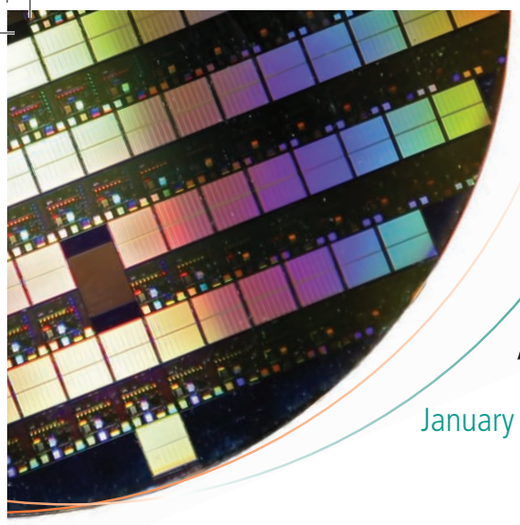

ELECTRONIC MATERIALS AND APPLICATIONS 2015

January 21-23 | DoubleTree by Hilton Orlando at Sea World® | Orlando, Florida USA

INTRODUCTION

Electronic Materials and Applications 2015, jointly programmed by the Electronics Division and Basic Science Division of The American Ceramic Society, is the sixth in a series of annual international meetings. EMA 2015 will be held January 21-23, 2015 at the DoubleTree by Hilton Orlando at Sea World®.

The 2015 meeting includes focused symposia on a wide array of topics addressing the basic and applied science and technology of ceramic materials for electronic, magnetic, dielectric, and optical components, devices, and systems for data and energy storage and conversion, lighting, sensing, actuation, power systems, and transduction, to name just a few. In addition, the 2015 meeting again includes a tutorial on thin film stability and a session on failure, two casual evening events that should be on everyone's agenda.

The conference features plenary lectures from leaders in the field representing industry and academia. The technical program includes invited lectures, contributed papers, and poster presentations, and provides ample opportunity for the exchange of information and ideas on the latest developments in the theory, experimental investigation and applications of electroceramic materials. Participants represent an international mix of industrial, university, and federal laboratory researchers, engineers, technologists and leaders. Participation of students and young professionals in the meeting is particularly encouraged! In addition to student poster and presentation awards, financial support has been set aside for students and young professionals—please contact the organizers for more information.

We are pleased to build on the previous successes of this conference series in providing a distinctive forum to address emerging needs, opportunities and key challenges in the field of electronic materials and applications. We anticipate that this meeting will continue to highlight the most recent scientific advances and technological innovations in the field, and facilitate interactions and collaborations that will help to shape its future.

Please join us in Orlando, Florida to participate in this unique experience.

– EMA 2015 Organizing Committee

ORGANIZING COMMITTEE

Haugan

Dillon

Brennecka

Timothy Haugan, Electronics Division
US Air Force Research Lab
timothy.haugan@us.af.mil

Shen Dillon, Basic Science Division
University of Illinois at Urbana-Champaign
sdillon@illinois.edu

Geoff Brennecka, Electronics Division
Sandia National Laboratories
glbrenn@sandia.gov

HOTEL INFORMATION

DoubleTree by Hilton Orlando at Sea World®

10100 International Drive
Orlando, FL 32821

407-352-1100 / 800-327-0363

Rate:

Single/double/triple/quad – $149.00

CONFIRMED PLENARY SPEAKERS

Kent Budd, 3M, USA

Hiroshi Funakubo, Tokyo Institute of Technology, Japan

Greg Rohrer, Carnegie Mellon University, USA

2013-14 OFFICERS

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Secretary-Elect: **Brady Gibbons**

ABSTRACT SUBMISSION INSTRUCTIONS

Visit **www.ceramics.org/ema2015** to review the session topics and select the "Submit Abstract" hyperlink to be directed to the Abstract Central website. If you have questions, please contact **Marilyn Stoltz** at **mstoltz@ceramics.org** or 614-794-5868.

www.ceramics.org/ema2015

call for papers Submit your abstracts by September 10, 2014

TECHNICAL SESSIONS

S1. Advanced Electronic Materials: Processing, Structures, Properties and Applications

This symposium brings together materials researchers from academia and industry to present the latest advances in electronic materials, including synthesis/processing and characterization of dielectric, piezoelectric, pyroelectric and ferroelectric materials in the form of bulk ceramics, single crystals, and multilayer structures. These materials have a tremendous impact on a variety of technologies, including ultrasonic transducers, high energy storage, piezoelectric composites, energy harvesting, actuators, sensors and tunable microwave devices. Other topics of interest are (but not limited to) nanoscale domain phenomena, defect chemistry, structure-property relationships, electrocaloric and electric field induced phase transitions.

Proposed Sessions

- Advanced electronic materials, including ferroelectric, piezoelectric, dielectric, electrostrictive, pyroelectric, electrocaloric and flexoelectric materials
- Materials design, new materials and structures and their emerging applications
- Characterization of materials, crystal structure, phase transitions, as well as electrical, mechanical, electromechanical, and other functional properties
- Nanoscale phenomena in dielectric, ferroelectric and piezoelectric materials
- Energy storage, conversion and harvesting materials and device structures
- Harsh environment (high temperature, cryogenic temperature, high pressure, corrosive, radiation-hard, high g, etc.) sensing using piezoelectric, piezoresistive and capacitive materials
- Lead-free piezoelectrics
- Reliability of electronic materials and devices

Symposium Organizers

- **Shujun Zhang**, The Pennsylvania State University, USA
- **Xiaoli Tan**, Iowa State University, USA
- **Jürgen Rödel**, Technische Universität Darmstadt, Germany
- **Satoshi Wada**, University of Yamanashi, Japan
- **Steven C. Tidrow**, The University of Texas – Pan American, USA

Point of Contact

- **Shujun Zhang**, soz1@psu.edu

S2. Ceramic Composites, Coatings, and Fibers

This symposium brings together researchers from academia, government labs, and industry to present the latest advances in processing, modeling, and characterization of ceramic composites, coatings, and fibers. These materials can have an impact on a variety of fields, including tunable microwave devices, transducers, high-energy-density capacitors, supercapacitors, piezoelectrics, energy harvesting, flexible components, textile capacitors, thermal protection, actuators and sensors. Materials for applications such as secure communications, radar systems, electromagnetic armor, USG, all electric warship, space systems, wearable electronics, pulsed power weapons, power grid conditioning circuits, sonar transducers, and any other energy related applications. The composites can be multi-ceramic composites or incorporate polymers such as PVDF, PP, or PC. Non-traditional materials such as exfoliated clays, nanosheets, bio-inspired materials, graphene, and phosphorene are highly desired topics for discussion.

Proposed Sessions

- Nano-composites and interfaces
- Theory and modeling
- Fibers, wires, and tubes
- Bio-inspired composites
- Novel coatings and layered structures

Symposium Organizers

- **Edward P. Gorzkowski**, Naval Research Laboratory, USA
- **Mason Wolak**, Naval Research Laboratory, USA
- **Serge M. Nakhmanson**, University of Connecticut, USA
- **Andres Bujanda**, Army Research Lab, USA

Point of Contact

- **Edward P. Gorzkowski**, edward.gorzkowski@nrl.navy.mil

S3. Computational Design of Electronic Materials

Given the pressing requirements for new high-performance electronic materials to meet important application needs, computational methods are required to understand unusual phenomena and to design new classes of materials. Computationally exploring the properties of novel materials has the potential to mitigate the costs, risks and time involved in the preparation and testing of potentially useful materials, and could yield valuable insights into the fundamental factors underlying materials behavior. Moreover, such computational design efforts form the core of the U. S. White House Materials Genome Initiative. This symposium will bring together materials scientists and engineers from academia, industry, and national laboratories to discuss the current state-of-the-art (and future outlook) within various types of materials modeling and materials informatics efforts, aimed primarily at electronic materials.

Proposed Sessions

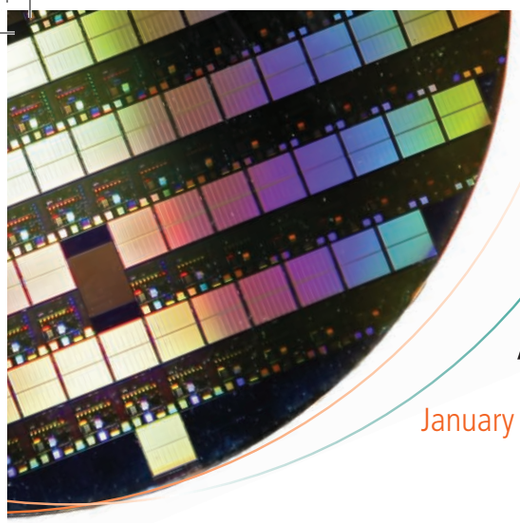
- Inorganic, organic and organic-inorganic hybrid electronic and functional materials
- Low-dimensional systems (quantum dots, nanowires, 2D crystals, and related systems)
- Novel phenomena at interfaces; Interface driven functional materials
- Defects in electronic materials
- Theoretical challenges and development to accurate description of defects and interface properties
- Emerging strategies for searching, designing and discovering new electronic materials
- High throughput data generation and screening via first principles and other computations
- Modeling at different (and across) scales (first principles, force fields, phase field, etc.)

Symposium Organizers

- **Mina Yoon**, Oak Ridge National Laboratory, USA
- **Ghanshyam Pilania**, Los Alamos National Laboratory, USA
- **Wolfgang Windl**, The Ohio State University, USA
- **R. Ramprasad**, University of Connecticut, USA

Point of Contact

- **Mina Yoon**, myoon@ornl.gov



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S4. Functional Thin Films: Processing and Integration Science

This symposium will bring together researchers from academia, government laboratories, and industry to focus on the profound role of processing and integration science on structure-property relations and widespread utilization of functional thin films. Topics of interest for this symposium include: advances in thin film synthesis that enable integration with industrially relevant and scalable substrates and process flows; deposition methods that facilitate epitaxy, strain engineering, and integration on a large scale; and novel developments in processing science that achieve bulk-like and/or enhanced responses in thin film systems. The relevant materials systems include ferroelectrics, piezoelectrics, multiferroics, intercalation structures, transparent conducting oxides, optical materials, phase change materials, and other electrically functional materials. The spectrum of materials systems considered is intentionally broad in an effort to bridge the functional electronic materials communities (e.g. piezoelectrics, batteries, memories, etc.) with the vacuum science, semiconductor processing, and integration industry for highest impact and knowledge sharing. Topics of interest include (but are not limited to) integration of oxides with flexible substrates for embedded and conformal applications, advanced substrate preparation methods, optimized and novel synthesis routes to enhance thin film structure, morphology, and properties, achieving and surpassing bulk properties in thin films, and advanced characterization methods that can guide material synthesis.

Proposed Sessions

- Deposition engineering for enhanced performance
- Controlling thin film growth morphology (within the structure zone model)
- Controlling phase distribution in thin films
- Preparing thin films containing volatile species
- Integration challenges for functional devices, low temperature processing, and novel substrates
- Integrating functional oxides with compound semiconductors
- Thin film memory and piezoelectric materials
- Advanced thin film characterization to guide materials synthesis

Symposium Organizers

- **Brady Gibbons**, Oregon State University, USA
- **Jon Ihlefeld**, Sandia National Laboratories, USA
- **Ron Polcawich**, Army Research Laboratory, USA
- **Jon-Paul Maria**, North Carolina State University, USA

Points of Contact

- **Brady Gibbons**, brady.gibbons@oregonstate.edu
- **Jon Ihlefeld**, jihlefe@sandia.gov

S5. Ion Conducting Ceramics

Ion conducting membranes are expected to be vital components of an increasingly demanding global energy future. New technologies ranging from clean energy production to electrical energy storage and chemical separations will require the development of robust, highly functional ion conducting ceramics. This symposium will bring together researchers from academia, government labs, and industry to discuss critical properties-processing-performance relationships central to the effective development of ion conducting ceramics. Presentations and discussions are expected to address technical challenges and insights across a wide range of length scales (atomic to macroscopic), address both cation and anion conductors, and consider a variety of ion conducting materials relevant to a diverse application space.

Proposed Sessions

- Novel ion conducting materials
- Influences of ceramic processing on ion conduction
- Cation conducting ceramics for energy storage
- Oxygen conductors
- Membranes for chemical separations
- Computational studies in ion-transport ceramics

Symposium Organizers

- **Erik D. Spoerke**, Sandia National Laboratories, USA
- **Jon Ihlefeld**, Sandia National Laboratories, USA
- **Doreen Edwards**, Alfred University, USA

Point of Contact

- **Erik D. Spoerke**, edspoer@sandia.gov

S6. LEDs and Photovoltaics — Beyond the Light: Common Challenges and Opportunities

In today's green economy, photovoltaics (PV) and light emitting diodes (LEDs) are central technologies with the potential to dramatically economize the rapidly growing global energy landscape. These complementary technologies approach electronic materials from opposite directions: PVs generate renewable energy by efficiently capturing light, while LEDs generate light by efficiently consuming electricity. Both technologies have similar challenges to overcome before widespread utilization can be realized. Surprisingly, though, there has been little dialog between the two technical fields. This symposium draws these two technical disciplines together in an effort to attack similar problems from alternative points of view. Arguably, the greatest challenge to each system is cost, which is linked to their technical design, ranging from semiconductor efficiency to device reliability. Many of these issues could be overcome in both disciplines, for example, with the development of highly efficient semiconductors (>60%), high light extraction/absorption of the substrate/chip/optical systems, better optical coupling, and high-speed, low-cost manufacturing. Issues of reliability could be addressed through the development of environmentally stable materials and encapsulants, better thermal management, and reliable thermal and electrical interconnects. This symposium presents an opportunity for the presentation and discussion of the common problems and creative solutions key to advancing next generation technologies.

Proposed Sessions

- Advances in active layer materials (Si, GaN, CdTe, CIGS, etc.)
- Transparent conductive electrodes and charge transport interfaces.

- Thermal management (sub-strates, die-attach, TIMs, cooling, etc.)
- Environmental stability & lifetime; encapsulation and packaging
- Optical coupling: novel light extraction and absorption, high index materials
- Low cost, high speed manufacturing
- Advanced optoelectronic characterization
- Computational design

Symposium Organizers
- **Adam M. Scotch**, OSRAM SYLVANIA, USA
- **Erik D. Spoerke**, Sandia National Laboratories, USA

Point of Contact
- **Adam M. Scotch**, adam.scotch@sylvania.com

S7. Multiferroic Materials and Multilayer Ferroic Heterostructures: Properties and Applications

This symposium will provide an international, interdisciplinary forum for scientists and engineers from academia, industry, and national laboratories interested in the research, characterization, development, manufacturing, design, and applications of multiferroic materials and multilayer ferroic heterostructures. The purpose of this symposium is to cover a wide spectrum of research activities, from the basic science to technological applications. Additionally, this symposium will serve to unite researchers from a broad range of disciplines to discuss the current state-of-the-art, physics, engineering, and future challenges of multicomponent multifunctional materials. Papers focusing on the understanding of such materials systems utilizing theoretical, experimental and/or novel sophisticated characterization methods are an important theme. The relationship between materials growth, microstructure, and the relation between microstructure and physical properties will be highlighted. Emphasis will also be devoted to applications of these materials in sensors/actuators, energy harvesting, and solid-state heating/cooling. The symposium program will consist of invited, regular, and poster presentations.

Proposed Sessions
- Dielectric, piezoelectric, pyroelectric, electrocaloric, magnetoelectric, magnetostrictive, electrostrictive, and other ferroic properties
- Transport properties of multilayer multiferroics
- Multiferroic thin film growth, materials design, processing, and integration
- Interfaces in multilayered ferroic heterostructures, functionally graded ferroics, and artificial multiferroics
- Structure: defects and doping; the relationship between materials growth, microstructure, and the relation between microstructure and physical properties
- Theory and modeling of multiferroics
- Technological applications ranging from medicine to aerospace industry: tunable high dielectric materials for high frequency applications; micro-electro mechanical systems (MEMS); sensors, transducers, and non-linear optical devices; ferroelectric memories; active/smart materials, vibration damping, actuators, artificial muscles, self assembled actuators and devices; electrocaloric heating/cooling

Symposium Organizers
- **Ichiro Takeuchi**, University of Maryland, USA
- **Melanie W. Cole**, U.S. Army Research Laboratory, USA
- **S. Pamir Alpay**, Institute of Materials Science, University of Connecticut, USA

Points of Contact
- **Ichiro Takeuchi**, takeuchi@umd.edu
- **Melanie W. Cole**, melanie.w.cole.civ@mail.mil

Registration Support

Support has been earmarked especially for students and young professionals. Support for registration waivers comes from the conference, both the Electronics and Basic Science divisions, and sponsors. If you would like to request a student registration waiver please contact Shen Dillon (sdillon@illinois.edu).

Conference or Symposia Sponsorship

Sponsorship opportunities are available. For more information about sponsoring the meeting or an individual symposium, please contact Mona Thiel (mthiel@ceramics.org).

Student Awards and Competition

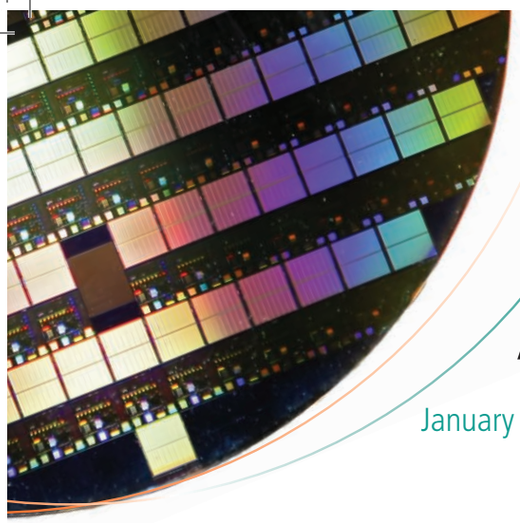
The EMA 2015 conference will follow an established tradition of strongly supporting both undergraduate and graduate student participation. At least 6 awards with cash prizes will be given at EMA 2015 for best student presentations and posters. Shortly after the abstract submission deadline, the top abstracts with student presenters will be selected from across the entire meeting. These student finalists will be given the option of presenting in their original symposium and/or as part of special lunchtime sessions on Wed and Thurs that will highlight the work of the top students. Only presentations during the lunch sessions will be judged for the cash awards, which will be given out at the conference banquet on Thursday evening.

Young Professionals Network

The ACerS Young Professionals Network (YPN) is encouraging the participation of young professionals via invited talks and a limited number of registration waivers. Young professionals are loosely defined as individuals in the first 10 years of their career. Please contact Ed Gorzkowski (edward.gorzkowski@nrl.navy.mil) for more details.

Failure: The Greatest Teacher

The vast majority of scientific literature and conference talks report positive results, but there's a lot to be learned from negative results and missteps as well. Don't miss this opportunity to hear recognized leaders in the field discuss failure and perhaps recount some of their most spectacular learning experiences during a frank and friendly discussion in a relaxed atmosphere. Speakers and audience alike are encouraged to check their egos at the door for this event that has turned into an EMA highlight. For more details, please contact Geoff Brennecka (glbrenn@sandia.gov).



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S8. Recent Developments in High-Temperature Superconductivity

Recently, significant progress has been made world-wide in both fabrication and fundamental understanding of high-temperature superconductors (HTS). For example, high-temperature superconductor (such as cuprates) wires and tapes have been commercially produced; advances continue to be made in fabrication and application of superconducting MgB2; and the iron arsenide family of superconductors has set off an intense search for new superconductors with even higher transition temperatures and lower anisotropies. However, challenges remain to increase the overall current carrying ability for applications and to correlate the interplay between structure, magnetism, and superconductivity in these superconductors on micro-, meso-, and nano-scales for fundamental understanding of the mechanism of superconductivity. This symposium will cover recent developments in the processing of superconducting materials, improved flux-pinning via structural and defect optimization, and recent advances in the discovery of new superconducting materials. The development and status of applications, and the materials science drivers and issues for these applications will also be addressed.

Proposed Sessions

- Issues related to the fabrication of low-cost and high performance second generation coated conductors
- Flux-pinning engineering in thick HTS films via structural and defect optimization
- Processing and properties of cuprate, MgB_2, and iron arsenide superconductors
- New superconducting materials and phenomena
- Characterization of structural and superconducting properties
- AC-losses
- Applications and related materials issues including wire properties

Symposium Organizers

- **Haiyan Wang**,Texas A&M University, USA
- **Claudia Cantoni**, Oak Ridge National Laboratory, USA
- **Gang Wang**, Institute of Physics - CAS, China
- **Timothy Haugan**, The Air Force Research Laboratory, USA

Point of Contact

- **Haiyan Wang**, wangh@ece.tamu.edu

S9. Structure of Emerging Perovskite Oxides: Bridging Length Scales and Unifying Experiment and Theory

Pb-based oxides have been plagued with ever-increasing environmental and health concerns. As a result, numerous research groups around the globe have contributed to a resurgence in Pb-free materials development. The principles understood in Pb-based compositions, namely those associated with the morphotropic phase boundary (MPB), have guided the inquiry toward new materials. Some principles of MPBs that have been argued to strongly influence properties include monoclinic structural distortions, nanodomain structures, co-existing ferroelectric phases, domain wall contributions, oxygen octahedral tilting, etc. These physical phenomena span length scales, making a single characterization technique difficult to completely and conclusively determine the structure and structural origin of the properties. Moreover, experimental results need to be interpreted through (and further inform) theoretical models. The challenges in structural and phase determination transcend single research groups and necessitate cooperation of experts in numerous fields. This symposium is a forum for these researchers to disseminate their results and develop new integrated approaches.

Proposed Sessions

- New insights from components (single phase)
- Phase equilibria and solid solutions
- Domain walls and other topological defects
- Role of point defects
- Role of oxygen octahedral tilts
- Microstructures and nanostructures
- Performance: origin of properties and in situ measurements

Symposium Organizers

- **Jan Seidel**, University of New South Wales, Australia
- **Igor Levin**, NIST, USA
- **Jens Kreisel**, LMGP, France
- **Pam Thomas**, University of Warwick, UK
- **Chan-Ho Yang**, Korea Advanced Institute of Science and Technology (KAIST), S. Korea

Point of Contact

- **Jan Seidel**, jan.seidel@unsw.edu.au

S10. Thermoelectrics: From Nanoscale Fundamental Science to Devices

Approximately 40% of the primary energy produced world-wide is lost as waste heat, much of it at high grade. Thermoelectric materials have attracted increasing interest in this context since they are low cost, scalable, and flexible devices that enable energy conversion in the relevant temperature ranges. This symposium focuses both on (i) the fundamental science of relevant thermoelectric properties (i.e., Seebeck effect, electrical and thermal conductivity) and (ii) challenges and solutions for advanced thermoelectric materials and devices, including novel materials, measurements, bonding, ceramic processing, crystal chemistry, modeling, nanostructured materials, devices, and others.

Fundamental physics include phonon transport and interactions in solids, nanosystems and across interfaces. Topics including, but not limited to, coherent phonon transport, non-local phonon conduction around interfaces, phonon interference, the interplay between material structures and intrinsic phonon scattering mechanisms, and how these processes relate to the thermal conduction mechanisms in solids and across interfaces are encouraged. Problems encountered and solutions developed overlap with a

broader spectrum of topics. This symposium encourages contributions from topics outside the traditional thermoelectrics research to cultivate exchange of ideas, especially on electrical and thermal properties. This symposium is a forum for discussing defect chemistry, conductivity, thermal conductivity optimization and applications for novel thermoelectrics.

Proposed Sessions

- Theory and applications of thermoelectrics and related phenomena
- Fundamental physics of phonon transport
- Thermoelectric materials: silicides, oxides, tellurides and other novel composites
- Low dimensional materials and crystal chemistry approaches
- Nanoscale scattering effects
- Defects and defect chemistry and their effects on electrical and thermal conductivity
- Thermophotovoltaics and emerging thermal devices

Symposium Organizers

- **Alp Sehirlioglu**, Case Western Reserve University, USA
- **David Singh**, Oak Ridge National Laboratory, USA
- **Antoine Maignan**, CrisMat, France
- **Winnie Wong-Ng**, NIST, USA
- **Anke Weidenkaff**, University of Stuttgart, Germany
- **Patrick Hopkins**, University of Virginia, USA

Point of Contact

- **Alp Sehirlioglu**, alp.sehirlioglu@case.edu

S11. Thin Films and Interfaces: Stability, Stress Relaxation, and Properties

Thin films and interfaces are critical to a wide range of electronic applications, serving as active and passive components, as semiconductors, conductors, dielectrics, and insulators, and as diffusion barriers, adhesion layers, and electrochemically active layers. A major issue with thin films is their microstructural stability during use. Thin films may be highly stressed due to deposition and these stresses may change during use due to causes ranging from inherent instability due to interfacial dewetting to highly localized fatigue damage, fracture, delamination, and whisker and hillock formation under changing states of stress. Significant microstructural changes may accompany electromigration and interdiffusion. This symposium will explore the thermodynamics and kinetics of thin film instabilities for ceramic, metal, and polymer thin films and structures, as well as methods to observe thin film breakup directly under different conditions and techniques for stabilizing thin films for a range of applications. In addition, focused sessions are planned on fundamental studies of structure, properties, thermodynamics and kinetics of electrochemically active surfaces and interfaces such as those found in fuel cells and rechargeable batteries.

Proposed Sessions

- Interface thermodynamics & its relationship to microstructural evolution during dewetting
- Thin film stress development and relaxation
- Kinetics of dewetting, creep, grain boundary grooving, interface fracture, and deformation
- Morphological evolution in response to curvature, stress, temperature, and magnetic fields
- Structure, properties, thermodynamics and kinetics of electrochemically active surfaces and interfaces, particularly as they relate to maximizing reversible power density, efficiency, minimizing side reactions, and controlling interfacial impedance

Symposium Organizers

- **John Blendell**, Purdue University, USA
- **Wayne Kaplan**, Technion - Israeli Institute of Technology, Israel
- **Carol Handwerker**, Purdue University, USA
- **R. Edwin García**, Purdue University, USA

Point of Contact

- **John Blendell**, blendell@purdue.edu

Tutorial on Thin Film Stability

The goal of this tutorial is to introduce the topics that will be discussed during the Basic Science Division Symposium, S11 "Thin Films: Stability, Stress Relaxation, and Properties", held during EMA 2015. The level of the tutorial will be for researchers and students without extensive background in thin films and is designed to introduce the basic concepts, terminology and results in order to assist with interactions during the symposium. The specific issues for discussion will be selected based on titles of the invited talks, and the particular interest of the instructors. The issues for discussion include:

- Thin Film growth, microstructure, and stress
  - Epitaxial and textured films
- Thin Film stress relaxation
  - Dislocation mechanisms in thin films
  - Diffusion in thin films
- Thin Film properties
  - Size dependent plasticity
  - Thermal stresses
  - Fracture of thin films

Pre-Symposium Tutorial speakers

Carl Thompson, Massachusetts Institute of Technology, USA

Gerhard Dehm, Max-Planck-Institut für Eisenforschung GmbH, Germany