The American Ceramic Society
ceramics.org

Electronic Materials and Applications (EMA 2025)

FEBRUARY 25 – 28, 2025
DENVER, CO, USA

ABSTRACT DEADLINE
SEPTEMBER 23, 2024

ceramics.org/ema2025

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ABSTRACT SUBMISSION INSTRUCTIONS

- Visit www.ceramics,org/ema2025 for more information and to review session topics.
- Select "Submit Abstract" to be directed to the abstract submission website or visit https://ema2025.abstractcentral.com
- **Abstract deadline is September 23, 2024**

If you have questions, please contact Karen McCurdy at kmccurdy@ceramics.org or 1-614-794-5866

HILTON CITY CENTER
1701 California St.
Denver, Colorado, USA
(303) 297-1300

Standard Rate: $179 a night plus tax

Cut-Off Date: February 3, 2025

Online Reservation Booking Link:
https://book.passkey.com/e/50809082

Electronic Materials and Applications (EMA 2025)

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CALL FORABSTRACTS

Electronic Materials and Applications 2025 (EMA 2025) is an international conference focusing 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 the Basic Science Division of the American Ceramic Society, EMA 2025 will be held at the Hilton Denver City Center, February 25-28, 2025.

EMA 2025 is designed for scientists, engineers, and students interested in the basic science, engineering, and applications of electroceramic materials. Participants from academia, industry, and national laboratories around the world will exchange information and ideas on the latest developments in the theory, experimental investigation, and applications of electroceramic materials.

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

The technical program includes plenary lectures, invited lectures, contributed papers, poster presentations, and open discussions. EMA 2025 will feature symposia focusing on:

- Dielectric, piezoelectric, pyroelectric, magnetoelectronic, magnetic, (multi)ferroic, quantum, relaxor, optoelectronic and photonic materials
- Complex oxide thin films, heterostructures and nanocomposites
- Semiconductors
- Superconductors
- High entropy oxides
- Materials for Batteries and Energy Applications
- Materials for advanced microelectronics, next-generation computing devices and energy applications

Other symposia will focus on broader topics such as:

- Processing, Microstructure Development and Integration
- Additive Manufacturing
- Structure-Property Relationships
- Surface and interface effects on processing, transport, and properties
- Point defects, dislocations and grain boundaries
- In-situ/operando characterization
- Computational design of electroceramics
- Machine learning and AI for advanced materials

EMA 2025 includes several networking opportunities to facilitate collaborations for scientific and engineering advances related to materials, components, devices, and systems. The Basic Science Division will host a tutorial session in addition to the regular conference program. The grand finale of the meeting will again be the symposium "Failure: The Greatest Teacher." We invite anyone interested to submit a short abstract for this educational and engaging event that will close the meeting.

Please join us in Denver, CO for this unique experience!

TECHNICAL PROGRAM

ENERGY APPLICATION

Symposium 1:
Ceramics for the Hydrogen Economy

Symposium 2:
Electronic and Ionic Materials for Energy Storage and Conversion Systems

QUANTUM/COMPUTING

Symposium 3:
Nano4Neuro–Mechanisms and Materials for Next Generation Computing

Symposium 4:
Oxide Quantum Materials: Synthesis, Properties, and Applications

NANOMATERIALS/2D

Symposium 5:
In-situ/Operando Characterization of Nanomaterials

Symposium 6:
Two-dimensional Quantum Materials: Synthesis, Theories, Properties, and Applications

ADDITIVE MANUFACTURING

Symposium 7:
Additive Manufacturing for Power Sources in Electronics

Symposium 8:
New Frontiers and Science in Additive Manufacturing of Ceramic Materials

COMPLEX OXIDES

Symposium 9:
Data-driven and Model-supported Structure-property Relationships in Complex Electroceramics

Symposium 10:
Structure, Dynamics, and Functionalities in High-entropy and Compositionality Complex Oxides

Symposium 11:
Complex Oxide Thin Films and Heterostructures: From Synthesis to Strain/Interface-engineered Emergent Properties

MICROELECTRONICS / TRANSPORT

Symposium 12:
Advanced Semiconductors and Microelectronics

Symposium 13:
Defects and Transport in Ceramics

AI / THEORY / COMPUTATION

Symposium 14:
AI in Materials Research: From Data Analysis, Autonomous Experimentation, to Human-AI Cooperation

Symposium 15:
High-Performance Computational Design and Discovery of Electronic Materials

STRUCTURE-PROPERTY / INTERFACE / BOUNDARY

Symposium 16:
Controlling Grain Boundary Structure, Chemistry, and Their Network as a Function of Material Processing

Symposium 17:
Emerging Semiconductor Materials and Interfaces

Symposium 18:
Characterization of Structure – Property Relationships in Functional Ceramics

EMERGING PROPERTIES - MAGNETIC / SUPERCONDUCTING / FERROIC

Symposium 19:
Frontiers in Ferroic Ceramics: Synthesis, Properties, and Applications

Symposium 20:
Magnetic and Superconducting Materials: From Basic Science to Applications

SPECIAL TOPICS

Symposium 21:
Failure: The Greatest Teacher

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SYMPOSIUM 1

CERAMICS FOR THE HYDROGEN ECONOMY

The transition to a sustainable, hydrogen-based economy is a critical global challenge that requires innovative solutions across various sectors. Ceramics have emerged as promising materials for enabling and advancing the hydrogen economy. However, applications like solid oxide fuel cells (SOFC) and electrolyzers (SOEC) are still far from being established technologies. There is still a high demand for new ceramic materials and in-depth investigations of their physical properties. Therefore, this symposium aims to bring together leading researchers working on ceramics for hydrogen technologies.

The symposium will provide a unique platform for us to delve into the diverse applications of ceramics in the hydrogen economy, including hydrogen production, storage, and fuel cell technologies. Furthermore, alternative fuel production from hydrogen, such as ammonia and e-fuels, is the focus. This is an exciting opportunity for us to collectively contribute to the advancement of ceramics in the hydrogen economy.

PROPOSED SESSION TOPICS

- High-performance ceramic materials for hydrogen production
- Ceramic components for hydrogen fuel cells, including electrolytes, electrodes, and sealants
- Proton-conducting membranes
- Ceramic processing and manufacturing techniques for hydrogen applications
- Decreasing the application temperature for electrolyzers and fuel cells
- Mechanical properties of fuel cell and electrolyzer material
- Sustainability and life-cycle analysis of ceramic-based hydrogen technologies

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SYMPOSIUM 2

ELECTRONIC AND IONIC MATERIALS FOR ENERGY STORAGE AND CONVERSION SYSTEMS

The continued advance of energy systems hinges on the scientifically informed innovation of key electronic and ionic materials across the entire energy storage and generation system assembly. Understanding the fundamental materials properties and dynamic, multiscale electrochemical phenomena that govern performance is key to the innovation and design of the next generation of safe, cost-effective, and high-performance energy storage and conversion systems. Abstracts are solicited that describe innovative electronic and ionic materials advances for a wide range of applications, including but not limited lithium-ion, beyond lithium-ion (e.g., sodium, zinc, potassium, magnesium, calcium), redox flow, metal-air, and solid-state batteries, solid-state fuel cells, , electrolyzers, and other emerging systems. We are interested in fundamental experimental investigations of electronic and ionic phenomena, computational modeling and predictions of materials behavior, advanced characterization techniques, and assessments of energy storage system performance.

PROPOSED SESSION TOPICS

- Electrodes (anodes and cathodes)
- Interfaces
- Current collectors / electrode supports
- Next-generation electrolytes (including solid-state)
- Separators
- Characterizations

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SYMPOSIUM 3

NANO4NEURO-MECHANISMS AND MATERIALS FOR NEXT GENERATION COMPUTING

This symposium pursues fundamental understanding of materials that will enable energy-efficient, massively parallel and environment-tolerant computing, sensing and data storage. The recent explosion of new ideas for neuromorphic, reservoir, thermal, optical computing raises new opportunities as well as requirements for materials and devices. We seek to connect diverse audiences from academia, industry and national labs with expertise in computing, materials theory and design, device measurements, advanced characterization, and AI/ML to outline the fundamental mechanisms of energy and information transduction in material systems, open questions and challenges in computing materials and architectures, and the application areas where new computing will find unique applications complementary to existing technologies. Particular attention will be drawn to synergistic approaches among synthesis, theory, modeling and characterization that can bridge the multiplicity of energy, time and length-scales involved in computation, and enable accelerated adoption of new material systems for future information technologies.

PROPOSED SESSION TOPICS

- Phase transitions in 2D materials and devices
- CMOS compatible ferroelectric materials and devices
- Fundamental materials needs for emerging computing paradigms
- Electrochemical and reservoir memory and computing devices
- Scalable modeling and computation for switching phenomena
- Applications of machine learning in device modeling and characterization
- Co-design of materials, devices, and systems
- Advanced characterization techniques

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SYMPOSIUM 4

OXIDE QUANTUMMATERIALS: SYNTHESIS, PROPERTIES, AND APPLICATIONS

The interplay between charge, spin, orbital, and lattice in strongly correlated oxide materials leads to a plethora of implications in both scientific research and technological applications. Emergent phenomena in oxide quantum materials, exhibited across a diverse array of material forms, offer novel functional properties of ceramics that extend beyond conventional electronic applications. This symposium covers recent advances in the synthesis and characterization of oxide quantum materials, encompassing thin film heterostructures, bulk crystals, membranes, and nanomaterials. Topics of interest include epitaxial growth of complex oxides, exploration of new materials, investigation of electronic, magnetic, and quantum properties, advanced characterization techniques, and device applications.

This symposium aims to bring together scientific experts and young scientists with an interest in oxides, fostering interactions and advancing knowledge of emergent functional properties and related hardware concepts for unconventional computing.

PROPOSED SESSION TOPICS

- Emergent properties at oxide interfaces
- Oxide materials for unconventional computing
- Novel characterization of complex oxides
- Discovery and synthesis of novel oxide materials
- Theory and calculation of oxide properties

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SYMPOSIUM 5

IN-SITU / OPERANDO CHARACTERIZATION OF NANOMATERIALS

The advancement of new technologies in recent decades has enabled a variety of new in-situ/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, for example. 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, X-ray and neutron diffraction/reflectivity, atomic force microscopy, and synchrotron techniques.

PROPOSED SESSION TOPICS

- 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.

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SYMPOSIUM 6

TWO-DIMENSIONAL QUANTUM MATERIALS: SYNTHESIS, THEORIES, PROPERTIES, & APPLICATIONS

We propose to organize a symposium focusing on the modelling, synthesis, characterization, and application of two-dimensional (2D) electronic materials. Topics will include, but are not limited to, novel synthesis methods of a wide range of 2D materials, such as 2D transition metal chalcogenides, oxides, nitrides and halides, characterization of their electronic, magnetic, and optical properties, and theoretical studies of these materials' ground and excited states, and device demonstrations. The symposium will cover advanced characterization techniques, including physical measurements and machine-learning-assisted methods, and the application of 2D ceramics such as oxides and nitrides in electronic and quantum devices, such as transistors, sensors, and memory devices. Challenges and opportunities in large-scale production will be addressed, with special attention given to the role of defects, interfaces, and strain engineering in tuning properties. This symposium aims to bring together researchers from diverse backgrounds to exchange ideas and foster collaborations in this rapidly evolving field.

PROPOSED SESSION TOPICS

- Synthesis of 2D quantum materials and their bulk counterparts
- Novel 2D heterostructures with emergent electronic, photonic, and magnetic properties
- Electronic, optoelectronic, and spintronic 2D devices
- Structural characterization of 2D materials
- Quasiparticles (e.g., phonons, magnons, excitons) in 2D materials and heterostructures
- Theoretical simulation of 2D material and device properties
- Quantum Defects in 2D materials
- Neuromorphic computing via 2D devices
- 2D semiconductors, 2D magnets, 2D ferroelectrics, and 2D semimetals.

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SYMPOSIUM 7

ADDITIVE MANUFACTURING FOR POWER SOURCES IN ELECTRONICS

The vast electronics market demands highly tailored power sources to suit specific application environments. Traditional battery production lines struggle to keep up with the rapidly evolving and diverse requirements. Additive manufacturing stands out for its exceptional customization capabilities and efficiency. However, power sources, predominantly batteries, produced through additive manufacturing have yet to reach the commercialization stage due to technical and cost challenges. We invite abstract submissions that highlight advancements in additive manufacturing and associated technologies for battery and supercapacitor applications. We welcome both experimental and computational contributions. Potential power sources encompass lithium-ion batteries, non-lithium-ion batteries (sodium, zinc, magnesium, aluminum, etc.), lithium-metal batteries, solid-state batteries, metal-air batteries, supercapacitors, and other emerging systems. Additionally, we seek characterization and simulation tools that elucidate battery failure mechanisms. From an industrial standpoint, insights into cost and scalability are particularly valued.

PROPOSED SESSION TOPICS

- AM for lithium ion batteries
- AM for beyond lithium batteries
- AM for supercapacitors
- AM for other novel power sources
- Simulations for 3D batteries
- Characterization tools for battery failure mechanisms

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SYMPOSIUM 8

NEW FRONTIERS AND SCIENCE IN ADDITIVE MANUFACTURING OF CERAMIC MATERIALS

Additive manufacturing (AM, or 3D printing) has emerged as novel ceramic manufacturing processes with the advantages of design freedom, flexibility, high customization, and waste minimization. Various AM processes have been developed for structural and functional ceramic materials, including binder jetting, stereolithography, inkjet printing, selective laser sintering, fused deposition modeling, which have provided new opportunities to overcome the limitations of traditional ceramic manufacturing processes, such as the long processing time and difficulty to fabricate structures with complex geometries.

This special symposium will provide an international forum to foster technical discussions of the fundamental mechanisms related to processing-microstructure-property relationship during AM of ceramic-based materials. With the recent advances in powder processing, in-situ process monitoring, in-situ and ex-situ characterization tools, nondestructive evaluation and testing, qualification and certification, we will develop a better understanding of the physical mechanisms controlling the unique microstructures, defect formation, and physical and chemical properties of additively manufactured ceramics.

PROPOSED SESSION TOPICS

- New approaches for AM processes of ceramics and ceramic-matrix composites
- Novel techniques to prepare ceramic powders for AM
- Multiscale computational modeling and data-driven process optimization
- In-situ and ex-situ characterization of phase transformation, textures, defects, etc., using synchrotron X-ray, neutron diffraction, electron microscopy
- Mechanical, thermal, electrical, magnetic, and optical properties
- New applications of additively manufactured ceramics

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SYMPOSIUM 9

DATA-DRIVEN & MODEL-SUPPORTED STRUCTURE-PROPERTY RELATIONSHIPS IN COMPLEX ELECTROCERAMICS

Modelling combined with experimental data has been increasingly employed to better understand structure-property relationships in electroceramics. Exciting results have been unveiled in the field of ferroic materials, which are useful to develop the next generation of energy harvesting and storage, sensors and actuators. Often these are both chemically and structurally complex systems. Understanding the role of differently charged substituents, their lattice distribution, polar order/disorder on multiple length scales is of paramount importance to optimize their performance. Recent contributions in the field of materials genomics, for example the use of high-throughput DFT and artificial intelligence-based property inference, have shown their strength in complementing finite element modeling and phase field modeling approaches to uncover new or unseen structure-property relationships, and in designing new materials with improved functionalities.

This symposium targets the use of data-and/or physics-based modelling approaches combined with experimental data to rapidly uncover the structure-property relationships in complex, disordered solids, including ceramic relaxors, nanostructured metallic oxides, and semiconductors. The symposium themes will include the interplay of local structure, configurational entropy, ergodic-nonergodic behavior and instabilities induced by chemical substitution, and electric polarization on multiple length scales, and how it impacts macroscopic properties relevant for applications (energy storage, electromechanical and electrocaloric applications). Contributions involving advanced nano- to micro-scale characterization methods in synergy with multiscale modeling and physics-informed machine learning, providing key insights to better understanding the structure-property relationships in complex and disordered solids are welcomed.

PROPOSED SESSION TOPICS

- Theoretical foundations of data-driven models and physics-informed machine learning
- Local structure and properties of complex electroceramics
- Model-supported advanced nano- and microscale characterization methods
- Real-world applications

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SYMPOSIUM 10

STRUCTURE, DYNAMICS, & FUNCTIONALITIES IN HIGH-ENTROPY & COMPOSITIONALLY COMPLEX OXIDES

High-entropy and compositionally complex oxides are novel materials with promising functional properties and a wider range of possible compositions compared to traditional synthesis and processing methods. As a consequence, they might eschew expensive or toxic materials while yielding equivalent or superior functional properties. However, many challenges remain when developing these materials, notably concerning the complex relationships between structure, properties, and composition, and the difficulty in predicting and understanding their behavior due to their compositional complexity. This symposium aims to bring together researchers from various fields to address synthetic, modelling and characterization challenges in order to accelerate progress in this exciting area. The symposium will cover topics ranging from applications in catalysis, energy storage, and dielectric properties, specialized techniques to synthesize and analyze these materials, and computational methods for predicting their stability and behavior.

PROPOSED SESSION TOPICS

- Experimental and theoretical phase stability
- Functional properties, from magnetism and dielectric constants to catalysis
- Structure, elasticity, and dynamics of atoms and spins

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SYMPOSIUM 11

COMPLEX OXIDE THIN FILMS AND HETEROSTRUCTURES: FROM SYNTHESIS TO STRAIN/INTERFACE-ENGINEERED EMERGENT PROPERTIES

This symposium covers recent advances in oxide thin films, heterostructures, and nanocomposites. Topics include epitaxy of complex oxides, strain-stabilization, heterointerface engineering, emergent interfacial properties, new materials, 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 for scientists, engineers, and researchers from industry, academia, and national laboratories 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; device fabrication and applications in energy harvesting, memories, sensors, etc. Specific properties of interest are magnetic, electronic, electrochemical, and photonic responses, as well as thermal transport phenomena, including strong correlation and quantum-confinement effects.

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SYMPOSIUM 12

ADVANCED SEMICONDUCTORS AND MICROELECTRONICS

This symposium focuses on recent advances and developments in semiconductors and microelectronics and their manufacturing processes. Topics of interest include devices in memory and data storage, quantum information science, emerging materials such as hybrid materials, organics and hetero-structures, such as 2D hetero-interfaces, for flexible electronics and optoelectronics. Contributions that connect device design/fabrication, defects and interfaces 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 collaborations. Board areas of interest include: the modeling and simulation to predict device properties; Role of defects, interface; synthesis and manufacturing process for integration; Specific devices of interest are memory and data storage devices, memristive devices, transistors, detectors and flexible electronics.

PROPOSED SESSION TOPICS

- 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
- Next generation microelectronics
- Dielectrics and ferroelectrics for device applications (e.g., gate dielectric and energy storage)
- Low dimensional materials for memory devices (e.g., van der Waals heterostructures) and transistors
- Solution grown semiconductors, flexible electronics
- Emerging optoelectronics and detectors (e.g., solar cells, Photoelectrochemical water-splitting cells, photodetectors, X-ray detectors, etc)

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SYMPOSIUM 13

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 and impacts interfacial reaction kinetics in electronic, ionic, and mixed-conducting ceramics. These materials are important for numerous applications, including solid-state batteries, memristors, dielectrics, solid oxide fuel/electrolysis cells, catalysts, and sensors. Many operate under extreme electrochemical conditions to gain higher energy, power density, and novel properties. 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 symposium furthermore includes the influence of dislocations and grain boundaries as higher-dimensional defects.

PROPOSED SESSION TOPICS

- Predictive bulk and interfacial point defect energetics and equilibria from density functional theory, molecular dynamics, and other computational methods
- Structure and stability of defects and defect complexes via in-situ measurement (e.g., EPR, TSDC, EXAFS)
- Defect-mediated transport & reaction kinetics, including concerted/cooperative effects, via advanced in-situ and ex-situ measurement (e.g., QENS, NMR, isotope-APT)
- High-throughput, screening, and combinatorial methods applied to the study of defect equilibria and point defect-mediated properties
- 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, stress, high E-fields, irradiation)
- Defect-mediated properties (e.g., conductivity, surface oxygen or proton exchange kinetics, optical absorption, grain growth, creep, magnetism, ferroelectric imprint, dielectric degradation)
- Impact of dislocations and grain boundaries on ceramic functional properties

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SYMPOSIUM 14

AI IN MATERIALS RESEARCH: FROM DATA ANALYSIS, AUTONOMOUS EXPERIMENTATION, TO HUMAN-AI COOPERATION

This symposium aims to explore the role of machine learning (ML) in materials science, including concept development, experimental design, material synthesis, and characterization. The symposium covers a range of cutting-edge topics including the utilization of computer vision techniques for advanced data analysis and modeling, automated and autonomous synthesis and characterization, the integration of natural language processing in materials research, and strategies for effective human-AI collaboration. The goal of the symposium is to foster a collaborative environment that catalyzes the development of novel materials and advance fundamental knowledge by leveraging not only the synergy between ML algorithms and tool automation but also enhancing human-AI cooperation.

PROPOSED SESSION TOPICS

- Autonomous Synthesis, Characterization, and Modeling
- Machine Learning Algorithms for Diffraction, Spectroscopy, and Imaging Analysis
- Natural Language Processing for Knowledge Extraction, Experiment Planning, and Workflow Design
- Theory in the Loop Automated Experimentation
- Physics-AI and Human-AI Synergies
- Autonomous research data management"

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SYMPOSIUM 15

HIGH-PERFORMANCE COMPUTATIONAL DESIGN AND DISCOVERY OF ELECTRONIC MATERIALS

With the rapid advancements in high-performance computing and artificial intelligence, theoretical simulations have become integral part in the prediction of novel materials with tailored properties.

This symposium seeks to advance our understanding of fundamental materials properties, elucidate the underlying mechanisms, and pave the way for the development of next generation electronic devices with enhanced performance, functionality and sustainability.

PROPOSED SESSION TOPICS

- Advancements in the accuracy and scalability of electronic-structure theory methods enabling calculations for larger problem sizes with unprecedented accuracy
- The development of novel methodologies to simulate material properties not addressable before
- The establishment of high-throughput protocols to explore materials' space at a scale for the creation of databases
- The exploitation of AI techniques that further accelerate such simulations and materials discovery by order of magnitudes.

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SYMPOSIUM 16

CONTROLLING GRAIN BOUNDARY STRUCTURE, CHEMISTRY, AND THEIR NETWORK AS A FUNCTION OF MATERIAL PROCESSING

Electronic and mechanical properties that control the function of ceramic devices, like 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, 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 in order 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 SESSION TOPICS

- 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 (SPS, FAST, HIP, etc.)
  - Extreme temperatures (cold sintering, SPS, etc.)
  - Environments (oxygen, hydrogen, etc.)

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SYMPOSIUM 17

EMERGING SEMICONDUCTOR MATERIALS AND INTERFACES

This symposium will focus on the recent advances in new semiconductors and heterostructures for advancing the state-of-the-art in wide range of devices from power, RF, and logic to optoelectronics and photonics. Materials of interest for this symposium will include wide bandgap and ultra-wide bandgap semiconductors, 2D materials and inorganic perovskites. The symposium will include synthesis, characterization and high-throughput computational materials screening of these materials. The symposium will provide an interdisciplinary forum for researchers with expertise in diverse materials platforms to interact with each other which will lead to cross pollination of new ideas.

PROPOSED SESSION TOPICS

- Wide bandap (WBG) and ultra-wide bandgap (UWBG) materials
- 2D materials
- Inorganic perovskites

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SYMPOSIUM 18

CHARACTERIZATION OF STRUCTURE–PROPERTY RELATIONSHIPS IN FUNCTIONAL CERAMICS

Probing structure–property relationships in functional ceramics demands integrated approaches combining complementary experimental probes (e.g., light, X-ray, electron, neutron) with theory and simulation. Spatially and temporally resolved multiscale state-of-the-art scattering, imaging, and/or spectroscopy techniques can capture the dynamic material structure, composition and microstructure under external stimuli (e.g., electric/magnetic and stress/strain fields), which are necessary to answer open questions in this field.

This symposium bridges the Basic Science and Electronics Divisions, focusing on rapidly developing experimental and computational-imaging techniques, big-data analysis, and modeling approaches, to answer open structure–property relationship questions in functional ceramics, and demonstrate use cases of these methods.

The symposium will demonstrate new characterization techniques and stimulate new research questions and collaborations. Methods for approaching challenging problems spanning from functional interfaces to structural ordering will be featured. Contributions integrating novel applications of computational tools to predict and interpret scattering, diffraction, and microscopy data (e.g., Ptychography, Molecular-Dynamics) are encouraged.

PROPOSED SESSION TOPICS

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

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SYMPOSIUM 19

FRONTIERS IN FERROIC CERAMICS: SYNTHESIS, PROPERTIES, AND APPLICATIONS

Ceramic materials, such as metal oxides, exhibit rich ferroic physics and great potential for applications in next-generation devices. Significant research efforts over the past decades have created unprecedented advances in the study of these materials. Recent breakthroughs in materials synthesis, characterization, theory and modeling, and device fabrication have led to emerging materials in the form of bulk crystals, thin films, heterostructures, and nanomembranes, as well as emergent phenomena, including but not limited to exotic topological structures, multiferroicity, spin transport, and quantum magnetism. These advancements have attracted worldwide interest and opened up a new era toward understanding fundamental ferroic phenomena.

This symposium will focus on the interdisciplinary topics related to the physics, materials science, and engineering within the field of ferroic ceramics. The goal of this symposium is to bring together scientific experts and young scientists with an interest in ferroic materials to advance the fundamental understanding, develop modern experimental techniques, and explore new devices and applications.

PROPOSED SESSION TOPICS

- Advanced synthesis
- Mesoscopic imaging of ferroic domains
- Multiscale theory and modeling of ferroicity
- In situ control of magnetism and spin textures
- Ferroic materials for novel devices

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SYMPOSIUM 20

MAGNETIC AND SUPERCONDUCTING MATERIALS: FROM BASIC SCIENCE TO APPLICATIONS

The ever-growing field of magnetic materials enables countless technologies including information storage, sensing, transportation, communications, and biomedical applications. Additionally, superconductivity and magnetism and their correlation to spin, charge and orbital order parameters are dominant topics in quantum material research. To bridge the gap between fundamental research and device performance/applications for magnetic and superconducting materials requires approaches that transect multiple disciplines and require a collaborative approach.

This symposium covers a broad range of topics related to magnetism and superconductivity with more focus on magnetism this year, including the materials synthesis, crystal growth, 2D device fabrication & characterization, structures, dynamics, and properties of moiré superlattices, electronic, optical, and magnetic properties of 2D materials and van der Waals heterostructures, plus other topics such as magnets and 2D devices, and heterostructures for quantum information sciences, large-area growth and processing of magnetic materials for related applications thereof and industry perspectives on magnetic materials and 2D magnets in general. Specific topics include superconducting and magnetic materials, synthesis and characterization of nanomaterials and composites, modeling at multiple length scales, microwave or mm-wave materials, spintronic devices, magneto-ionics, magneto optical properties, magnetocalorics, and 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 and related superconductivity research.

SYMPOSIUM 20

MAGNETIC AND SUPERCONDUCTING MATERIALS: FROM BASIC SCIENCE TO APPLICATIONS (CONTINUED)

PROPOSED SESSION TOPICS

- Low dimensional, correlated magnetic materials
- Superconducting materials and devices related to magnetic orders and fluctuations
- Crystal growth, large area thin film deposition of magnetic materials and 2D magnets.
- Electronic, optical, and magnetic properties of 2D magnets and their heterostructures with other van der Waals materials
- Structures, dynamics, and properties of moiré superlattices of 2D materials
- Magnetic and superconducting devices: from nanoscale to large scale applications
- Novel applications of magnetic materials: magnetoelectrics, magneto-ionic transport, magnetocalorics, hybrid magnonics, magnetoresistance, quantum magnetic phenomena.
- New Superconducting Materials and related synthesis & properties
- Superconductivity and competing phases: theory and advanced characterizations
- Superconducting and magnetic electronics and devices
- Nanomaterials and composites, skyrmions and other topological phenomenon, 2D magnetic materials.
- Multiscale modeling of magnetism
- High frequency magnetic phenomena: spintronics, microwave materials, ultrafast switching and other magnetization dynamics.
- Sustainability in magnetics research

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SYMPOSIUM 21

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. Do not 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.

PROPOSED SESSION TOPICS

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

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SYMPOSIUM 22

ADVANCED ELECTRONIC MATERIALS: PROCESSING STRUCTURES 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 SESSION TOPICS

- Advanced electronic materials
- Materials design, new materials and structures and global structures and emerging applications
- Reliability and fatigue

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