email: [gz3e@virginia.edu](mailto:gz3e@virginia.edu); **Ji Ma**, University of Virginia, email: [jm5bu@virginia.edu](mailto:jm5bu@virginia.edu); **Christopher Arges**, Louisiana State University, email: [carges@lsu.edu](mailto:carges@lsu.edu).

### E03 Electrodeposition of Reactive Metals and Compounds 2 (No Water Allowed)

Electrodeposition Division; Battery Division; Industrial Electrochemistry and Electrochemical Engineering Division

This symposium covers all aspects of (electro)chemically reactive materials, ranging from their modeling, synthesis, characterization, and industrial upscaling to various applications in functional electrodes (electrochemical energy conversion and storage, sensors, actuators, micro and nanoelectronics, electrochromic devices, refining and recycling processes, etc.). The materials under discussion include, but are not limited to electrodeposition of refractory metals and their alloys, metals, and alloys more negative than hydrogen reversible potential, electrodeposition of alkali metals, electrodeposition of intermetallic compounds and Eutectics, etc. Due to the limited electrochemical window of water, some interesting elements and compounds (e.g., aluminum, refractory metals) cannot be electrodeposited from aqueous solvents.

The electrodeposition of lithium and sodium metal for battery applications is of special interest for this symposium. We seek discussion between experts from electrodeposition and battery communities. Metallic lithium is considered as anode in solid state lithium metal batteries. Reversible electrodeposition and stripping with near perfect current efficiency are required for long cycling lifetime. Furthermore, lithium plating is of interest for fabrication of low-cost lithium thin foils on, for example, copper current collectors.

This symposium focuses on novel electrodeposition processes from non-aqueous media such as organic solvents, supercritical fluids, molten salts, ionic liquids, etc. We also invite papers from non-standard and extreme conditions such as high pressure, supercritical fluids, from vapor and gas phase. From a fundamental point of view, possible topics are—but are not limited to—the role of the speciation of the metals in the electrolytes, the structure of the electrode-liquid interphase, and nucleation and growth phenomena. Also of interest are papers discussing the challenges associated with setting up, running, and maintaining a non-aqueous plating line.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Philippe Vereecken**, Katholieke Universiteit Leuven, email: [philippe.vereecken@imec.be](mailto:philippe.vereecken@imec.be); **Andreas Bund**, Technische Universität Ilmenau, email: [andreas.bund@tu-ilmenau.de](mailto:andreas.bund@tu-ilmenau.de); **Robert F. Savinell**, Case Western Reserve University, email: [rfs2@case.edu](mailto:rfs2@case.edu); **David Wood**, Oak Ridge National Laboratory, email: [wooddl@ornl.gov](mailto:wooddl@ornl.gov); **Daniel Steingart**, Columbia University, email: [dan.steingart@columbia.edu](mailto:dan.steingart@columbia.edu).

## F— Electrochemical Engineering

### F01 Advances in Industrial Electrochemistry and Electrochemical Engineering

Industrial Electrochemistry and Electrochemical Engineering Division

Papers are solicited in areas of industrial electrochemistry and electrochemical engineering that are not covered by other symposia at this meeting. Of particular interest are papers concerning: design, operation, testing and/or modeling of industrial electrochemical systems; electrochemical waste treatment technologies, methods for electrosynthesis; electrolytic recovery of process materials; new electrode



# 240TH ECS MEETING

materials, new electrochemical cell designs; and electrocatalysis. Also encouraged are presentations on industrially significant areas, such as chloralkali and fluorine production; manufacture of aluminum and other metals; the use of electrochemical methods in pulp and paper bleaching; and generation of environmentally-friendly bleaching chemicals and other active oxidants. Papers may contain theoretical and experimental work, and papers dealing with either area will be considered.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Douglas P. Riemer**, TDK, email: [riemerdp@hotmail.com](mailto:riemerdp@hotmail.com); **John Staser**, Ohio University, email: [staser@ohio.edu](mailto:staser@ohio.edu).

**F02**

## Electrochemical Separations and Sustainability 4

Industrial Electrochemistry and Electrochemical Engineering Division; Energy Technology Division; High-Temperature Energy, Materials, and Processes Division; Physical and Analytical Electrochemistry Division

There is a growing need to develop and understand technologies that can efficiently and effectively segregate and collect ionic species in gas, water or other liquids using electrochemical approaches. Key applications include gas (e.g., O<sub>2</sub>, H<sub>2</sub>, CO<sub>2</sub>) separation, water desalination, ultrapure water production, food and wine industry, selective ion removal from waste streams, treatment of produced and process water from the oil and gas industries, flow batteries, and sensors. This symposium intends to address the common technical and fundamental threads found in these technologies by focusing on topics included, but not limited to: materials and techniques for electrochemical deionization, electrochemically motivated membrane-based selective ion separation techniques, sea and brackish desalination technologies, and reversible flow batteries based on either solvated species or slurries of active materials, non-aqueous solvent separation, and ionic liquid membrane separations.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Hui Xu**, Giner Inc., email: [hxu@ginerinc.com](mailto:hxu@ginerinc.com); **Alice Suroviec**, Berry College, email: [asuroviec@berry.edu](mailto:asuroviec@berry.edu); **Xiao Su**, University of Illinois at Urbana-Champaign, email: [x2su@illinois.edu](mailto:x2su@illinois.edu).

**F03**

## Electrochemical Conversion of Biomass 3

Industrial Electrochemistry and Electrochemical Engineering Division

This symposium provides a forum to present applications, technology and recent development in the area of electrochemical conversion of biomass. Of particular interest are topics related to electrochemical conversion of biomass to value-added chemicals and fuels of all kinds, and treatment of industrial waste. Presentations related to the development of electrocatalysts or other materials, as well as complete systems, for the electrochemical conversion of biomass are relevant. Kinetics and electrochemical conversion mechanisms are also of interest. This topic focuses on electrochemical conversion of all forms of biomass, including algae and lignocellulosic materials.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Elizabeth Biddinger**, The City College of New York, email: [ebiddinger@che.ccny.cuny.edu](mailto:ebiddinger@che.ccny.cuny.edu); **Luis Diaz**, Idaho National Laboratory, email: [luis.diazaldana@inl.gov](mailto:luis.diazaldana@inl.gov); **Christopher Saffron**, Michigan State University, email: [saffronc@msu.edu](mailto:saffronc@msu.edu); **Jamie Holladay**, Pacific Northwest National Laboratory, email: [Jamie.Holladay@pnnl.gov](mailto:Jamie.Holladay@pnnl.gov); **John Staser**, Ohio University, email: [staser@ohio.edu](mailto:staser@ohio.edu); **Scott Calabrese Barton**, Michigan State University, email: [scb@msu.edu](mailto:scb@msu.edu).

**F04**

## Pulse and Reverse Pulse Electrolytic Processes 3

Industrial Electrochemistry and Electrochemical Engineering Division; Electrodeposition Division

Recent advances in pulse and pulse-reversed electric fields have found application in electrochemical machining, electropolishing and surface finishing, and a wide variety of electrodeposited materials. New electrolytes have also become viable due to the application of pulse and pulse reverse technologies. Papers are sought that describe recent advancement in methods, materials, and processes that utilize pulsed and pulse-reversed electric fields.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Maria Inman**, Faraday Technology, Inc., email: [maria.inman@faradaytechnology.com](mailto:maria.inman@faradaytechnology.com); **EJ Taylor**, Faraday Technology, Inc., email: [jenningtaylor@faradaytechnology.com](mailto:jenningtaylor@faradaytechnology.com); **Andreas Bund**, Technische Universität Ilmenau, email: [Andreas.Bund@tu-ilmenau.de](mailto:Andreas.Bund@tu-ilmenau.de).

**F05**

## Reduction of CO<sub>2</sub>: From Laboratory to Industrial Scale 2

Industrial Electrochemistry and Electrochemical Engineering Division; Energy Technology Division; High-Temperature Energy, Materials, and Processes Division

This session focuses on electrochemical techniques to reduce CO<sub>2</sub> to more useful chemicals that are not greenhouse gas pollutants. Of interest are presentations addressing research and development of electrochemical CO<sub>2</sub> reduction from the laboratory to industrial scale, including electrocatalysis, reactor design and operation, process modeling and simulation, scale-up to industrial scale, and techno-economic analysis.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Christopher Arges**, Louisiana State University, email: [carges@lsu.edu](mailto:carges@lsu.edu); **John Staser**, Ohio University, email: [staser@ohio.edu](mailto:staser@ohio.edu); **S. R. Narayan**, University of Southern California, email: [sri.narayan@usc.edu](mailto:sri.narayan@usc.edu); **Paul Kenis**, University of Illinois, email: [kenis@illinois.edu](mailto:kenis@illinois.edu); **John Flake**, Louisiana State University, email: [johnflake@lsu.edu](mailto:johnflake@lsu.edu); **Fikile Brushett**, Massachusetts Institute of Technology, email: [brushett@mit.edu](mailto:brushett@mit.edu); **Huyen Dinh**, National Renewable Energy Laboratory, email: [Huyen.dinh@nrel.gov](mailto:Huyen.dinh@nrel.gov).

**F06**

## Process Intensification Using Electrochemical Routes

Industrial Electrochemistry and Electrochemical Engineering Division

Process intensification consists of the combination of multiple unit operations in a process with the intent of reducing operational costs, equipment size, energy consumption, and/or waste generation, while maintaining a production goal. Engineers have been exploring process intensification since the early 1990s. Electrochemical technologies can play an important role in process intensification by enabling process pretreatment and efficient separations. This symposium provides a forum for the presentation and discussion of approaches for the incorporation of electrochemical routes in process intensification. Topics of interest include, but are not limited to:

- (1) Hybrid electrochemical/thermal chemical reactors;
- (2) Novel electrochemical reactor designs;
- (3) Electrochemical separations;
- (4) Selective oxidation/reduction processes;
- (5) Applications and economic analysis.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Paul Kenis**, University of Illinois, email: [kenis@illinois.edu](mailto:kenis@illinois.edu); **Wenzhen Li**, Iowa State University, email: [wzli@iastate.edu](mailto:wzli@iastate.edu); **William Tarpeh**, Stanford University, email: [wtarpeh@stanford.edu](mailto:wtarpeh@stanford.edu); **Scott Calabrese Barton**, Michigan State University, email: [scb@msu.edu](mailto:scb@msu.edu).

## G—Electronic Materials and Processing

**G01**

## Atomic Layer Deposition Applications 17

Electronics and Photonics Division; Dielectric Science and Technology Division

Continued progress in nanotechnology and nanomanufacturing requires precise, conformal coatings of thin film materials. Atomic layer deposition (ALD) enables the deposition of ultra-thin, highly conformal coatings over complex, 3D topographies with precise control over thickness and composition. Consequently, ALD has become the technology of choice for a large variety of applications beyond microelectronics. Over the last sixteen years, this symposium has earned a leading position among the meetings where ALD is discussed. This symposium offers an excellent forum for sharing cutting edge research on existing and emerging ALD applications, as well as fundamental aspects of ALD technology.

Contributions are solicited in the following areas:

- (1) Semiconductor CMOS applications: development and integration of ALD high-k oxides and metal electrodes with conventional and high-mobility channel materials
- (2) Volatile and non-volatile memory applications: extendibility, Flash, MIM, MIS, RF capacitors, etc.
- (3) Interconnects and contacts: integration of ALD films with Cu and low-k materials
- (4) Fundamentals of ALD processing: reaction mechanisms, in-situ measurement, modeling, theory
- (5) New precursors and delivery systems
- (6) Optical and photonic applications
- (7) Coating of nanoporous materials by ALD
- (8) MLD and hybrid ALD/MLD

- (9) ALD for energy conversion applications such as fuel cells, photovoltaics, etc.
- (10) ALD for energy storage applications
- (11) Productivity enhancement, scale-up and commercialization of ALD equipment and processes for rigid and flexible substrates, including roll-to-roll deposition
- (12) Area-selective ALD
- (13) Atomic layer etching (“reverse ALD”) and related topics aiming at self-limited etching, such as atomic layer cleaning, etc.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Fred Roozeboom**, Eindhoven University of Technology, email: [f.roozeboom@tue.nl](mailto:f.roozeboom@tue.nl); **Stefan De Gendt**, Katholieke Universiteit Leuven, email: [Stefan.Degendt@imec.be](mailto:Stefan.Degendt@imec.be); **Jolien Dendooven**, Ghent University, email: [Jolien.Dendooven@UGent.be](mailto:Jolien.Dendooven@UGent.be); **Jeffrey Elam**, Argonne National Laboratory, email: [jelam@anl.gov](mailto:jelam@anl.gov); **Oscar van der Straten**, IBM Corporation Research Center, email: [ovander@us.ibm.com](mailto:ovander@us.ibm.com); **Andrea Illiberi**, ASM Europe, email: [andrea.illiberi@asm.com](mailto:andrea.illiberi@asm.com); **Ganesh Sundaram**, Veeco-CNT, email: [gsundaram@veeco.com](mailto:gsundaram@veeco.com); **Rong Chen**, Huazhong Univ. Science & Technology, email: [rongchen@hust.edu.cn](mailto:rongchen@hust.edu.cn); **Thorsten Lill**, Lam Research, email: [Thorsten.Lill@lamresearch.com](mailto:Thorsten.Lill@lamresearch.com); **Oana Leonte**, Berkeley Polymer Technology, email: [odleonte@comcast.net](mailto:odleonte@comcast.net); **Matthias Young**, University of Missouri, Columbia, MO 65211, email: [matthias.young@missouri.edu](mailto:matthias.young@missouri.edu).

**G02**

## Semiconductor Process Integration 12

Electronics and Photonics Division

The 12th Symposium on Semiconductor Process Integration provides a forum for reviewing and discussing all aspects of process integration. Contributed papers are solicited in the following areas:

- (1) Device Technologies: trends in nanoscaled technologies on DRAM, SRAM, flash memory, high density logic/low power, RF, mixed analog/digital, high voltage, process integration yield, 3D integration, advanced SOI single and multi-gate;
- (2) Front-end-of-line Integration: gate dielectrics (ultra-thin, high-k) and dual gates, stacks (barriers) electrode/dielectrics for memory capacitors and transistors, source-drain and channel processing, rapid thermal processing, novel isolation schemes, ultra-shallow junction, plasma processing aspects, transistor process/device integration issues;
- (3) Back-end-of-line Integration: CMP issues, low-k dielectrics, multilevel integrated structures, copper interconnects and barriers, air-gap structures, metal fill technologies, optical interconnects, alternative metallization schemes;
- (4) Alternative Channel Technologies: Ge, III-V technologies, alternative high mobility substrates (sSOI, sSi, SiGe, GeOI, etc.), hybrid integration, new channel materials;
- (5) Emerging Technologies: novel memory elements (RRAM, PCRAM, etc.); device integration for artificial intelligence, neuromorphic and quantum computing; novel integration schemes for SoC solutions (3D-monolithic, vertical integration, etc.); emerging material integration (carbon nanotubes, 2D materials, graphene devices, III/V, silicon-organic-hybrid photonic [SOH], polymer electronics, spin and quantum devices); energy efficiency in nanoelectronics—and many things.

This symposium’s proceedings will be published in *ECS Transactions* and available at the meeting. Authors accepted for presentation are strongly encouraged to submit their full text manuscript for the issue no later than July 16, 2021. Submit all manuscripts online in either MS Word or PDF format.

# 240TH ECS MEETING

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Junichi Murota**, Tohoku University, email: murota2@riec.tohoku.ac.jp; **Cor Claeys**, Katholieke Universiteit Leuven, email: c.claeys@ieee.org; **Hiroshi Iwai**, Tokyo Institute of Technology, email: iwai.h.aa@m.titech.ac.jp; **Simon Deleonibus**, CEA LETI MINATEC, email: simon.deleonibus.1992@ieee.org; **Andreas Mai**, Leibniz-Institut fuer innovative Mikroelektronik-IHP Microelectronics, email: mai@ihp-microelectronics.com; **Hiromu Ishii**, Toyohashi University of Technology, email: ishii@ee.tut.ac.jp; **Yu Cao**, Qorvo Inc, email: Yu.Cao@qorvo.com; **Yuji Zhao**, Arizona State University, email: Yuji.Zhao@asu.edu.

## **G03** Thermoelectric and Thermal Interface Materials 7 Electronics and Photonics Division

Today's electronics are smaller and more powerful than ever, leading to ever increasing thermal challenges. Approximately 90% of the world's electricity is generated by heat energy, typically operating at 30-40% efficiency, losing roughly 15 terawatts of power in the form of heat to the environment. Heat sinks and liquids can be used to provide cooling. Advances in thermoelectric materials and devices with high Seebeck coefficients and figures of merit offer possible routes for thermal management, but also waste heat harvesting and power generation. Thermal interface materials importantly help to transfer heat from hot spots to the cooling hardware, and advances in thermoelectric materials and interface materials are required.

This symposium addresses the most recent developments in thermoelectric and thermal interface materials and strategies for modern devices and applications. Papers on practical and fundamental issues are solicited on topics related to thermoelectric material growth, analysis, processing, and applications, as well as thermal interface material applications and properties. The symposium addresses basic and applied research and development, which includes the following areas of particular interest:

- (1) Advances in bulk and nanoscale growth methods;
- (2) Advances in device processing of thermoelectric and thermal interface materials;
- (3) Power generation and energy harvesting and scavenging;
- (4) Refrigeration and cooling;
- (5) Semiconductor materials, growth, and processing;
- (6) Phonon engineering and transport;
- (7) In situ and ex situ examination;
- (8) Modeling of nanoscale effects in modern thermoelectric materials;
- (9) Bismuth chalcogenides;
- (10) Inorganic clathrates;
- (11) Group IV and related compounds;
- (12) Oxide and transition metal silicides, properties, and processing;
- (13) Advanced thermoelectric materials;
- (14) High ZT materials and devices.

This symposium's proceedings will be published in *ECS Transactions* and available at the meeting. Authors accepted for presentation are strongly encouraged to submit their full text manuscript for the issue no later than July 16, 2021. Submit all manuscripts online in either MS Word or PDF format.

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Jaeho Lee**, University of California, Irvine, email: jaeholee@uci.edu; **Woohul Lee**, University of Hawaii, email: woohull@hawaii.edu; **Jr Hau He**, City University of Hong Kong, email: jrhaue@cityu.edu.hk; **Kafil Razeed**, Tyndall National Institute, University College Cork, email: kafil.mahmood@tyndall.ie; **Renkun Chen**, University of California, San Diego, email: rkchen@ucsd.edu; **Yue Wu**, Iowa State University, email: yuewu@iastate.edu; **Colm O'Dwyer**, University College Cork, email: c.odwyer@ucc.ie.

## **H—Electronic and Photonic Devices and Systems**

### **H01** State-of-the-Art Program on Compound Semiconductors 64 (SOTAPOCS-64) Electronics and Photonics Division

Compound semiconductors are a significant enabler of numerous optoelectronic, high-speed, power, and sensor devices. The SOTAPOCS 64 symposium addresses the most recent developments in inorganic compound semiconductor technology, including traditional III-V materials, III-nitrides, II-VI materials, silicon carbide, diamond, and other emerging materials. Papers on practical and fundamental issues are solicited. The following areas are of particular interest:

- (1) Advances in bulk and epitaxial growth techniques
- (2) Advances in device processing
- (3) Novel electronic, optoelectronic, and sensor devices
- (4) Schottky and ohmic contact technology
- (5) Dielectric properties and passivation
- (6) Wafer bonding and packaging
- (7) In situ and ex situ process monitoring
- (8) Materials characterization and wafer level testing and mapping
- (9) Process-induced defects
- (10) Reliability and device degradation mechanisms
- (11) Demonstration of state-of-the-art devices and applications

This symposium will be organized/scheduled in close collaboration with the symposium H03, "Gallium Nitride and Silicon Carbide Power Technologies 11."

This symposium's proceedings will be published in *ECS Transactions* and available at the meeting. Authors accepted for presentation are strongly encouraged to submit their full text manuscript for the issue no later than July 16, 2021. Submit all manuscripts online in either MS Word or PDF format.

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Jennifer Hite**, U.S. Naval Research Laboratory, email: jennifer.hite@nrl.navy.mil; **Travis Anderson**, U.S. Naval Research Laboratory, email: travis.anderson@nrl.navy.mil; **Robert Lynch**, University of Limerick, email: robert.lynch@ul.ie; **Colm O'Dwyer**, University College Cork, email: c.odwyer@ucc.ie; **Erica Douglas**, Sandia National Laboratories, email: edougla@sandia.gov; **Yuji Zhao**, Arizona State University, email: Yuji.Zhao@asu.edu.

### **H02** Low-Dimensional Nanoscale Electronic and Photonic Devices 14 Electronics and Photonics Division

The 14th LDEPD symposium addresses the most recent developments in nanoscale transparent electronic, photonic materials, and devices. The symposium encompasses low dimensional and transparent novel materials and devices, processing, device fabrication, reliability, and other related topics. Papers on practical issues and fundamental studies are solicited. The symposium consists of invited and contributed papers.

This symposium's proceedings will be published in *ECS Transactions* and available at the meeting. Authors accepted for presentation are strongly encouraged to submit their full text manuscript for the issue no later than July 16, 2021. Submit all manuscripts online in either MS Word or PDF format.

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Yu-Lun Chueh**, National Tsing Hua University, email: ylchueh@mx.nthu.edu.tw; **Colm O'Dwyer**, University College Cork, email: c.odwyer@ucc.ie; **Jr-Hau He**, King Abdullah University of Science and Technology, email: jrhaue@kaust.



# 240TH ECS MEETING

edu.sa; **Motofumi Suzuki**, Kyoto University, email: m-snki@me.kyoto-u.ac.jp; **Song Jin**, Department of Chemistry, UW-Madison, email: jin@chem.wisc.edu; **Sang-Woo Kim**, Sungkyunkwan University, email: kimsw1@skku.edu; **Johnny Ho**, City University of Hong Kong, email: johnnyho@cityu.edu.hk; **Zhiyong Fan**, The Hong Kong University of Science and Technology, email: eezfan@ust.hk; **Qiliang Li**, George Mason University, email: qli6@gmu.edu; **Gary W Hunter**, NASA Glenn Research Center, email: Gary.W.Hunter@nasa.gov; **Kuniharu Takei**, Osaka Prefecture University, email: takei@pe.osakafu-u.ac.jp; **Jyh Ming Wu**, National Tsing Hua University, email: jmwuyun@gmail.com; **Lance Li**, email: lance.sinica@gmail.com.

## H03

### Gallium Nitride and Silicon Carbide Power Technologies 11

Electronics and Photonics Division

This symposium continues to showcase the state-of-the-art in the development of GaN and SiC wide bandgap material and device technologies for power switching and power amplifier applications. Ultra-wide bandgap technologies based on high Al-content AlGaN and Gallium Oxide are also addressed. The symposium covers a wide range of topics related to these technologies and their applications: bulk and thin film growth and characterization of materials; defect characterization and reduction techniques; growth chamber design and modeling; doping and carrier lifetime control techniques; high-frequency low-loss power magnetic materials; novel power devices and device structures; power device fabrication technologies; chip-scale capacitor, inductor and transformer structures and fabrication technologies; novel physical mechanisms including micro plasma and current filamentation; short-term and long-term device degradation and failure mechanisms; novel accelerated stress testing and lifetime prediction methodologies; device characterization and modeling for performance and reliability; manufacturing cost and yield improvement approaches; homogeneous and heterogeneous chip-scale integration; power converters and power amplifiers; packaging and thermal management; and cooling of power chips and modules. A poster session is scheduled.

This symposium will be organized/scheduled in close collaboration with the symposium H01, "State-of-the-Art Program on Compound Semiconductors 64 (SOTAPOCS-64)."

This symposium's proceedings will be published in *ECS Transactions* and available at the meeting. Authors accepted for presentation are strongly encouraged to submit their full text manuscript for the issue no later than July 16, 2021. Submit all manuscripts online in either MS Word or PDF format.

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Michael Dudley**, Stony Brook University, email: Michael.Dudley@stonybrook.edu; **Noboru Ohtani**, Kwansei Gakuin University, email: Ohtani.Noboru@kwansei.ac.jp; **Mietek Bakowski**, Rise Acreo, email: mietek.bakowski@rise.se; **Balaji Raghothamachar**, Stony Brook University, email: Balaji.Raghothamachar@stonybrook.edu.

## I—Fuel Cells, Electrolyzers, and Energy Conversion

## 101

### Polymer Electrolyte Fuel Cells & Electrolyzers 21 (PEFC&E 21)

Energy Technology Division; Battery Division; Corrosion Division; Industrial Electrochemistry and Electrochemical Engineering Division; Physical and Analytical Electrochemistry Division

This international symposium is devoted to all aspects of research, development, and engineering of polymer electrolyte fuel cells and electrolyzers (PEFC&Es), as well as low-temperature direct-fuel cells using either anion or cation exchange membranes. The intention is to bring together the international community working on these technologies and enable effective interactions between research and engineering communities. The symposium is structured as seven sections covering (A) diagnostic techniques; (B) design/components for fuel cell systems; (C) acid and alkaline membranes and ionomers for fuel cells; (D) catalysts for acid fuel cells; (E) catalysts and membranes for alkaline fuel cells and direct-fuel acid fuel cells; and (F) water electrolysis. Abstracts will be considered for other polymer-membrane-based electrochemical devices like electrochemical hydrogen pumps, etc., but excluding CO<sub>2</sub> electrochemical reduction and photochemical water splitting, which are covered by other Symposia.

PEFC&E21 will encourage student participation by paying the registration cost for students and hosting a Student Poster Contest with cash prizes. We anticipate being able to pay the registration cost for over 30 students who are a lead author on an abstracts submitted to the symposium – the exact number will depend on the level of sponsorship and will be determined by lottery. Additional cash awards will be awarded as part of the Student Poster Contest to posters with the best technical and visual quality, as selected by a technical panel either at the conference or virtually. Students who wish to compete poster award should send a copy of their accepted abstract to Professor Jim Fenton (jfenton@fsec.ucf.edu) and Professor Iryna Zenyuk (iryana.zenyuk@uci.edu).

#### Section A: Diagnostics/Characterization Methods, MEA Design/Model

Organizers: F. N. Büchi, A. Weber, E. Kjeang, H. Jia

Presentations related to acid and alkaline fuel cells that discuss:

- (1) Novel gas diffusion medium substrates and micro-porous layer designs;
- (2) Modeling and diagnostic methods to characterize mass- and heat-transport related phenomena, and water management in cells and membrane electrode assemblies;
- (3) CO<sub>2</sub> tolerance modeling of anion exchange membrane fuel cells;
- (4) In situ measurement or visualization (X-ray tomography, neutron imaging, etc.);
- (5) Advanced ex situ characterization methods (TEM, STM);
- (6) AC-impedance methods;
- (7) Electrode and MEA electrochemical modeling.

#### Section B: Cells, Stacks and Systems

Organizers: C. Rice, B. Lakshmanan, K. Swider-Lyons

Presentations related to acid and alkaline fuel cells and other electrochemical energy conversion devices that discuss cells, stacks, and systems for:

- (1) Hydrogen or hydrogen-reformate fuel cells;
- (2) Direct-fuel fuel cells (DMFC, borohydride, etc.);
- (3) Alkaline (membrane) fuel cells;
- (4) Portable fuel cells;

# 240TH ECS MEETING

- (5) New cell and stack structures, including new types of bipolar plates and flow fields;
- (6) Degradation of fuel cell components and the influence of degradation products on component and system performance, including corrosion of bipolar plates and BOP, and degradation of sealing materials and other components;
- (7) Electrochemical hydrogen compression;
- (8) Balance-of-plant (BOP) components;
- (9) Design and specifications of complete power systems in the context of transportation and stationary power generation applications as well as for micro-fuel cell systems;
- (10) Components and systems for other electrochemical energy conversion devices such as electrochemical hydrogen pumps, etc.

## Section C: Ion-Exchange Membrane Development, Performance and Durability

Organizers: A. Kusoglu, P. N. Pintauro, D. J. Jones

Presentations related to acid and alkaline fuel cells that discuss:

- (1) Development of cation-exchange membranes and ionomers (PFSA, hydrocarbon-based, etc.);
- (2) Development of novel anion-exchange membranes and ionomers;
- (3) High-temperature polymer membranes;
- (4) Physico-chemical properties of fuel cell membranes;
- (5) Structural and microscopic characterization of membranes and ionomers;
- (6) Degradation/aging of membranes (chemical and mechanical);
- (7) Molecular modeling of membrane properties;
- (8) Ionomer properties and characterization.

## Section D: Catalyst Activity/Durability for Hydrogen(-Reformate) Acidic Fuel Cells

Organizers: H. Uchida, P. Strasser, Y.-T. Kim, U. Kramme

Presentations related to acidic fuel cells that discuss:

- (1) Fuel cell electrocatalysts for hydrogen and hydrogen-reformate fuel cells (PEMFC, PAFC, etc.);
- (2) Novel catalyst supports;
- (3) Degradation of fuel cell electrocatalysts and catalyst supports; and
- (4) Ab initio computational studies of catalytic mechanisms and for the design of novel catalysts.

## Section E: Materials for Alkaline Fuel Cells and Direct-Fuel Fuel Cells

Organizers: W. Mustain, R. Mantz, D. Dekel

Presentations related to alkaline fuel cells and direct-fuel acid fuel cells that discuss:

- (1) Electrocatalysts for hydrogen oxidation and oxygen reduction in alkaline fuel cells;
- (2) Catalysts for direct-borohydride applications;
- (3) Novel anion-exchange membranes;
- (4) Degradation mechanisms of anion-exchange membranes;
- (5) Catalysts for the direct electrooxidation of alternative fuels (e.g., methanol, ethanol, ammonia, etc.) in alkaline and acidic fuel cells.

## Section F: Polymer-Electrolyte Electrolysis

Organizers: B. S. Pivovar, H. Xu, K. Ayers, S. Mitsushima

Presentations related to low-temperature, polymer electrolyte water electrolysis for hydrogen and oxygen production (specifically excluding approaches that are primarily focused on photoelectrochemical water splitting or CO<sub>2</sub> electrochemical reduction, as these areas are covered by other symposia dedicated specifically to these topics:

- (1) Electrocatalysts for hydrogen reduction and oxygen evolution including performance and durability;
- (2) Polymers, membranes, and electrodes for electrolysis applications;
- (3) Transport media and bipolar plates;

- (4) Balance-of-plant (BOP) components;
- (5) Degradation of electrolysis components and the influence of degradation products on system performance and lifetime;
- (6) Design and specifications of complete electrolysis systems in the context of hydrogen generation applications as well as intermittent or load following applications.

Abstracts should be submitted electronically to ECS headquarters via the ECS website. Researchers may select between an oral or poster contribution. Space for oral presentations is limited, so research groups that submit several abstracts should seek a reasonable balance between oral and poster contributions as. An enhanced edition of *ECS Transactions* is planned, and will be available at the meeting. All authors accepted for oral or poster presentations may submit a full text manuscript for the ECS Transactions issue for PEFC&E21 no later than July 16, 2021 via an email link provided to authors by the ECS.

Questions and inquiries should be sent to the symposium organizers: Session Chair: **Karen E. Swider-Lyons**, Naval Research Laboratory, email: karen.lyons@nrl.navy.mil; **Felix Buechi**, Paul Scherrer Institut, felix.buechi@psi.ch; **Adam Weber**, Lawrence Berkeley National Laboratory, azweber@lbl.gov; **Erik Kjeang**, Simon Fraser University, ekjeang@sfu.ca; **Hongfei Jia**, Toyota Research Institute of North America, hongfei.jia@toyota.com; **Cynthia Rice**, Tennessee Technological University, CRice@tntech.edu; **Balsu Lakshmanan**, General Motors, balsu.lakshmanan@gm.com, **Ahmet Kusoglu**, Lawrence Berkeley National Laboratory, akusoglu@lbl.gov; **Deborah Jones**, CNRS/Université de Montpellier, Deborah.Jones@umontpellier.fr; **Peter Pintauro**, Vanderbilt University, pn.pintauro@vanderbilt.edu, **Hiroyuki Uchida**, University of Yamanashi, h-uchida@yamanashi.ac.jp, **Peter Strasser**, Technical University Berlin, pstrasser@tu-berlin.de; **Yong-Tae Kim**, Pusan National University, yongtae@postech.ac.kr; **Ulrike Kramm**, Technische Universität Darmstadt, kramm@ese.tu-darmstadt.de; **William Mustain**, University of South Carolina, mustainw@mailbox.sc.edu; **Robert Mantz**, United States Army Research Office, robert.a.mantz@us.army.mil; **Dario Dekel**, Technion-Israel Institute of Technology, dario@technion.ac.il; **Bryan Pivovar**, National Renewable Energy Laboratory, bryan.pivovar@nrel.gov; **Hui Xu**, Giner, Inc., hxu@ginerinc.com; **Kathy Ayers**, NEL Hydrogen, kayers@nelhydrogen.com; **Shigenori Mitsushima**, Yokohama National University, mitsushima-shigenori-hp@ynu.ac.jp; **James Fenton**, University of Central Florida, jfenton@fsec.ucf.edu; **Iryna Zenyuk**, University of California, Irvine, iryna.zenyuk@uci.edu.

## 102 Materials for Low Temperature Electrochemical Systems 7 Energy Technology Division

Materials development is critical to the commercialization of electrochemical technologies including batteries, alkaline and proton exchange membrane fuel cells, supercapacitors, and other electrochemical applications/devices. This symposium focuses on the fundamental and applied aspects of the materials for low temperature electrochemical technologies. Topics of interest include, but are not restricted to:

- (1) Experimental methods for membrane/ionomer design, synthesis, characterization, and evaluation;
- (2) Modeling for guiding membrane materials development and for the prediction of membrane material properties;
- (3) Electrocatalyst design, synthesis, characterization, and performance/durability evaluation for fuel cells, metal-air batteries, etc.;
- (4) Design, characterization, and evaluation of active materials for batteries and supercapacitors;
- (5) Electrolytes and separators for batteries.

# 240TH ECS MEETING

This symposium's proceedings will be published in *ECS Transactions* and available at the meeting. Authors accepted for presentation are strongly encouraged to submit their full text manuscript for the issue no later than July 16, 2021. Submit all manuscripts online in either MS Word or PDF format.

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Minhua Shao**, The Hong Kong University of Science and Technology, email: kemshao@ust.hk; **Joshua Spurgeon**, Conn Center for Renewable Energy Research, University of Louisville, email: joshua.spurgeon@louisville.edu.

103

## Renewable Fuels via Artificial Photosynthesis or Heterocatalysis 7

Energy Technology Division

This symposium provides an international and interdisciplinary forum to present the latest research on the production of fuels (e.g., hydrogen or other gas/liquid hydrocarbon fuels) by solar energy or electrical energy. Topics of interest include, but are not limited to:

- (1) Utilization of renewable energy resources such as water, carbon dioxide, nitrogen or biomass for generation of fuels such as hydrogen, ammonia, and hydrocarbon compounds;
- (2) Generation of fuels with photocatalysts or photoelectrochemical cells (PECs);
- (3) Generation of fuels with electrocatalysts;
- (4) Sunlight-driven production of bio-fuels and bio-hydrogen with enzymes and photoautotrophic microorganisms;
- (5) Synthesis and characterization of photocatalysts or electrocatalysts;
- (6) Exploration of new materials for solar energy conversion;
- (7) Generation of fuels with solar-thermal processes;
- (8) Simulation and modeling of materials, devices, and systems for solar energy conversion.

This symposium's proceedings will be published in *ECS Transactions* and available at the meeting. Authors accepted for presentation are strongly encouraged to submit their full text manuscript for the issue no later than July 16, 2021. Submit all manuscripts online in either MS Word or PDF format.

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Nianqiang (Nick) Wu**, University of Massachusetts Amherst, email: nianqiangwu@umass.edu; **Vaidyanathan Subramanian**, University of Nevada Reno, email: raviv@unr.edu; **Heli Wang**, Sabic Technology Center, email: hwang@sabic.com; **Mani Manivannan**, Global Pragmatic Materials, email: manigpm1@outlook.com; **Jae-Joon Lee**, Dongguk University, email: jjlee@dongguk.edu; **Gary Wiederrecht**, Argonne National Laboratory, email: wiederrecht@anl.gov; **Tetsu Tatsuma**, University of Tokyo, email: tatsuma@iis.u-tokyo.ac.jp; **Dongling Ma**, Université du Québec, email: ma@emt.inrs.ca; **Eric Miller**, United States Department of Energy, email: Eric.Miller@ee.doe.gov; **Pawel Kulesza**, University of Warsaw, email: pkulesza@chem.uw.edu.pl.

104

## Crosscutting Materials Innovation for Transformational Chemical and Electrochemical Energy Conversion Technologies 4

Energy Technology Division

In 2016, the U.S. Department of Energy (DOE) launched the Energy Materials Network (EMN) to accelerate the process of materials discovery, development, and ultimate deployment in major clean energy sectors. Innovations in clean energy technologies are vital to domestic energy security and economic growth. Consistent with the EMN vision, moving transformational energy technologies forward requires an honest discussion of the challenges and opportunities in critical materials R&D. An integrated approach spanning materials design and synthesis

through process scale-up and qualification is essential to this effort. This symposium brings together materials experts and stakeholders from multiple sectors covered in the current EMN portfolio. This includes world class leaders with multi-physics and multi-scale expertise from the EMNs as well as leaders of other high impact materials initiatives in chemical and electrochemical systems for clean energy applications. Some common material challenges across all EMNs include interfaces, corrosion, performance, benchmarking, analysis, and computational modeling. It is expected that cross-cutting conversations at this session foster synergy for future collaborations.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Huyen Dinh**, National Renewable Energy Laboratory, email: huyen.dinh@nrel.gov; **Eric Miller**, United States Department of Energy, email: Eric.Miller@ee.doe.gov; **Sanjeev Mukerjee**, Northeastern University, email: s.mukerjee@northeastern.edu.

105

## Advanced Manufacturing for High-Temperature Materials and Devices

High-Temperature Energy, Materials, and Processes Division; Battery Division; Industrial Electrochemistry and Electrochemical Engineering Division

Advances in materials manufacturing has provided new opportunities for exploring, developing, and implementing process technologies where complex thermodynamics, ionic transport, and chemistry can play a key role. With the inception of direct digital manufacturing (such as additive manufacturing and computer numerical control manufacturing), rapid laser processing, and AI-driven automated manufacturing, the ability for control and simulation of materials manufacturing is enabling materials and device manufacturing at higher rates, precision, and customization. Advanced manufacturing has found the significant application of high-temperature materials and devices relevant to electrochemistry and energy conversion/storage. Many advanced manufacturing-related activities provide unique opportunities for a wide array of electrochemical energy conversion and storage, electrochemical membrane reactors, chemical sensors, high-temperature electrochemical processing, and high-temperature electrochemical materials. Topics of interest include but are not limited to, experimental and modeling studies of:

- (1) Additive manufacturing of energy conversion and storage materials and devices (e.g., fuel cells, electrolysis cells, elevated-temperature solid state batteries and supercapacitors, electrochemical membrane reactors, high-temperature chemical sensors);
- (2) Experimental and theoretical analysis of laser processing (for sintering, machining, drying, polishing) of high-temperature electrochemical materials and devices;
- (3) Simulation and automated control of manufacturing of high-temperature electrochemical materials and devices;
- (4) Rapid consolidation (e.g., sintering) of materials and devices used in high-temperature electrochemical processes and environments;
- (5) Testing and characterization of high-temperature electrochemical material properties, material microstructures, and devices obtained by advanced manufacturing materials;
- (6) AI-driven intelligent manufacturing with in situ characterization of materials properties/microstructures for high-temperature electrochemical materials and devices;
- (7) New advances in manufacturing progress on high-temperature electrochemical materials and devices.
- (8) This symposium addresses application and fundamentals of advanced manufacturing for high-temperature electrochemical materials and devices. We want to facilitate broad interdisciplinary conversations through this symposium.



# 240TH ECS MEETING

This symposium's proceedings will be published in *ECS Transactions* and available at the meeting. Authors accepted for presentation are strongly encouraged to submit their full text manuscript for the issue no later than July 16, 2021. Submit all manuscripts online in either MS Word or PDF format.

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Jianhua Tong**, Clemson University, email: jianhut@clemson.edu; **Gregory Jackson**, Colorado School of Mines, email: gsjackso@mines.edu; **Sean R. Bishop**, Sandia National Laboratories, email: srbisho@sandia.gov; **Dong Ding**, Idaho National Laboratory, email: dong.ding@inl.gov; **Corie L. Cobb**, University of Washington, email: clcobb@uw.edu; **John Staser**, Ohio University, email: staser@ohio.edu.

## J—Luminescence and Display Materials, Devices, and Processing

### J01 Luminescence: Fundamentals and Applications Luminescence and Display Materials Division; Dielectric Science and Technology Division

This symposium focuses on the physical and chemical aspects of luminescence in organic and inorganic materials. Presentations at this meeting focus on photoluminescent materials, cathodoluminescent materials, electroluminescent materials, scintillators, persistent phosphors, and laser materials. This can include fundamental studies as well as the application of luminescent materials. This symposium also features talks on luminescent materials for energy reduction and renewable energy sources. Such topics include, but are not limited to, experimental and theoretical works on LED-based lighting, laser-driven white lighting, mini- or micro-LED based display lighting, OLEDs, white and colored LEDs, quantum dot-based luminescence, and related up-conversion/down-conversion processes.

This symposium will be organized/scheduled in close collaboration with the symposium L07, "Electrochemical Luminescence and Fluorescence."

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Jakoah Brgoch**, University of Houston, email: jbrgoch@central.uh.edu; **Rong-Jun Xie**, Xiamen University, email: rxjie@xmu.edu.cn; **Peter Mascher**, McMaster University, email: mascher@mcmaster.ca; **Kailash Mishra**, OSRAM Opto Semiconductors, email: kailash5652@gmail.com.

### J02 Ultraviolet and Infrared Luminescent Materials: Development and Applications Luminescence and Display Materials Division; Dielectric Science and Technology Division

This symposium focuses on recent trends in ultraviolet and infrared regions of the electromagnetic spectrum. The talks focus on the discovery of new luminescent materials such as inorganic phosphors and quantum dots that emit light outside of the visible region. Topics can include the development of new theories, computational modeling, and measurement

and synthesis methods. Papers can cover the uses of these materials in solar cell applications, involving up-conversion and down-conversion phosphors to utilize solar spectrum in UV and IR regions. Additionally, applications of UV and IR light in biology including diagnostics, sanitizing and sterilizing surfaces, and food safety are encouraged.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Jakoah Brgoch**, University of Houston, email: jbrgoch@central.uh.edu; **Peter Mascher**, McMaster University, email: mascher@mcmaster.ca.

## K—Organic and Bioelectrochemistry

### K01 Advances in Organic and Biological Electrochemistry Organic and Biological Electrochemistry Division

Contributions are solicited in all areas of organic and biological electrochemistry, including synthetic and mechanistic organic electrochemical research as well as biological and biochemical electrochemistry. Sensor applications in these areas are also welcome.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Diane K. Smith**, San Diego State University, email: dksmith@sdsu.edu; **Song Lin**, Cornell University, email: songlin@cornell.edu; **Flavio Maran**, Università degli Studi di Padova, email: flavio.maran@unipd.it.

## L—Physical and Analytical Electrochemistry, Electrocatalysis, and Photoelectrochemistry

### L01 Physical and Analytical Electrochemistry, Electrocatalysis, and Photoelectrochemistry General Session Physical and Analytical Electrochemistry Division

This symposium address all aspects of physical and analytical electrochemistry from fundamentals to new practical applications. The symposium invites papers on new theoretical and experimental approaches that may lead to improved merits of analytical techniques as well as papers concerning any aspect of physical electrochemistry.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Andrew C. Hillier**, Iowa State, email: hillier@iastate.edu; **Petr Vanysek**, CEITEC - Central European Institute of Technology, email: pvanysek@gmail.com.

# 240TH ECS MEETING

**L02**

## Advanced Techniques for In Situ Electrochemical Systems 4

Physical and Analytical Electrochemistry Division;  
Energy Technology Division; High-Temperature  
Energy, Materials, and Processes Division

In situ methods help advance the understanding of electrochemical systems developed to solve the energy, environmental, and biological needs of society. This symposium provides a forum targeting advancements and applications of various methods for in situ and operando characterization of electrochemical systems. Solicitation topics include, but are not limited to, various electroanalytical methods and in situ spectroscopy, spectrometry, and microscopy techniques. Of special interest are papers focused on synchrotron-based techniques for characterization of electroactive materials, electrode-electrolyte interfaces, and electrochemical devices.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Svitlana Pylypenko**, Colorado School of Mines, email: [spylypen@mines.edu](mailto:spylypen@mines.edu); **Anne Co**, OSU, email: [co.5@osu.edu](mailto:co.5@osu.edu); **Minhua Shao**, The Hong Kong University of Science and Technology, email: [kemshao@ust.hk](mailto:kemshao@ust.hk).

**L03**

## The Brain and Electrochemistry 3

Physical and Analytical Electrochemistry Division;  
Organic and Biological Electrochemistry Division

The symposium provides a forum for the discussion of research and developments on how the central (CNS) and peripheral nervous systems (PNS) can be viewed and studied in terms of electrical circuits and electrochemical sensors, reactions and methods. Potential topics include:

- (1) Unresolved questions in brain function and neurological dysfunction;
- (2) CNS and PNS monitoring and different ways to activate the nervous system including electrical neurostimulation, optogenetics, magnetogenetics, and other novel approaches;
- (3) Simulation and modeling of neural circuits;
- (4) Electrochemical sensors, measurements, and methods of neurochemistry;
- (5) Novel neural interfaces, materials stability, and biocompatibility of implantable devices.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **David Cliffel**, Vanderbilt University, email: [d.cliffel@vanderbilt.edu](mailto:d.cliffel@vanderbilt.edu); **Mekki Bayachou**, Cleveland State University, email: [m.bayachou@csuohio.edu](mailto:m.bayachou@csuohio.edu); **Hariklia Deligianni**, IBM, email: [lili.deligianni@gmail.com](mailto:lili.deligianni@gmail.com).

**L04**

## Education in Electrochemistry 3

Physical and Analytical Electrochemistry  
Division; Energy Technology Division; Industrial  
Electrochemistry and Electrochemical Engineering  
Division

With the continued need for more well-trained electrochemistry and electrochemical engineers, being able to teach the fundamentals of electrochemistry has become ever more important. The Education in Electrochemistry symposium is focused on new pedagogies of teaching

electrochemistry in a variety of settings. Papers from students are also invited as an opportunity to showcase their work. Papers on basic and applied research and teaching in all areas of electrochemistry, electrochemical systems, and physics related to solid state and electrochemical science and technology are solicited. The topics include:

- (1) Power and energy applications;
- (2) Corrosion phenomena;
- (3) Electrochemical synthesis and engineering;
- (4) Sensors and biosensors;
- (5) Luminescent processes;
- (6) Materials and biomaterials;
- (7) Electron transport and electrochemistry;
- (8) Biochemical and biomedical applications;
- (9) Novel approaches to teaching electrochemistry.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Alice Suroviec**, Berry College, email: [asuroviec@berry.edu](mailto:asuroviec@berry.edu); **Thomas Fuller**, School of Chemical & Biomolecular Engineering, email: [tom.fuller@chbe.gatech.edu](mailto:tom.fuller@chbe.gatech.edu); **John Harb**, Dept. of Chemical Engineering, Brigham Young University, email: [john\\_harb@byu.edu](mailto:john_harb@byu.edu); **Michelle Rasmussen**, Lebanon Valley College, email: [rasmusse@lvc.edu](mailto:rasmusse@lvc.edu); **Plamen Atanassov**, University of California Irvine, email: [plamen.atanassov@uci.edu](mailto:plamen.atanassov@uci.edu); **Alanah Fitch**, Loyola University, email: [afitch@luc.edu](mailto:afitch@luc.edu).

**L05**

## Electrochemical Water Remediation

Physical and Analytical Electrochemistry Division;  
Industrial Electrochemistry and Electrochemical  
Engineering Division

Water remediation is a critical but energy-intensive process today. This symposium discusses the use of electrochemistry and electrochemical techniques for water purification. This includes all uses of electrochemistry for cleaning all types of water (wastewater, drinking water, saline water, etc.). This symposium also discusses the use of electroanalytical techniques for testing water quality.

This symposium will be organized/scheduled in close collaboration with the symposium D05, "Water-Energy Nexus Research Relating to Semiconducting Materials."

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Shelley Minteer**, University of Utah, email: [minteer@chem.utah.edu](mailto:minteer@chem.utah.edu); **David Cliffel**, Vanderbilt University, email: [d.cliffel@vanderbilt.edu](mailto:d.cliffel@vanderbilt.edu); **Xiao Su**, University of Illinois at Urbana-Champaign, email: [x2su@illinois.edu](mailto:x2su@illinois.edu); **Wenzhen Li**, Iowa State University, email: [wzli@iastate.edu](mailto:wzli@iastate.edu).

**L06**

## Nitrogen Reduction

Physical and Analytical Electrochemistry  
Division; Energy Technology Division; Industrial  
Electrochemistry and Electrochemical Engineering  
Division

The feasibility of performing nitrogen electroreduction reaction, or nitrogen fixation, particularly in aqueous solutions, constitutes an attractive prospect to produce ammonia under ambient, or near ambient, conditions. Development of durable, specific, and reasonably efficient low-cost catalysts remains a great challenge for electrochemical science

# 240TH ECS MEETING

and technology. Currently, most electrochemical approaches to N<sub>2</sub>-fixation suffer from slow kinetics due to the difficulty of achieving the appropriate adsorption and activation of dinitrogen leading to cleavage of the strong, triple N≡N bond. This symposium features presentations on research dealing with the fundamental and applied aspects of nitrogen reduction reactions of relevance to various aspects of science and existing technologies.

The symposium aims to bring together researchers in different areas of electrocatalysis and materials chemistry as well as electrochemical science and technology with the intent to discuss the current state of the art and understanding of the electrochemical fixation of nitrogen. Experimental and theoretical papers as well as contributions involving simulations and DFT calculations are welcomed in an effort to forge a stronger link between the experiential parameters and the N<sub>2</sub>-reduction mechanisms. Additional specific areas covered include the design of electrode materials, new preparative and processing approaches, fabrication of advanced catalytic systems, as well as their characterization, including in situ and ex situ methods, electrochemical properties and performances, and computational modeling.

The symposium includes invited and contributed papers on all aspects of the electrochemical fixation of N<sub>2</sub>. Presentation and discussion of comparative results based on photoelectrochemical and bioelectrochemical approaches are welcome.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Pawel Kulesza**, University of Warsaw, email: [pkulesza@chem.uw.edu.pl](mailto:pkulesza@chem.uw.edu.pl); **Iwona Rutkowska**, University of Warsaw, email: [ilinek@chem.uw.edu.pl](mailto:ilinek@chem.uw.edu.pl); **Vito Di Noto**, Università degli Studi di Padova, email: [vito.dinoto@unipd.it](mailto:vito.dinoto@unipd.it); **Marta Hatzell**, Georgia Tech, email: [marta.hatzell@mc.gatech.edu](mailto:marta.hatzell@mc.gatech.edu).

L07

## Electrochemical Luminescence and Fluorescence

Physical and Analytical Electrochemistry Division;  
Luminescence and Display Materials Division

This symposium addresses all aspects of electrochemically assisted fluorescence and luminescence from fundamentals to new practical applications. The symposium invites papers on new theoretical and experimental approaches that may lead to improved merits of analytical techniques, as well as papers describing the modeling of such systems. Recent years have shown a number of innovations in the combination of electrochemistry and fluorescent methods including using bipolar electrodes, fluorescence amplification, and multicolor readout.

This symposium will be organized/scheduled in close collaboration with the symposium J01, "Luminescence: Fundamentals and Applications."

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **David Cliffel**, Vanderbilt University, email: [d.cliffel@vanderbilt.edu](mailto:d.cliffel@vanderbilt.edu); **Bo Zhang**, University of Washington, email: [zhang@chem.washington.edu](mailto:zhang@chem.washington.edu).

L08

## Pulsed Electroanalytical Techniques

Physical and Analytical Electrochemistry Division

This symposium provides an international and interdisciplinary forum to present the latest research on development, modeling, and use of pulsed electroanalytical techniques. The topics include, but are not restricted to:

- (1) Power and energy applications;
- (2) Analytical applications;
- (3) Pulsed voltammetry techniques (square wave, normal pulse, differential pulse, reverse pulse, etc.);
- (4) Pulsed coulometry techniques;
- (5) Pulsed amperometry techniques.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Robert A. Mantz**, United States Army Research Office, email: [robert.a.mantz@us.army.mil](mailto:robert.a.mantz@us.army.mil); **Paul Trulove**, Department of Chemistry, U. S. Naval Academy, email: [trulove@usna.edu](mailto:trulove@usna.edu).

L09

## Electrochemistry of Two-Dimensional Materials

Physical and Analytical Electrochemistry Division

This symposium focuses on fundamental science and applications for a wide range of two-dimensional (2D) materials in electrochemistry. 2D materials such as graphene, boron nitride, layered semiconductors such as molybdenum disulfide, MXenes such as titanium carbide, and others, have found wide application in electrochemical science. They offer very high surface area for interfacial reactions and charge-discharge phenomena, ultrathin character and the prospect of highly controlled pore formation for separations, and a size match to electrocatalytic enzymes which can render them well suited for bioelectrochemical applications. Topics of interest for the symposium include the following: fundamental electrochemical properties of 2D materials including electronic/ionic conductance, capacitive charging/discharging, and pore transport; use of 2D materials in electrodes for fuel cells and electrolysis cells (including biofuel cells and bio-electrolysis cells), batteries and electrochemical capacitors; biofuel cells; electrochemical biosensors; electrochemical membrane separations; and other areas.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizer: **Stephen Creager**, Clemson University, email: [screage@clemson.edu](mailto:screage@clemson.edu).

L10

## Supramolecular Materials

Physical and Analytical Electrochemistry Division;  
Organic and Biological Electrochemistry Division

This symposium provides an international and interdisciplinary forum to present the latest research on supramolecular or supermolecule materials that are made up of a discrete number of assembled molecular subunits or components using either weak (hydrogen bonding, electrostatic, van der Waals, etc.) or strong (covalent bonding) forces. The study of non-covalent interactions is crucial to understanding many biological processes from cell structure to vision that rely on these forces for structure and function. Biological systems are often the inspiration for supramolecular research. Papers on basic and applied research in all areas of chemistry, biomolecular science, engineering, electrochemical systems, and physics related to supramolecular materials are solicited. Topics include:

- (1) Molecular recognition;
- (2) Directed or self-assembly;
- (3) Catalysis;
- (4) Folding or mechanical architectures;
- (5) Template directed synthesis;



# 240TH ECS MEETING

- (6) Solute and solvent properties (e.g., structural investigations, melting behavior, dynamics, and stability of molten salts);
- (7) Molecular machines;
- (8) New supramolecular systems that don't easily fit in the categories above.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Hugh C. De Long**, United States Army Research Office, email: [hugh.c.delong.civ@mail.mil](mailto:hugh.c.delong.civ@mail.mil); **Robert A. Mantz**, United States Army Research Office, email: [robert.a.mantz@us.army.mil](mailto:robert.a.mantz@us.army.mil); **Paul Trulove**, Department of Chemistry, U. S. Naval Academy, email: [trulove@usna.edu](mailto:trulove@usna.edu); **Diane K. Smith**, San Diego State University, email: [dksmith@sdsu.edu](mailto:dksmith@sdsu.edu).

## M—Sensors

### MO1 Recent Advances in Sensors Systems Sensor Division

This symposium proves a forum for the broad discussion of research and development in the field of physical and chemical sensors (gas, liquid, and other types), including molecular recognition surfaces, transduction methods, and integrated and microsensor systems. Topics of interest include, but are not limited to:

- (1) Development of new selective molecular recognition surface and materials;
- (2) Sensor and analytical systems for safety and security;
- (3) Novel methods for signal amplification and detection;
- (4) Sensor arrays for the simultaneous detection of multiple analytes;
- (5) Micro total analysis systems ( $\mu$ -TAS);
- (6) Physics and chemistry of sensors and sensor materials, synthesis/fabrication, and characterization of novel compositions;
- (7) Novel sensor concepts, design, modeling, and verification;
- (8) Sensor arrays, and electronic noses and tongues;
- (9) Physical, chemical, and biological/biomedical sensors and actuators, such as gas, humidity, ion, and molecular sensors, their system integration and actuating functions;
- (10) Optical sensors and fiber optic sensors;
- (11) Wireless sensors;
- (12) Emerging technologies and applications including nanosensors and sensors leveraging nanotechnology;
- (13) Harsh environment sensors.

All transduction methods are of interest for this symposium (e.g., electrochemical, resistive, capacitive, optical, acoustic, gravimetric, and thermal). The goal of this symposium is to present the broadest possible coverage of modern physical and chemical sensing progress, and to highlight the present state of the art relative to basic and applied areas.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Ajit Khosla**, Yamagata University, email: [khosla@yz.yamagata-u.ac.jp](mailto:khosla@yz.yamagata-u.ac.jp); **Sheikh Ali Akbar**, Ohio State University, email: [akbar.1@osu.edu](mailto:akbar.1@osu.edu); **Sheikh Ali Akbar**, Ohio State University, email: [akbar.1@osu.edu](mailto:akbar.1@osu.edu).

### MO2 Biosensors and Nanoscale Measurements: A Symposium in Honor of Professors Nongjian Tao and Stuart Lindsay Sensor Division

This symposium honors the late Professor Nongjian Tao for his longstanding contribution to the development of biosensors and nanoscale measurements. Meanwhile, as a separate track within the symposium, it also serves as a celebration of the 70th birthday of Professor Stuart Lindsay, Professor Tao's doctoral advisor and longtime collaborator of 35 years. This symposium focuses on all aspects of biosensor technology with topics that include, but are not limited to, electric, magnetic, and optical biosensors, novel transduction modes, molecular recognition elements, and implantable/wearable sensors for biological/medical applications. In addition, novel nanoscale measurements of cells and cellular/molecular components (e.g., nucleic acid, proteins, organic molecules), including scanning probe microscopy, plasmonic and optical imaging of biomolecules, are also highly encouraged. Many of these measurements lead to improved understanding of transduction mechanisms and novel biosensors that allow for ultrasensitive and dynamic detection in living systems.

This symposium's proceedings will be published in *ECS Transactions* and available at the meeting. Authors accepted for presentation are strongly encouraged to submit their full text manuscript for the issue no later than July 16, 2021. Submit all manuscripts online in either MS Word or PDF format.

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Larry Nagahara**, Johns Hopkins University, email: [larry.nagahara@jhu.edu](mailto:larry.nagahara@jhu.edu); **Thomas G. Thundat**, University at Buffalo, email: [tthunda@buffalo.edu](mailto:tthunda@buffalo.edu); **Chen-Zhong Li**, Florida International University, email: [licz@fiu.edu](mailto:licz@fiu.edu); **Erica Forzani**, Arizona State University, email: [erica.forzani@asu.edu](mailto:erica.forzani@asu.edu); **Nianqiang (Nick) Wu**, University of Massachusetts Amherst, email: [nianqiangwu@umass.edu](mailto:nianqiangwu@umass.edu).

## Z—General

### Z01 General Student Poster Session All Divisions

This poster session provides a forum for graduate and undergraduate students to present research results of general interest to ECS. The purpose of this session is to foster and promote work in electrochemical and solid state science and technology, and to stimulate active student interest and participation in ECS. A competition for the best posters in wet chemistry and solid state areas is part of the session. Cash prizes are given to the presenting student author on each winning paper; the amounts are awarded at the discretion of the organizers and judges.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Alice Suroviec**, Berry College, email: [asuroviec@berry.edu](mailto:asuroviec@berry.edu); **Andrew Herring**, Colorado School of Mines, email: [aherring@mines.edu](mailto:aherring@mines.edu); **Kalpathy B. Sundaram**, University of Central Florida, email: [kalpathy.sundaram@ucf.edu](mailto:kalpathy.sundaram@ucf.edu); **Vimal Chaitanya**, New Mexico State University, email: [vimalc@nmsu.edu](mailto:vimalc@nmsu.edu); **Venkat R. Subramanian**, University of Texas at Austin, email: [venkat.subramanian@utexas.edu](mailto:venkat.subramanian@utexas.edu).

# 240TH ECS MEETING

**Z02**

## Electrochemistry in Space 2

High-Temperature Energy, Materials, and Processes Division; Battery Division; Electrodeposition Division; Energy Technology Division; Industrial Electrochemistry and Electrochemical Engineering Division; Organic and Biological Electrochemistry Division; Physical and Analytical Electrochemistry Division; Sensor Division, Interdisciplinary Science and Technology Subcommittee

Increases in investment for exploration and development in space by public agencies and private entities has presented numerous extraterrestrial opportunities for electrochemical processes and technology. Many space-related activities provide unique opportunities for a wide array of electrochemical power, sensors, and chemical/materials processing including but not limited to the following:

- (1) Electrochemical power sources with high specific power and robust materials to survive harsh environments of space;
- (2) Sensors for materials, chemical, and radiation detection as well as for environmental and human health monitoring;
- (3) Fundamental impacts of extraterrestrial environments on electrochemical processes;
- (4) Electrochemical processes for efficient environmental controls for extraterrestrial activities;
- (5) Long-term energy storage for transient management of solar resources in various extraterrestrial environments;
- (6) In situ resource utilization and conversion of lunar, Martian, and asteroid materials to produce propellants, clean water, oxygen, and structural or functional materials/devices.

Space exploration, development, and other activities will be fueled through processes and systems that enable extraction of materials and propellants in space for more affordable and flexible transport and facilities construction. Electrochemistry will no doubt play a critical role in establishing the processes, systems, and monitoring to support advances in space activities. This interdisciplinary symposium brings together speakers from across a broad range of disciplines to discuss how advances in research and development for electrochemistry in space are addressing these exciting challenges and opportunities. This symposium also addresses how the features of extraterrestrial environments such as low gravity, extreme temperatures, and remote operations impact electrochemical processes as well as component design and operation. We want to facilitate broad interdisciplinary conversations through this symposium.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Gregory Jackson**, Colorado School of Mines, email: [gsjacks@mines.edu](mailto:gsjacks@mines.edu); **E. Jennings Taylor**, Faraday Technology, Inc., email: [jenningtaylor@faradaytechnology.com](mailto:jenningtaylor@faradaytechnology.com); **Jessica Koehne**, NASA Ames Research Center, email: [jessica.e.koehne@nasa.gov](mailto:jessica.e.koehne@nasa.gov); **George Nelson**, University of Alabama in Huntsville, email: [george.nelson@uah.edu](mailto:george.nelson@uah.edu); **Ratnakumar V. Bugga**, Jet Propulsion Laboratory, email: [ratnakumar.v.bugga@jpl.nasa.gov](mailto:ratnakumar.v.bugga@jpl.nasa.gov); **Yasuhiro Fukunaka**, Waseda University, email: [hirofukunaka@gmail.com](mailto:hirofukunaka@gmail.com); **Santosh Vijapur**, Faraday Technology, Inc., email: [santoshvijapur@faradaytechnology.com](mailto:santoshvijapur@faradaytechnology.com); **Scott Calabrese Barton**, Michigan State University, email: [scb@msu.edu](mailto:scb@msu.edu).

**Z03**

## Electrochemical and Solid State Science and Engineering Applied to COVID Issues

Organic and Biological Electrochemistry Division; Dielectric Science and Technology Division; Energy Technology Division; Nanocarbons Division; Sensor Division, Interdisciplinary Science and Technology Subcommittee

The focus of this symposium includes most recent results related to emergent viral diseases. It covers the science and engineering of diagnostics of SARS-CoV-2, methods of its deactivation, therapeutics, surveillance, health care devices, PPE, and other approaches to mitigate the COVID-19 pandemic and its consequences.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Sadagopan Krishnan**, Oklahoma State University, email: [gopan.krishnan@okstate.edu](mailto:gopan.krishnan@okstate.edu); **Hiroshi Imahori**, Kyoto University, email: [imahori@sci.kyoto-u.ac.jp](mailto:imahori@sci.kyoto-u.ac.jp).

**Z04**

## Electrochemical Recovery, Recycling, and Sustainability of Critical and Value Added Materials

Industrial Electrochemistry and Electrochemical Engineering Division; Battery Division; Corrosion Division; Electrodeposition Division; Energy Technology Division; High-Temperature Energy, Materials, and Processes Division, Interdisciplinary Science and Technology Subcommittee

Electrochemical systems, in addition to enabling sustainability through energy generation and storage, can play a central role in enabling the cradle-to-cradle strategy in materials. This strategy encompasses three aspects (a) sustainability-driven right-sized design using electrochemical processing of materials through electrochemical methods such as electrodeposition; (b) electrochemical means of recovering valuable materials after products reach end of life; and (c) design and development of recycling methods for materials used in electrochemical devices such as batteries, fuel cells, electrochemical reactors, etc. Papers are invited in the areas of (i) low or zero carbon way of synthesizing right structures and smart structures through electrodeposition and electrochemical machining; (ii) research, design, and development of electrochemical reactors to aid in the recovery of rare earth elements, photovoltaic components, battery materials, electronic devices and components, materials from electroplating operations, etc.; and (iii) design and build for sustainability aspects of batteries, fuel cells, and other electrochemical devices including, but not limited to, life cycle assessments, mathematical modeling and simulation of recycling, environmentally friendly solvent processing for recycling, etc.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

# 240TH ECS MEETING

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **Chockalingam Karuppaiah**, Vetri Labs, email: [chock.karuppaiah@vetrilabs.com](mailto:chock.karuppaiah@vetrilabs.com); **Paul Kenis**, University of Illinois at Urbana-Champaign, email: [kenis@illinois.edu](mailto:kenis@illinois.edu); **E. Jennings Taylor**, Faraday Technology, Inc., email: [jenningtaylor@faradaytechnology.com](mailto:jenningtaylor@faradaytechnology.com); **Xiao Su**, University of Illinois at Urbana-Champaign, email: [x2su@illinois.edu](mailto:x2su@illinois.edu); **Roseanne Warren**, University of Utah, email: [roseanne.warren@utah.edu](mailto:roseanne.warren@utah.edu); **Luca Magagnin**, Politecnico di Milano, email: [luca.magagnin@polimi.it](mailto:luca.magagnin@polimi.it); **Natasa Vasiljevic**, University of Bristol, email: [N.Vasiljevic@bristol.ac.uk](mailto:N.Vasiljevic@bristol.ac.uk); **Zheng Chen**, University of California San Diego, email: [zhengchen@eng.ucsd.edu](mailto:zhengchen@eng.ucsd.edu); **Jean St-Pierre**, University of Hawaii, email: [jsp7@hawaii.edu](mailto:jsp7@hawaii.edu); **Masayuki Itagaki**, Tokyo University of Science, email: [itagaki@rs.noda.tus.ac.jp](mailto:itagaki@rs.noda.tus.ac.jp); **Hojong Kim**, Pennsylvania State University, email: [huk29@psu.edu](mailto:huk29@psu.edu).

**Z05**

## Electrochemical and Solid State Data Science Showcase and Software Sprint All Divisions

All ECS divisions are increasingly generating large, sophisticated computational and experimental datasets, and in parallel, the advanced data analysis software tools needed to query, clean, visualize, and analyze these data sets. The Showcase is a one-day symposium featuring some of the most advanced data-driven discoveries and software tools being generated across all divisions of ECS. The “showcase” element of each talk is a live demonstration of how to access and use the data and analysis software that enabled the new science and engineering discoveries being discussed. Showcase talks should be given by the electrochemical or solid state scientist that developed the dataset or tool that enabled new science. Because Showcase presentations are given by a researcher with advanced data science skills, we invite all presenters to join our two-day software sprint after the Showcase, where this group defines and sprints towards one or more software tools or dataset standards that can be a foundational data science research product of broad value to the ECS community.

An issue of *ECS Transactions* is NOT planned for this symposium. Authors are encouraged to submit a full text preprint, slides, or other presentation-related materials to the preprint server, ECSarXiv (<http://www.electrochem.org/ecsarxiv/>).

Submit abstracts electronically to ECS headquarters. Send questions and inquiries to the symposium organizers: **David Beck**, University of Washington, email: [dacb@uw.edu](mailto:dacb@uw.edu); **Laura Bruckman**, CWRU, email: [lsh41@case.edu](mailto:lsh41@case.edu); **Matthew Murbach**, Hive Battery Labs, email: [matt@hivebattery.com](mailto:matt@hivebattery.com); **Daniel Schwartz**, University of Washington, email: [dts@u.washington.edu](mailto:dts@u.washington.edu).



## SYMPOSIUM SPONSORSHIP & SPEAKER SUPPORT

In addition to general meeting and custom sponsorship options, ECS offers specific symposium sponsorship. By sponsoring a symposium, you directly support the scientists who make the meeting possible. Sponsorships offset travel expenses, registration fees, complimentary proceedings, and/or host receptions for invited speakers, researchers, and students.

	Platinum \$15,000*	Gold \$10,000*	Silver \$5,000*	Bronze \$2,500*	Contributing \$1,500*
Brand exposure on the meeting program, app, website, and signage	Full logo hyperlinked to website	Full logo hyperlinked to website	Full logo hyperlinked to website	Full logo hyperlinked to website	Organization Name
Recognition and special thanks from the symposium podium	✓	✓	✓	✓	n/a
Recognition in emails to funding recipients	✓	✓	✓	n/a	n/a
Your logo featured as the screen saver on symposium room computers	Full color logo	Full color logo	Full color logo	Organization Name	Organization Name
Free ad in meeting program	Full Page	1/2 Page	1/4 Page	n/a	n/a
Recognition in the <i>ECS Transactions</i> proceedings volume for that symposium (deadlines apply ~ not all symposia publish ECST)	Full color logo	Full color logo	Full color logo	Full color logo	Organization Name
Complimentary meeting registration	2	1	0	0	0
Literature display in symposium room	✓	can be added for \$250	can be added for \$350	can be added for \$500	can be added for \$750

For more information regarding symposium sponsorship, please contact [sponsorship@electrochem.org](mailto:sponsorship@electrochem.org)

\*all prices USD