# ELECTRONIC MATERIALS AND APPLICATIONS 2015

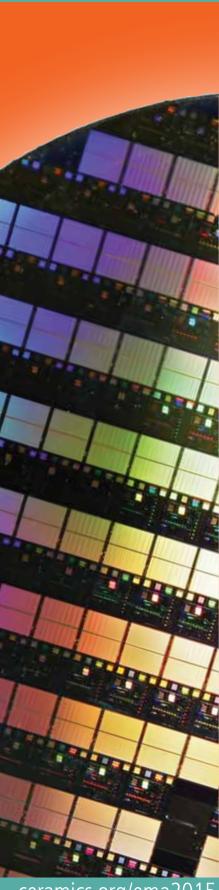
January 21-23 | DoubleTree by Hilton Orlando at Sea World® | Orlando, Florida USA

ceramics.org/ema2015





## ELECTRONIC MATERIALS AND APPLICATIONS 2015



EMA 2015 addresses key challenges in the field of electronic materials. The 11 symposia coverad vances in basic and applied science of electronic, magnetic, dielectric, and optical components and devices; data and energy storage and conversion systems; and sensing, actuation, power systems, and transduction.

### ORGANIZING COMMITTEE



Timothy Haugan
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### TUTORIAL ON THIN-FILM STABILITY This tutorial introduces tonics that will be discussed.

This tutorial introduces topics that will be discussed during the Basic Science Division symposium, Thin Films—Stability, Stress Relaxation, and Properties. Designed for researchers and students without extensive background in thin-films, the tutorial covers basic concepts, terminology, and results to maximize the value of the symposium. Discussions will 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

### **Tutorial Speakers**

**Carl Thompson**, Massachusetts Institute of Technology, USA

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

### 2014 - 2015 OFFICERS

### **Basic Science Division**

Chair: Bryan D. Huey
Chair-elect: Shen Dillon
Vice chair: Xingbo Liu

### **Electronics Division**

Trustee: Winnie Wong-Ng
Chair: Timothy Haugan
Chair-elect: Haiyan Wang
Vice chair: Geoff Brennecka
Secretary: Brady Gibbons
Secretary-elect: Rick Ubic

### HOTEL INFORMATION

### DoubleTree by Hilton Orlando at Sea World®

10100 International Drive Orlando, FL 32821

407-352-1100 / 800-327-0363

**Rate:** \$149 **Cutoff:** December 23, 2014



JANUARY 21–23, 2015 | DOUBLETREE BY HILTON ORLANDO AT SEA WORLD® | ORLANDO, FLORIDA, USA

### **TECHNICAL SESSIONS**

10 a.m. – 12:30 p.m.

- S1: Advanced Electronic Materials: Processing, Structures, Properties and Applications
- S2: Ceramic Composites, Coatings, and Fibers
- S3: Computational Design of Electronic Materials
- S4: Functional Thin Films: Processing and Integration Science
- **S5: Ion Conducting Ceramics**
- S6: LEDs and Photovoltaics Beyond the Light: Common Challenges and Opportunities
- S7: Multiferroic Materials and Multilayer Ferroic Heterostructures: Properties and Applications
- S8: Recent Developments in High-Temperature Superconductivity
- S9: Structure of Emerging Perovskite Oxides: Bridging Length Scales and Unifying Experiment and Theory
- S10: Thermoelectrics: From Nanoscale Fundamental Science to Devices
- S11: Thin Films and Interfaces: Stability, Stress Relaxation, and Properties

### **INVITED SPEAKERS**

**S. Pamir Alpay**, Univ. of Connecticut, *Electrothermal properties of ferroelectric multilayers* 

Amalia Ballarino, CERN, HTS for use in accelerator facilities Wei Bao, Renmin Univ. of China, High-pressure single-crystal

neutron scattering study of the 245 superconductor

Richard Beanland, Univ. of Warwick, Measuring symmetry,
structure and bonding in functional ceramics using 'digital'

electron diffraction

Scott Beckman, Iowa State Univ.,

Special quasirandom structures of  $K_{0.5}Na_{0.5}NbO_3$ 

Nicole Benedek, The Univ. of Texas at Austin, In search of simple design principles for the transport properties of complex oxides

Jerry Bernholc, NC State Univ., Electronic structure and electron transport in carbon-based nanosystems

Saad Binomran, King Saud Univ., First-principles-based investigation of physical properties of BST nanodot

Volker Blum, Duke Univ., First-principles, all-electron approach to electronic interfaces: Challenges and opportunities

Sören Boyn, Unité Mixte de Physique CNRS/Thales, Ferroelectric memristors for neuromorphic computing

Sergey Bud'ko, Ames Lab/Iowa State Univ., Combined effects of transition metal (Co, Ni, Rh) substitution, annealing/quenching and hydrostatic pressure on superconductivity and phase diagrams of CaFe.As.

**David Cann**, Oregon State Univ.,  $BaTiO_3 - Bi(Zn_{0.5}Ti_{0.5}Ti_{0.5})O_3$  relaxors for high temperature and high energy capacitor applications

Eric Chason, Brown Univ., A kinetic picture for understanding residual stress in thin films: real-time experiments and modeling

**Dominique Chatain**, CNRS - Aix-Marseille Univ., *A new mechanism of hetero-epitaxy and orientation relationships* 

**Xiaolong Chen**, Chinese Academy of Sciences, *Structural evolution in K*<sub>x</sub>Fe<sub>2,y</sub>Se<sub>2</sub>: *Unstable phase, superconducting phases, and vacancy phases* 

Paul C. W. Chu, Univ. of Houston, The meissner and mesoscopic superconducting states in the ultrathin FeSe-films

Kazimierz Conder, Paul Scherrer Inst., Superconductivity in alkali metal intercalated iron chalcogenides

**Alastair Cormack**, Alfred Univ., *Correlated sodium transport in* β-alumina

Shane Cybart, UC San Diego, Josephson and quasi-particle tunneling in high-transition-temperature superconductor Josephson junctions from ion beam irradiation

John Daniels, UNSW Australia, Experimental observations of grain-scale interactions in electroceramics: The difficult length scale

Gerhard Dehm, Max Planck Institut für Eisenforschung, *Probing deformation mechanisms of metallic structures relevant for electronic applications* 

Alex Demkov, Univ. of Texas, Austin, *Designing integrated ferroelectrics* 

Satoshi Demura, Tokyo Univ. of Science, Superconductivity and the magnetism in BiS, -based superconductors

Claudia Draxl, Humboldt-Universität zu Berlin, From molecules to their condensed phases: Challenges, concepts, and control of their properties

Roman Engel-Herbert, The Pennsylvania State Univ., Epitaxial integration of functional perovskite oxides on Si

Daniel Feezell, Univ. of New Mexico, Light-emitting diodes based on ordered arrays of III-nitride core-shell nanostructures

Peter Finkel, NRL, Giant magnetoelectric effect in nonlinear multiferroic heterostructure

Michael Foster, Sandia National Labs, Computational design of near-IR absorbing organic materials for light harvesting applications

Julia Glaum, UNSW Australia, Relaxor-ferroelectric transition in BNT-based piezoceramics

Giovanni Grasso, Columbus Superconductors SpA, Progress in industrial manufacturing of ex-situ MgB<sub>2</sub> superconducting wires Benjamin Griffin, Sandia National Labs, Piezoelectric MEMS based on aluminum nitride

Alexei Gruverman, Univ. of Nebraska-Lincoln, Electromechanical coupling and interface control of resistive switching in ferroelectric heterostructures Hongsoo Ha, Korea Electrotechnology Research Inst., Recent progress of ReBCO coated conductor made by RCE-DR process Hanns-Ulrich Habermeier, MPI-FKF, Thermoelectric properties of PLD grown Ca,Co,O<sub>o</sub> thin films

Seungbum Hong, Argonne National Lab, Enhancement of local piezoresponse in polymer ferroelectrics via nanoscale control of microstructure; Charge gradient microscopy: Electromechanical charge scraping at the nanoscale

Bryan Huey, Univ. of Connecticut, Ferroelectric domain switching in BiFeO, multiferroics

Jon Ihlefeld, Sandia National Labs, Room temperature voltage tuning of thermal conductivity in ferroelectric thin films

Akira Iyo, AIST, Recent discovery of new superconductors containing pnictogen atoms

Bharat Jalan, Univ. of Minnesota, MBE growth, heterostructure engineering and electronic transport properties of complex oxides via stoichiometry control

**Dirk Johrendt**, Ludwig-Maximilians-Universität München, Coexistence of 3d-ferromagnetism and superconductivity in [(Li<sub>0.8</sub>Fe<sub>0.7</sub>)OH]FeSe

**Jacob L. Jones**, North Carolina State Univ., *Doped HfO* $_2$ : Ferroelectricity and non-equilibrium structures in thin films and bulk ceramics; Insights into the local structure of ferroelectrics via pair distribution function studies

Daisuke Kan, Kyoto Univ., Phase control of a transition metal oxide through interface engineering of oxygen displacement

Maarit Karppinen, Aalto Univ., Nanostructuring of oxide thermoelectrics by atomic/molecular layer deposition

Dong Jik Kim, Univ. of Nebraska-Lincoln, Room-temperature ferroelectricity of epitaxially stabilized hexagonal TbMnO<sub>3</sub> films
Suk Jun Kim, KOREATECH, Novel application of metallic glass:
Ag paste for solar cell

Masahiko Kimura, Murata Manufacturing Co., Ltd., Study of textured piezoelectric ceramics fabricated by magnetic alignment

Emmanouil Kioupakis, Univ. of Michigan, Predictive calculations of nitride nanostructures for visible and ultraviolet light

### REGISTER BY DECEMBER 23 TO SAVE \$150!

y	Thursday		Friday	
2 – 5:30 p.m.	10 a.m. – 12:30 p.m	2 – 6 p.m.	10 a.m. – 12:30 p.m.	1:30 – 5:30 p.m.

**Ho-Yong Lee**, Sunmoon Univ., Lead-free piezoelectric Single Crystals  $[(Ba,Ca)(Zr,Ti)O_{3}]$  of k33 > 0.85

Jing-Feng Li, Tsinghua Univ., Synthesis and piezoelectricity of lead-free (K, Na)NbO<sub>3</sub> nanoscale single crystals

Fei Li, Xi'an Jiaotong Univ., Piezoelectric activity in perovskite ferroelectric crystals

Feng Liu, Univ. of Utah, Epitaxial growth of graphene-like overlayer on semiconductor surface towards room-temperature topological quantum states

Turab Lookman, Los Alamos National Lab, *Information-driven* approach to materials design

Mark Losego, Georgia Inst. of Technology, Sub-nanometer oxide coatings for improved stability of molecularly sensitized devices

Jian Luo, UCSD, Stabilization of nanometer-thick surficial films and their applications in battery materials

Joseph Luther, NREL, CdTe nanocrystals in ink-based photovoltaics: A study of grain growth and device architecture

M. Brian Maple, UCSD, Superconductivity in BiS<sub>2</sub>-based compounds

Jon-Paul Maria, North Carolina State Univ., Chemical pathways to advance the synthesis science of ferroelectric thin films

Lane Martin, UC Berkeley, New Horizons in strain control of ferroelectrics: Manipulating chemistry and domain structures for new phenomena

**Steven May,** Drexel Univ., Electronic and optical properties of epitaxial  $La_{1x}$ Sr $_x$ FeO $_3$  and  $La_{1x}$ Eu $_x$ FeO $_3$  films

**Steven Milne**, Univ. of Leeds, Alternative lead-free piezoelectrics based on  $Bi_{a_s}K_{a_s}TiO_3$ 

Xavier Moya, Univ. of Cambridge, Multicaloric perovskite oxides

**Hajime Nagata**, Tokyo Univ. of Science, Silver diffusion behavior into  $(Bi_{ns}K_{ns})$ TiO<sub>3</sub> lead-free ferroelectric ceramics

Serge Nakhmanson, Univ. of Connecticut, Complex-oxide multilayers by design: A treasure trove of unusual ferroic functionalities

George Nolas, Univ. of South Florida, Inorganic clathrates and other open-framework low thermal conductivity materials

Mark Nowakowski, UC Berkeley, Reversible electrically-driven magnetic domain wall rotation in multiferroic heterostructures to manipulate suspended on-chip magnetic particles

Hiromichi Ohta, Hokkaido Univ., Thermopower enhancement of two-dimensional electron gas in oxide semiconductors

Murat Okandan, Sandia National Labs, *Microsystems* enabled PV

Vidvuds Ozolin, UCLA, Computational design of earth-abundant thermoelectrics

Changwon Park, Oak Ridge National Lab, Electronic properties of bilayer graphenes strongly coupled to interlayer stacking and the external field

Joseph Perry, Georgia Tech, Organically modified silica hybrid sol-gel capacitors with high energy density and efficiency Krishna Rajan, lowa State Univ., Harnessing big data for

computational design of ceramics

Gregory Rohrer, Carnegie Mellon Univ., Combinatorial substrate epitaxy: A high throughput method to determine orientation relationships for electronic ceramics

Jeff Sakamoto, Univ. of Michigan, Superionic conducting ceramic electrolyte enabling Li metal anodes and solid state

Paul Salvador, Carnegie Mellon Univ., Combinatorial substrate epitaxy: A new route for stabilizing metastable electronic ceramics

Athena Sefat, Oak Ridge National Lab, Tuning of crystals on atomic scales

Ali Shakouri, Purdue Univ., Electronic and lattice thermal conductivity in nanostructured thermoelectric matrerials

Yang Shen, Tsinghua Univ., High energy density of polymer nanocomposites via interface-engineering

Hiroyuki Shimizu, Taiyo Yuden Co., Ltd., Antiferroelectric – ferroelectric phase switching in NaNbO<sub>3</sub>-based ceramics

**Derek Sinclair**, Univ. of Sheffield, *The defect chemistry of* Na<sub>a</sub> ¿Bi<sub>a</sub> ¸TiO<sub>3</sub>: A bipolar perovskite

Henry Sodano, Univ. of Florida, High energy density polymer nanocomposite capacitors using nanowires

Neil Sorensen, Sandia National Labs, Reliability issues associated with photovoltaics

Carl Thompson, MIT, The stability of retracting film edges during solid-state dewetting

Bala Vaidhyanathan, Loughborough Univ., Flash sintering of electroceramic devices

Peter van Aken, Max Planck Inst., Interfacial chemistry and atomic arrangement of ZrO\_/LSMO pillar-matrix structures

**Gang Wang**, Inst. of Physics, Chinese Academy of Sciences, Cobalt vacancies and related properties in LaCo<sub>2x</sub>As<sub>2</sub>: Structural evolution in K<sub>x</sub>Fe<sub>2x</sub>Se<sub>2</sub>: Unstable phase, superconducting phases, and vacancy phases

Jian Wang, Peking Univ., Direct evidence of the thinnest high temperature superconductor

Ming-Jye Wang, Academia Sinica, Fe-vacancy in FeSe-based superconductors

**Ruiping Wang**, AIST, *Niobate lead-free piezoelectric ceramics* exhibiting the MPB and their application to AE sensor

Kyle Webber, Technische Universität Darmstadt, Tailoring leadfree ferroelectric composites

Jiagang Wu, Sichuan Univ., High strain and large piezoelectricity in potassium-sodium niobate lead-free ceramics

Bin Xu, Univ. of Arkansas, Finite-temperature properties of rareearth-substituted BiFeO, multiferroic solid solutions

Boris Yakobson, Rice Univ., 2D materials canvas: Carbon, h-BN, metal-disulfides, and topological defects therein

Zuo-Guang Ye, Simon Fraser Univ., Synthesis, structure and properties of novel antiferro-/ferroelectric complex perovskite solid solutions

Kuang Yu, Princeton Univ., First-principles-derived strategy to stabilize kesterite phase CZTS for high performance solar cells

Yu Zhong, Florida International Univ., In situ phase transformation of scandia-zirconia by high temperature x-ray diffraction; Application of computational thermodynamics on long term degradation of SOFC

Xingjiang Zhou, Inst. of Physics, Chinese Academy of Sciences, Electronic structure and high temperature superconductivity of FeSe/SrTiO, Films

Jianguo Zhu, Sichuan Univ., High piezoelectric properties of KNN-based piezoelectric ceramics

# ELECTRONIC MATERIALS AND APPLICATIONS 2015

### PLENARY SPEAKERS



#### Kent Budo

Senior staff scientist, Corporate Research Materials Laboratory, 3M, USA

Title: EMA-related technologies and research at a diverse global manufacturer

Budd



### **Greg Rohrer**

W.W. Mullins Professor of Materials Science, head, Materials Science and Engineering Department, Carnegie Mellon University, USA

Title: High throughput, data-rich experiments, and their impact on ceramic science



Funakubo

#### Hiroshi Funakubo

Professor, Tokyo Institute of Technology, Japan

Title: Domain motion under applied electric field in Pb(Zr,Ti)O<sub>3</sub> films and their contribution to the piezoelectric properties

### STUDENT AWARDS AND COMPETITION

EMA 2015 strongly supports undergraduate and graduate student participation. The student finalists may present in their original symposium or in a special lunchtime session on Wednesday and Thursday highlighting the work of top students.

### FAILURE—THE GREATEST TEACHER

The vast majority of scientific literature and conference talks report positive results, but there is a lot to be learned from negative results and missteps as well. Take 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.

### **SCHEDULE**

### Tuesday – January 20, 2015

Registration

### Wednesday – January 21, 2015

Registration 7:30 a.m. – 6:00 p 8:30 a.m. - 8:45 a.m Opening comments Plenary session I 8:45 a.m. - 9:30 a.r Concurrent technical sessions 10 a.m. - 12: 12:30 - 2:00 p.m. Lunch on own Student award session 12:40 p.m. -1:50 p.m. Poster session set-up Noon - 5:00 p.m. Concurrent technical sessions 2:00 p.m. - 5:30 p.m. Poster session & reception 5:30 p.m. - 7:30 p.m. **Basic Science Division tutorial** 7:45 p.m. - 9:45 p.m.

5:00 p.m. - 6:3

### Thursday – January 22, 2015

 Registration
 7:30 a.m. - 5:30 p.m.

 Plenary session II
 8:30 a.m. - 9:30 a.m.

 Concurrent technical sessions
 10:00 a.m. - 12:30 p.m.

 Lunch on own
 12:30 p.m. - 2:00 p.m.

 Student award session
 12:40 p.m. - 1:50 p.m.

 Concurrent technical sessions
 2:00 p.m. - 5:30 p.m.

 Conference dinner
 7:00 p.m. - 9:00 p.m.

### Friday – January 23, 2015

 $\begin{tabular}{ll} Registration & 7:30 a.m. - 5:30 p.m. \\ Plenary session III & 8:30 a.m. - 9:30 a.m. \\ Concurrent technical sessions & 10:00 a.m. - 12:30 p.m. \\ Lunch on own & 12:30 p.m. - 2:00 p.m. \\ Concurrent technical sessions & 2:00 p.m. - 5:30 p.m. \\ Failure—The greatest teacher & 5:45 p.m. - 6:45 p.m. \\ \end{tabular}$ 

REGISTRATION RATES	Early Reg. Through Dec. 23	After Dec. 23
ACerS Member	\$555	\$705
ACerS Member plus 12 month membership renewal	\$685	\$835
Nonmember	\$685	\$835
ACerS Emeritus/Senior/Associate Member	\$445	\$595
One Day Member	\$445	\$595
One Day Nonmember	\$575	\$725
Material Advantage Student Member	\$150	\$225
Nonmember Student	\$200	\$275
Guest	\$75	\$75

Note: All registrations include welcome reception and conference dinner.

Cancellation Policy: Full refund less \$50 if cancelled on or before December 23, 2014; 50% refund if cancelled between December 24, 2014 and January 22, 2015; no refunds after the start of the conference.