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DEADLINE SEPT. 12, 2022

ELECTRONIC MATERIALS AND APPLICATIONS (EMA 2023)

JAN. 17–20, 2023 | DOUBLETREE BY HILTON | ORLANDO, FLA., USA

Organized by the ACerS Electronics and Basic Science Divisions

The American Ceramic Society
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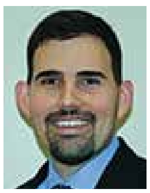

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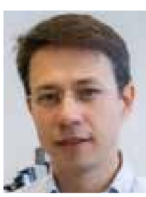

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INTRODUCTION

Electronic Materials and Applications 2023 (EMA 2023) is an international conference focused on electroceramic materials and their applications in electronic, electrochemical, electromechanical, magnetic, dielectric, and optical components, devices, and systems. Jointly programmed by the Electronics Division and Basic Science Division of The American Ceramic Society, EMA 2023 will take place at the DoubleTree by Hilton Orlando at Sea World, Jan. 18–20, 2023.

EMA 2023 is designed for scientists, engineers, technologists, and students interested in basic science, engineering, and applications of electroceramic materials. Participants from across the world in academia, industry, and national laboratories exchange information and ideas on the latest developments in theory, experimental investigation, and applications of electroceramic materials.

Students are highly encouraged to participate in the meeting. Prizes will be awarded for the best oral and poster student presentations. Students who wish to participate in the competition should opt in during the abstract submission process. In addition, there will be networking events as well career development activities for students and young professionals.

The technical program includes plenary talks, invited lectures, contributed papers, poster presentations, and open discussions. EMA 2023 features symposia focused on dielectric, piezoelectric, pyroelectric, magnetoelectronic, (multi)ferroic, quantum, relaxor, optoelectronic, and photonic ceramics; complex oxide thin films, heterostructures, and nanocomposites; semiconductors; superconductors; ion-conducting ceramics; 5G materials for millimeter-wave technology; and functional biological materials. Other symposia emphasize broader themes covering processing, microstructure evolution, and integration; effects of surfaces and interfaces on processing, transport, and properties; point defects, dislocations, and grain boundaries; mesoscale phenomena; and advanced characterization and computational design of electronic materials.

EMA includes several networking opportunities to facilitate collaborations for scientific and technical advances related to materials, components, devices, and systems. The Basic Science Division will again host a tutorial session in addition to the regular conference programming.

The grand finale of the meeting will again be Failure: The Greatest Teacher. We invite anyone interested to submit a brief abstract for this educational and engaging event that concludes the meeting.

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

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ABSTRACT SUBMISSION INSTRUCTIONS

- Visit **ceramics.org/ema2023** to review session topics.
- Select "Submit Abstract" to be directed to the Abstract Central website. Abstract title and text character limit (including spaces) is 1,500 characters.

If you have questions, please contact **Marilyn Stoltz** at **mstoltz@ceramics.org** or +1 614-794-5868.

Submit your abstracts at

https://ema2023.abstractscentral.com

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TECHNICAL PROGRAM

S1 – Characterization of Structure–Property Relationships in Functional Ceramics

Probing structure–property relationships in functional ceramics demands an integrated approach that combines complementary experimental probes (e.g., light, X-ray, electron, neutron) with theory and simulation. State-of-the-art scattering, imaging, and/or spectroscopy techniques that address multiple dimensions (2D, 3D, and beyond), are multiscale (both spatially and temporally), and can capture dynamic material structure under external stimuli (e.g., electric and magnetic fields, stress and strain fields), which are necessary to answer many open questions in this field.

This symposium will provide a bridge between the Basic Science and Electronics Divisions of EMA 2023. The first half will focus on rapidly developing experimental techniques, big-data analysis, and modeling approaches to answer open structure–property relationship questions in functional ceramic materials. The second half will highlight the use cases of these methods. Materials of interest include, but are not limited to, those used for energy storage, ferroics and multiferroics (ferroelectrics, electrocalorics, magnetoelectrics, relaxors), flexoelectrics, optical, and quantum, among others.

The symposium will expose scientists to new characterization techniques, unfamiliar research questions, and stimulate new ideas and new collaborations. Methods for approaching the challenging material problems spanning functional interfaces, short-range structural orders, and long-range crystallinity will be featured. Contributions integrating novel applications of machine learning and other computational tools (such as molecular dynamics) to predict and interpret scattering (such as Monte Carlo methods) and imaging data also are welcome. Tools to predict and interpret diffraction and microscopy data also are welcome.

Proposed sessions

- Advances in scattering, imaging, and analytical techniques
- Integrating machine learning into the structural measurement workflow
- Advances in connecting local and global structure to properties
- Addressing open questions in functional ceramics

Symposium organizers:

- **James LeBeau**, Massachusetts Institute of Technology, USA, lebeau@mit.edu
- David W. McComb, Ohio State University, USA, mccomb.29@osu.edu
- Abhijit Pramanick, City University of Hong Kong, apramani@cityu.edu.hk
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- Igor Levin, National Institute of Science and Technology, USA, igor.levin@nist.gov

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TECHNICAL PROGRAM

S2 – Advanced Electronic Materials: Processing Structures, Properties, and Applications

This symposium brings together materials and engineering researchers to present the latest advances in electronic materials, including synthesis/processing as well as microstructure analysis and characterization of dielectric, piezoelectric, pyroelectric, and ferroelectric properties in the form of bulk ceramics, single crystals, glasses, and multilayers. These materials have tremendous impact on a variety of technologies, including ultrasonic transducers, memories, MEMS devices, actuators, sensors, and tunable microwave devices. Other topics of interest include nanoscale domain phenomena, defect chemistry, structure–property relationships, and electric-field-induced phase transitions.

Proposed sessions

- Advanced electronic materials, including ferroelectric, piezoelectric, dielectric, electrostrictive, and pyroelectric materials
- Materials design, new materials and structures, and their emerging applications
- Reliability and fatigue of ferroelectrics and related devices

Symposium organizers:

- **Eric Patterson**, Naval Research Laboratory, USA, eric.patterson@nrl.navy.mil
- Satoshi Wada, University of Yamanashi, Japan, swada@yamanashi.ac.jp
- Shujun Zhang, University of Wollongong, Australia, shujun@uow.edu.au

S3 – Frontiers in Ferroic Oxides: Synthesis, Structure, Properties, and Applications

This symposium will provide an international interdisciplinary forum for scientists and engineers from academia, industry, and national laboratories to present the latest advances in ferroic oxide materials. Complex oxides offer an extremely wide range of properties not observed in conventional metals or compound semiconductors. In these correlated materials, new emergent phenomena may arise at intrinsic homointerfaces, such as domain walls. This symposium will focus on interdisciplinary topics related to the physics, materials science, and engineering within the field of ferroic oxides, domains, and domain walls. The topical list reflects materials needs and challenges within the field, with emphasis on synthesis, ferroic domain/domain wall architecture–property correlations, and exploratory devices. Speakers will span the breadth of these interdisciplinary topics in order to accelerate understanding and development of materials and heterostructures to enable new functionalities for (multi)ferroic oxides.

Proposed sessions

- Magnetic, ferroelectric, and multiferroic films and ceramics
- Synthesis of ferroic oxides
- Structure and defects, structure–property relationships
- Domain and domain walls
- Theory and modeling: domain structure and evolution
- Materials integration and applications: rewritable electronics using domain walls, computational devices, sensors, transducers, actuators, and medical devices

Symposium organizers:

- **John Heron**, University of Michigan, USA, jtheron@umich.edu
- Morgan Trassin, ETH Zurich, Laboratory of Functional Materials, Switzerland, morgan.trassin@mat.ethz.ch

S4 – Complex Oxide Thin Films and Heterostructures: From Synthesis to Strain/Interface-engineered Emergent Properties

This symposium covers recent advances in complex oxide thin films, heterostructures, and nanocomposites. Topics of interest include epitaxy of complex oxides, strain stabilization, heterointerface engineering, emergent interfacial properties, new materials discovery, field tunable responses, advanced characterizations, device applications, and extensions to performance limits. Contributions that connect advances in synthesis science to structure and property trends are of particular interest, as are those which link theoretical/computational and experimental efforts. The goal is to create an international and interdisciplinary forum to exchange ideas and foster collaboration. Broad areas of interest include the theoretical understanding and design of material properties using first principles-based methods to enhance and inform synthesis; stabilization of new structures and useful functionality through strain and heterointerface engineering within multilayers and vertically aligned nanocomposites; emergent properties in high-entropy complex oxides; understanding the relationship between process space and equilibrium defect chemistry; strain-induced defects and interfacial microstructure and their relationships to material properties; and device fabrication and applications in energy harvesting, memories, and sensors, among other areas. Specific properties of interest are magnetic, electronic, electrochemical, and photonic responses, as well as thermal transport phenomena, including strong correlation and quantum-confinement effects.

Proposed sessions

- Theory, modeling, and first principles calculations of complex oxide thin films and heterostructures with focuses on strain and interface
- Controlled synthesis of lateral and vertical heteroepitaxial thin films and nanocomposites, including heterostructures, superlattices, and vertically aligned nanocomposites for functional properties
- Synthesis and properties of high-entropy complex oxides
- Strain, microstructures, and functionality tuning in superlattices, vertical nanocomposites, and high-entropy complex oxides
- Phenomena arising from strain couplings and interface couplings, including quantum phases, topological states, low dimensional effects and their control via external stimuli
- Characterizations of strain, defects, and interfaces
- Strain- and interface-controlled device performance in energy harvesting, memories, sensors, and other areas
- In-situ thin film characterization to guide materials synthesis, to understand growth mechanism, and to probe electrochemical reactions

Symposium organizers:

- **Yingge Du**, Pacific Northwest Laboratory, USA, Yingge.Du@pnnl.gov
- Weiwei Li, Nanjing University of Aeronautics and Astronautics, China, wl337@nuaa.edu.cn

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- Elizabeth Paisley, Sandia National Laboratories, USA, eapaisl@sandia.gov
- Hyoungjeen Jeen, Pusan National University, Korea, hjeen@pusan.ac.kr

S5 – Mesoscale Phenomena in Ferroic Nanostructures: From Patterns to Functionalitiess

Mesoscopic phenomena span length scales that are considerably larger than atomic-bond distances but are small enough that classical continuum physics with materials properties and behavior averaged over many domains, or regions 10–100 nm in size, does not apply. The involved physical processes are bridging quantum-mechanical and macroscopic-continuum materials descriptions, which makes them critically important for the design, modeling, growth, and characterization of ferroic nanostructures. Many such systems exhibit intriguing behavior with nontrivial dependence of their elastic, polar, and magnetic degrees of freedom—including domain pattern formation and evolution—on shape, size, and morphology. Additional interesting effects involve the influence of layering, composition variation, and diffusion. This symposium brings together experts from academia, industry, and national laboratories to discuss current state-of-the-art in theoretical modeling, synthesis, characterization, processing, and applications of ferroic nanostructures, with an emphasis on the influence of morphological patterns (including domains) on physical properties and functional behavior.

Proposed sessions

This symposium will emphasize the following themes related to ferroic nanostructures:

- Synthesis, characterization, and processing
- Chemistry and physics of ferroic materials at mesoscale
- Nano to micro to macro: size dependence of ferroic behavior and properties
- Structure, dynamics, and stability of ferroic domains
- Multiscale modeling of mesoscopic phenomena
- Applications involving electronic, magnetic, thermal, optical, and electrochemical functionalities

Symposium organizers:

- **Yachin Ivry**, Technion – Israel Institute of Technology, Israel, ivry@technion.ac.il
- Yogesh Sharma, Los Alamos National Laboratory, USA, ysharma@lanl.gov
- Edward Gorzkowski, Naval Research Laboratory, USA, edward.gorzkowski@nrl.navy.mil
- Serge M. Nakhmanson, University of Connecticut, USA, serge.nakhmanson@uconn.edu
- Seungbum Hong, KAIST, Daejeon, Republic of Korea, seungbum@kaist.ac.kr
- Matjaž Spreitzer, Jožef Stefan Institute, Slovenia, matjaz.spreitzer@ijs.si

S6 – Emerging Semiconductor Materials and Interfaces

This symposium focuses on recent advances in new semiconductor materials and interfaces that will enable novel optoelectronic and photonic devices, power electronics, high-frequency electronics, and photovoltaics, all of which will enable paradigm-changing technologies. Topics of interest include wide-band-gap oxides for high power electronics; strong light–matter interactions in chalcogenides; heterointerfaces of traditional semiconductors with functional oxides; stable and all-inorganic perovskites for high-efficiency solar cells; rational design of new functional semiconductors; control over defects and dopants; advances in synthesis, theory, and modeling; and characterization. This symposium will provide an international and interdisciplinary forum for researchers with expertise in theory and modeling, synthesis, characterization, and device fabrication and measurements to discuss key challenges and opportunities in these emerging semiconductors.

Proposed sessions

- Wide bandgap and ultrawide bandgap semiconductor thin films and heterojunctions
- Chalcogenide semiconductors with novel optical and electrical properties
- Stable, all-inorganic perovskite semiconductors
- Integration of functional oxides with semiconductors
- Control over dopants and defects
- Rational design of functional semiconductors
- Advances in synthesis

Symposium organizers:

- **Sriram Krishnamoorthy**, University of California, Santa Barbara, sriramkrishnamoorthy@ucsb.edu
- Matthew Brahlek, Oak Ridge National Laboratory, USA, brahlekm@ornl.gov

S7 – Superconducting and Related Materials: From Basic Science to Applications

The symposium will broadly cover the advances in current and emerging superconducting materials from both fundamental and applications perspective. Overall, we intend to cover the rapid progress made worldwide in both fundamental understanding and application of superconducting materials, and bridge fundamental research and device performance/applications for superconducting materials.

The fundamental focus of the symposium is materials discovery, synthesis, and advanced characterization of new superconducting materials; theoretical and experimental understanding of the superconducting and normal state properties of novel superconductors; their interaction with charge, spin, orbital, and lattice order parameters; and developing new materials/devices (such as topological superconductors) and superconducting electronics (such as quantum computation) to enable emergent phenomena and new functionalities. The application aspect of the symposium is to promote transition from basic science to technology deployment, where we will focus on the fabrication of superconducting wires, tapes, thin films, devices, and superconducting multilayers and composites toward large-scale, energy-relevant technology applications, including high-power transmission, energy and information storage, THz and GHz electronics, and processing technologies.

TECHNICAL PROGRAM

Proposed sessions

- New superconductors, unconventional superconductors, and related materials: Synthesis and properties
- Superconductivity and competing phases: theory and advanced characterizations
- Low dimensional and topological superconductors
- Tailoring superconducting and correlated materials for applications
- Superconducting electronics and devices: nanoscale to large scale applications

Symposium organizers:

- **Bing Lv**, University of Texas at Dallas, USA, blv@utdallas.edu
- Mike Susner, Air Force Research Laboratory, USA, mike.susner@gmail.com
- Timothy Haugan, Air Force Research Laboratory, USA, tjhaugan@hotmail.com
- Gang Wang, Institute of Physics, Chinese Academy of Sciences, China, gangwang@iphy.ac.cn

S8 – Data-driven and Model-supported Research of Structure-property Relationships in Complex Electroceramics

Complex, disordered electroceramics—such as relaxors or superparaelectrics—are finding increasing application in fields like energy harvesting and storage, electronics, telecommunications, sensors and actuators. In such materials, the role of differently charged substituents, their distribution in the lattice, and the arrangement of phases or of polar order/disorder on multiple length scale needs to be uncovered to enable advanced property tuning. Recent contributions in the field of materials genomics, for example, with the use of high-throughput density functional theory and artificial intelligence-based optimization, have shown their strength in uncovering new or overseen structure–property relationships, and in designing new materials with improved functionalities. This symposium targets the use of data-driven methods (along with experiments) to rapidly uncover the structure–property relationships in complex, disordered solids, including (but not limited to) ceramic relaxors and superparaelectrics, nanostructured metallic oxides, and semiconductors. Specifically, the interplay of local structure, chemistry, configurational entropy, ergodic-nonergodic behavior, and instabilities induced by substitution and electric polarization on multiple length scales—and how it impacts macroscopic properties relevant for applications (energy storage, electromechanical and electrocaloric applications, among others)—is a topic we look for. Importantly, we explicitly welcome contributions involving advanced nano- to microscale characterization methods in synergy with multiscale modeling, providing key insights to better understanding the structure–property relationships in complex and disordered solids.

Proposed sessions

- Theoretical foundations of data-driven models and atomistic simulations in complex electroceramics
- Accelerated search of complex electroceramics with enhanced properties
- Local structure and properties of complex electroceramics
- Model-supported advanced nano- and microscale characterization methods
- Application of data-driven models and characterization for electroceramics in real-world applications

Symposium organizers:

- **Marco Deluca**, Materials Center Leoben Forschung GmbH, Austria, marco.deluca@mcl.at
- Prasanna V. Balachandran, University of Virginia, USA, pvb5e@virginia.edu
- Antonio Feteira, Sheffield Hallam University, United Kingdom, A.Feteira@shu.ac.uk
- Jiri Hlinka, Institute of Physics, Academy of Sciences of the Czech Republic, Czech Republic, hlinka@fzu.cz

S9 – Ion-Conducting Ceramics

Ionic transports in functional ceramics are vital components of an increasingly demanding global energy and electronic future. Prevailing technologies ranging from clean energy production, electrical energy storage, chemical separations, and ionic memory devices will require the development of robust, highly functional conducting ceramics in either bulk, nanostructure, or thin film form. This symposium will bring together researchers from academia, government labs, and industry to discuss critical properties–process–performance relationships central to the effective development of ion-conducting ceramic materials and devices. Presentations and discussions will address technical challenges and insights across a wide range of spatiotemporal scales, address ionic transports, and consider a variety of ionic-conducting ceramics relevant to a diverse application space, e.g., energy and ionotronic applications. This symposium welcomes relevant presentations and contributions from experimental work, theory, and modeling, and advanced characterization of these technologically interesting and important materials.

Proposed sessions

- Influences of synthesis and processing conditions on ionic conduction
- Ionic-conducting ceramics for energy storage and energy conversion
- Ionic conduction in solid state batteries
- Electrostatic or electrochemical gating in ceramics via electrolytes (liquid or gel)
- Membranes for chemical separations and environmental remediation
- Theoretical and computational studies of ionic transports in functional ceramics
- Emergent and novel ionotronic devices (e.g., memristor, sensor, actuator, logic devices)
- Ionic-conducting ceramics for sustaining critical materials (e.g., rare earth elements, platinum group elements, Li, Ni, Co)

Symposium organizers:

- **Hua Zhou**, Argonne National Laboratory, USA, hzhou@anl.gov
- Erik David Spoerke, Sandia National Laboratory, USA, edspoer@sandia.gov
- Wei Tong, Lawrence Berkeley National Laboratory, USA, WeiTong@lbl.gov
- Jon Ihlefeld, University of Virginia, Charlottesville, USA, jfi4n@virginia.edu

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S10 – Defects and Transport in Ceramics

This symposium highlights experimental and computational research aimed at understanding point defect equilibria and kinetics in ceramic materials. Defect chemistry governs conductivity in electronic, ionic, and mixed-conducting ceramics, and these materials are important for numerous applications, including solid-state batteries, memristors, dielectrics, solid oxide fuel/electrolysis cells, catalysis, and sensors, many of which operate under extreme electrochemical conditions. In addition, defect transport is intimately related to microstructure evolution and many material degradation phenomena. We encourage symposium contributions that help establish a greater understanding of our ability to predict, design, and control defects to enhance ceramic properties and performance, including under extreme far-from-equilibrium conditions. This furthermore includes the influence of dislocations and grain boundaries as higher-dimensional defects.

Proposed sessions

- Predictive point defect energetics and equilibria from density functional theory and other computational methods
- Structure and stability of defects and defect complexes via in-situ measurement (e.g., EPR, TSDC, EXAFS)
- Point defect segregation to or depletion from dislocations, surfaces, grain boundaries, and interfaces
- Defect mobility and transport behavior, including under operando or in extreme environments (e.g., temperature, chemical reactions, irradiation)
- Defect-mediated properties (conductivity, grain growth, creep, magnetism, ferroelectric imprint, dielectric degradation)
- Impact of dislocations and grain boundaries on ceramic functional properties

Symposium organizers:

- **Till Frömling**, Technische Universität Darmstadt, Germany, froemling@ceramics.tu-darmstadt.de
- Tiffany Kaspar, Pacific Northwest National Laboratory, USA, tiffany.kaspar@pnnl.gov
- Douglas L. Irving, North Carolina State University, USA, dlirving@ncsu.edu
- Yanhao Dong, Massachusetts Institute of Technology, USA, dongyh@mit.edu

S11 – Evolution of Structure and Chemistry of Grain Boundaries and Their Networks as a Function of Material Processing

Electronic and mechanical properties that control the function of ceramic devices, such as capacitors and sensors, are highly dependent on the structure and chemistry of grains, grain boundaries, and the subsequently formed grain boundary network. The atomic structure, bonding configuration, defect distribution, and segregation behavior of these boundaries and the overall microstructure of the system are altered by material processing techniques. Developing a fundamental understanding of the effect of processing techniques on modifying these internal interfaces, and in turn, impacting the microstructure of ceramic materials is needed to tailor their properties and optimize their application in device technology.

This symposium explores fundamental research into the modifications of internal interfacial structure and composition as well as microstructure evolution in functional materials as it relates to processing techniques. These processing techniques include sintering, electric fields, high temperature and cryogenic application, and gas environment.

Proposed sessions

- Interface structure and chemistry
  - Atomic structure, chemistry, bonding configuration
  - Defect and segregation behavior
  - In-situ microscopy evaluation
- Microstructure evolution
  - Grain growth and mobility
  - Nanocrystalline ceramics
  - Material properties
- Processing parameters
  - Mechanical and electric fields (e.g., SPS, FAST, HIP)
  - Extreme temperatures (e.g., cold sintering, SPS)
  - Environments (e.g., oxygen, hydrogen)

Symposium organizers:

- **James Wollmershauser**, Naval Research Laboratory, USA, james.wollmershauser@nrl.navy.mil
- Amanda Krause, University of Florida, USA, a.krause@ufl.edu
- Edward Gorzkowski, Naval Research Laboratory, USA, edward.gorzkowski@nrl.navy.mil

S12 – Materials, Devices, and Applications in 6G Telecommunications

International standards bodies are defining the new sixth generation (6G) communication standard. 6G promises to build on the millimeter-wave (mmWave) foundation of 5G by pushing operating frequencies to frequencies above 100 GHz. As operating frequencies push higher to achieve 100 gigabit data rates and latencies around a second, current technologies are migrating from monolithic circuits to heterogenous packaging that leverage new materials and technology. Manufacturers need new materials and to understand the physics at interfaces to tackle 6G challenges. These challenges provide new opportunities to advance fundamental materials physics in phase transitions, loss, transport, and physical models. In this symposium, we kick off a discussion between worldwide experts from academia, government labs, and industry to identify how ceramics can help. Presentations and discussions will address technical challenges and insights across a wide range of topics, ranging from materials-by-design to proof-of-concept device development, all of which are relevant to a diverse application space. The broader impacts of this symposium will facilitate innovations in mmWave technology.

Proposed sessions

- Industrial telecommunications materials
- Devices and applications of millimeter wave materials
- Materials design, growth, and synthesis
- Microwave and millimeter wave measurement science

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TECHNICAL PROGRAM

Symposium organizers:

- **Nate Orloff**, National Institute of Standards and Technology, USA, orloff@nist.gov
- Mitch Wallis, National Institute of Standards and Technology, USA, thomas.wallis@nist.gov
- Geoff Brennecka, Colorado School of Mines, USA, geoff.brennecka@mines.edu
- Ling Cai, Corning, USA, CaiL@corning.com
- Turan Birol, University of Minnesota, USA, tbirol@umn.edu

S13 – Agile Design of Electronic Materials: Aligned Computational and Experimental Approaches and Materials Informatics

Given the pressing requirements for new high-performance electronic and other functional materials to meet important application needs, both computational and experimental approaches are required to understand unusual phenomena and to design new classes of materials. The collaborative effort between the two disciplines allows for an efficient exploration of materials property landscape, with the potential to mitigate cost, risk, and operation time for taking materials from research to manufacturing. In addition, it could yield valuable insights into the fundamental factors underlying materials behavior. This symposium will bring together materials scientists and engineers from academia, industry, and national laboratories to discuss cutting-edge methods within a broad range of materials modeling, experiments, and materials informatics-driven efforts, aimed primarily at electronic materials, which may benefit from methodological developments for other applications as well.

Proposed sessions

- Materials by design: emerging computational/experimental strategies for searching, designing, and discovering new electronic materials
- High-throughput computational/experimental screening, data mining, machine learning, and materials informatics
- Multiscale modeling (e.g., first principles, force fields, phase field, statistical mechanics) and computational tools for energy storage and conversion
- Novel phenomena at interfaces and heterostructures: synthesis, characterization, and modeling of interface-driven functional materials
- Predictive modeling, experimental synthesis, and characterization of novel electronic materials:
  - » Topological quantum materials (such as topological insulators, topological semimetals, and quantum magnets)
  - » Functional (hybrid) perovskite materials
  - » Stoichiometry control and polymorphic expressions in functional electroceramics
  - » Low-dimensional electronic materials (quantum dots, nanowires, 2D materials, and related systems)

Symposium organizers:

- **Mina Yoon**, Center for Nanophase Materials Science, Oak Ridge National Laboratory, USA, myoon@ornl.gov
- Sergey Levchenko, Skolkovo Institute of Science and Technology, Russia, s.levchenko@skoltech.ru
- Payam Kaghazchi, Forschungszentrum Jülich GmbH, Germany, p.kaghazchi@fz-juelich.de
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- Ghanshyam Pilania, Los Alamos National Laboratory, USA, gpilania@lanl.gov

S14 – Emergent Properties and Applications of Advanced Magnetic Materials

Magnetic materials have been used for thousands of years for navigation. Now, this ever-growing field enables countless technologies, including information storage, sensing, transportation, communications, and biomedical applications. To meet this critical demand for new and improved technologies, today's challenges require approaches that transect multiple disciplines and require a collaborative approach. This symposium covers a broad range of topics related to magnetism, including low-dimensional phenomena, high frequency dynamics, sustainability of materials, novel applications, and other related areas of interest. Specific topics include synthesis and characterization of nanomaterials and composites, modeling at multiple length scales, microwave or mm-wave materials, spintronics devices, magneto-ionics, magnetocalorics, and rare-earth-free permanent magnets. Relevant work spanning theory, synthesis, and characterization of new materials and phenomena is welcomed for submission to this symposium. The goal is to create an interdisciplinary forum where stakeholders from academia, industry, and national laboratories can discuss cutting-edge research to foster new collaborations to further advance the field of magnetism.

Proposed sessions

- Magnetism in low-dimensional systems: nanomaterials and composites, skyrmions and other topological phenomenon, 2D magnetic materials.
- Multiscale modeling of magnetism: first principles calculations, micromagnetics simulations, finite element analysis, high-throughput evaluation of materials (both computationally and experimentally).
- High frequency magnetic phenomena: spintronics, microwave materials, ultrafast switching and other magnetization dynamics.
- Sustainability in magnetics research: rare earth-free permanent magnets, materials recycling and other novel synthesis processes from waste products, low temperature or other energy efficient processing methods, green technologies
- Novel applications of magnetic materials: magneto-ionic transport, magnetocalorics, magnetoresistance, quantum magnetic phenomena.

Symposium organizers:

- **Margo Staruch**, Naval Research Laboratory, USA, margo.staruch@nrl.navy.mil
- Jennifer Andrew, University of Florida, USA, jandrew@mse.ufl.edu
- Sara Mills, Naval Research Laboratory, USA, sara.mills.ctr@nrl.navy.mil

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S15 – Advanced Microelectronics

This symposium focuses on recent advances and developments in advanced microelectronics for next-generation device applications. Topics of interest include devices in memory and data storage, quantum information science, neuromorphic computing, flexible electronics, and optoelectronics. Contributions that connect device design/fabrication, defects, and interface to structure and device performance are of particular interest.

The goal is to create an international and interdisciplinary forum for researchers from industry, academia, and national laboratories to exchange ideas and foster collaboration. Broad areas of interest include modeling and simulation to predict device properties, and the role of defects, interfaces, and synthesis/fabrication processes on device performance. Specific devices of interest are memory and data storage devices based on spintronics and ferroelectrics, memristive devices, neuromorphic systems, transistors, detectors, and flexible electronics.

Proposed sessions

- Theory, modeling, and first principles calculations of devices performance and properties
- Role of defects, interface and synthesis/fabrication process on device properties
- Ohmic and Schottky contacts for devices
- Memristive switching and performance
- Memory and data storage devices based on spintronics and ferroelectrics
- Neuromorphic computing
- Next-generation quantum information devices
- Dielectrics and ferroelectrics for device applications (e.g., gate dielectric and energy storage)
- High-performance thin film and 2D (e.g., van der Waals heterostructures) transistors/devices
- Flexible electronics
- Optoelectronics and detectors (e.g., solar cells, photoelectrochemical water-splitting cells, photodetectors, X-ray detectors)

Symposium organizers:

- **Aiping Chen**, Los Alamos National Laboratory, USA, apchen@lanl.gov
- Shinbuhm Lee, Daegu Gyeongbuk Institute of Science and Technology, Korea, lee.shinbuhm@dgist.ac.kr
- Tom Harris, Sandia National Laboratories, USA, ctharri@sandia.gov
- Weiwei Li, Nanjing University of Aeronautics and Astronautics, China, wl337@nuaa.edu.cn

S16 – In situ/operando Characterization of Nanomaterials

The advancement of new technologies in recent decades has enabled a variety of new in situ/in-operando techniques to study the materials behavior and microstructure evolutions in real time. The external stimulus can be in many forms, including heating or cooling, mechanical stress, light exposure, electric or/and magnetic fields, reactive gas or liquid environments, and ion irradiation. By capturing the real-time materials evolutions under certain external stimulus using in situ/operando characterization techniques, we can understand the functionality and device operation mechanisms fundamentally in their proposed working environments, which undoubtedly facilitate the development of novel material systems and devices for various technological applications.

This symposium focuses on the recent progress and development of using in situ/operando techniques to characterize functional and structural materials and devices. These techniques use photon, electron, neutron, and X-ray to probe materials and devices, including but not limited to transmission electron microscopy, neutron diffraction/reflectivity, atomic force microscopy, synchrotron techniques and so on.

Proposed sessions

- In operando study of advanced functional materials including transition metal oxides, transition metal dichalcogenides, halide perovskites and so on.
- Study of electronic materials such as Mott insulators, dielectrics, ionics, ferroics, semiconductors, superconductors etc. using advanced characterization techniques.
- In operando study of device performances and behaviors including batteries, fuel cells, solar cells, memristors, memory devices and so on.
- Study of nanomaterial-based catalysts at reactive environments
- Real-time investigation of mechanical properties in structural materials.
- Advances in developing in situ characterization techniques related to electron microscopy, X-ray, and neutron characterization techniques.

Symposium organizers:

- **Di Zhang**, Los Alamos National Laboratory, USA, dizhang@lanl.gov
- Yue Cao, Materials Science Division, Argonne National Laboratory, USA yue.cao@anl.gov
- Alessandro Mazza, Materials Science and Technology Division, Oak Ridge National Laboratory, USA, mazzaar@ornl.gov
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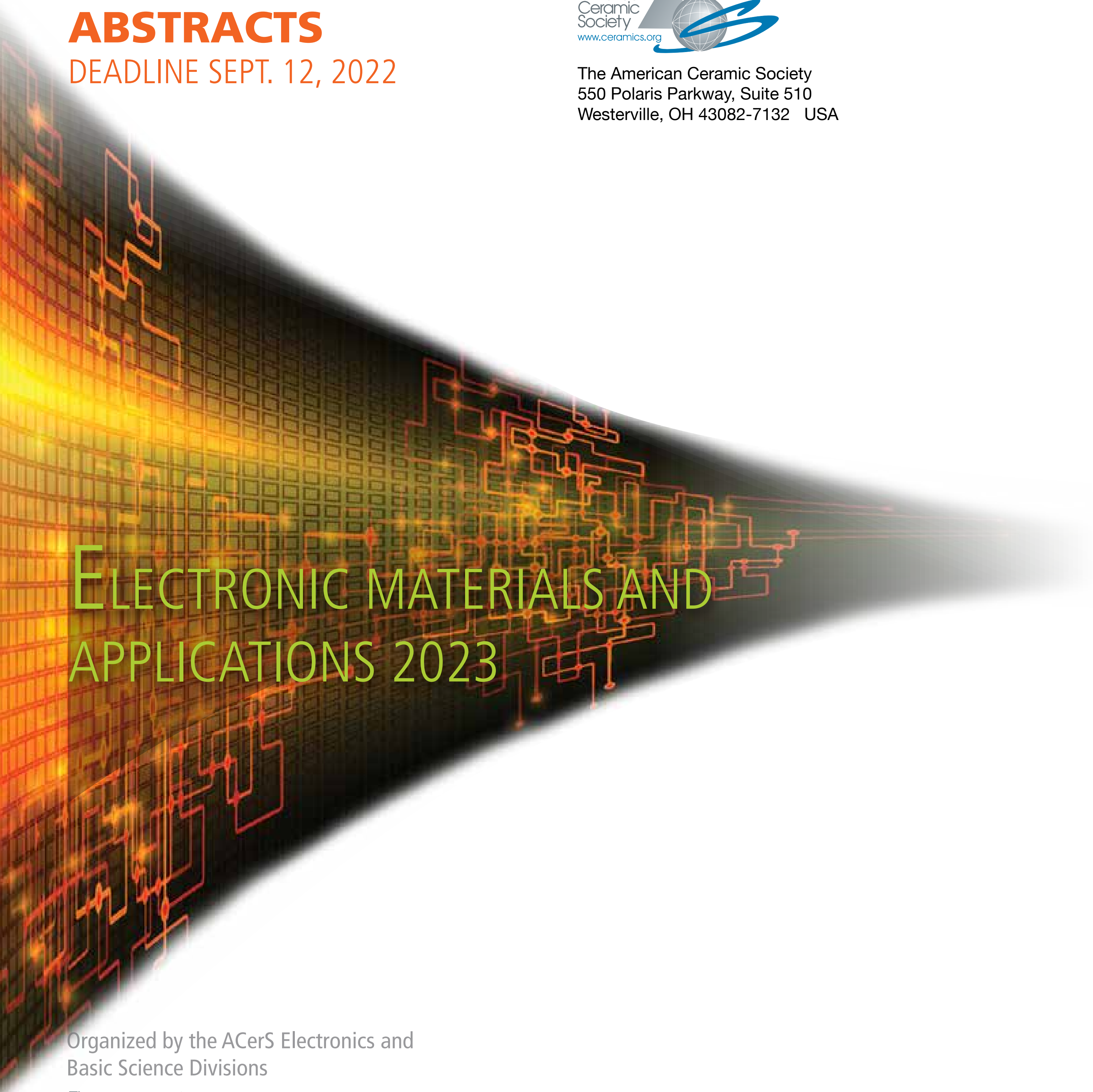

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