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2024 MRS® FALL MEETING & EXHIBIT

December 1–6, 2024 | Boston, Massachusetts

# CALL FOR PAPERS

**Abstract Submission Opens–Friday, May 24, 2024**
**Abstract Submission Closes–Monday, June 24, 2024 (11:59 pm ET)**

*Reminder: In fairness to all potential authors, late abstracts will not be accepted.*

## Symposium BI01: Democratizing AI in Materials Science—A Pathway to Broaden the Impact of Materials Research

This symposium aims to democratize and streamline materials science by lowering the barriers to adopting data-driven artificial intelligence techniques. Materials research is essential for technological advancements, but can be slow and resource-intensive. The utilization of AI methodologies provides a promising avenue for expediting materials research. Nevertheless, obstacles to embracing these approaches exist. Through collaborative discussions and innovative exploration, our symposium seeks to diminish these obstacles and foster a more accessible and efficient landscape for adopting data-driven artificial intelligence techniques in materials science. By democratizing materials science with AI, we mean to increase the visibility, availability, readiness, and user-friendliness of data, tools, platforms, and innovative concepts that are made available through various means such as web applications, Python packages, GitHub, or other sharing platforms. Our aim is to foster a collaborative and open discussion between data science experts and non-experts. This includes materials scientists and engineers, chemists, physicists, and computer scientists from academia and industry. Through these efforts, we hope to catalyze materials research and facilitate breakthroughs in areas ranging from sustainability to healthcare.

The discussion will revolve around data, tools, platforms, frameworks, and pioneering ideas that can accelerate materials research. It also includes the use of data-driven approaches for educational, explorative, accelerative, disseminative, and knowledge-preservative purposes. We expect our symposium to provide a forum to identify adoption barriers encountered by non-data experts.

## Topics will include:

- Data extraction, organization, curation, and storage, and materials ontologies
- Experimental and computational databases and sharing platforms
- High-throughput materials space exploration techniques with computations and experiments
- Numerical materials representations (fingerprints or descriptors)
- AI-guided experimentation
- Knowledge discovery, conservation, and dissemination
- Rule mining
- Synthesis, prediction, and design strategies
- Synergetic materials research strategies that combine experimentation and theory
- Accelerating materials discovery with human-assisted AI methods
- Machine learning techniques such as active learning, transfer learning, and large language models
- Boosting materials research through open-source datasets and software
- Broadening impact through outreach, societal interaction, and education

## Invited speakers include:

| | |
|---|---|
| **Milad Abolhasani** | North Carolina State University, USA |
| **Maria Chan** | Argonne National Laboratory, USA |
| **Steve Cranford** | Cell Press, USA |
| **Claudia Draxl** | Humboldt-Universität zu Berlin, Germany |
| **Matthew Evans** | Université catholique de Louvain, Belgium |
| **Alysia Garmulewicz** | Universidad de Santiago de Chile, Chile |
| **Neil Gershenfeld** | Massachusetts Institute of Technology, USA |
| **Gabe Gomes** | Carnegie Mellon University, USA |
| **Ivor Lončarić** | Institut Ruder Boškovic, Croatia |
| **Arun Mannodi-Kanakkithodi** | Purdue University, USA |
| **Nicola Marzari** | École Polytechnique Fédérale de Lausanne, Switzerland |
| **Adnan Mehonic** | University College London, United Kingdom |
| **Kristin Persson** | University of California, Berkeley, USA |
| **Lilo Pozzo** | University of Washington, USA |
| **Krishna Rajan** | University at Buffalo, The State University of New York, USA |
| **Kristin Schmidt** | IBM T.J. Watson Research Center, USA |
| **Rama Vasudevan** | Oak Ridge National Laboratory, USA |
| **James Warren** | National Institute of Standards and Technology, USA |

## Symposium Organizers


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## Symposium BI02: Early Career Development—Insights from Academia and Industry

There are several unknowns when it comes to finding a job in academia or industry that fits one's skills and passions. Even after landing the desired position, a significant amount of learning is required to become a successful professional.

This symposium is geared toward the next generation of professionals in academia and industry by providing technical instruction on different aspects of career development. This symposium will delve into the intricacies of the job application process, pinpointing potential opportunities, and sharing anecdotal experiences. Guidance on how to write successful proposals and grants needed for research in Early career will be discussed. Journal editors will share their vision on writing impactful papers, followed by a panel discussion. We aim to gather professionals from various stages of their life and career to offer diverse perspectives. Additionally, this symposium will feature talks on novel and successful teaching and mentoring strategies.

Direct interaction with the attendees of the symposium will be promoted in panel discussions around 1) work-life balance - strategies for maintaining good mental health, coping with pressure, combining family and career; 2) mobility in early careers - discussions will be on: should I move? When is it a good time? What issues will I face? How to get funding for my work?; and 3) What's next after my PhD? Is postdoc a correct decision? How to shift from industry to academia? Is my profile more suited for industry or academia? What other options are there besides industry and academia? An informal networking session will be organized at the end of the symposium.

## Topics will include:

- Early career perspectives
- Faculty application
- Mentoring strategies
- Teaching methods
- Writing impactful research articles
- Grant proposal writing
- Job application
- Work-life balance
- Mobility in science

## Invited speakers include:

| | |
|---|---|
| **Jain Abnubhav** | Lawrence Berkeley National Laboratory, USA |
| **David Bahr** | Purdue University, USA |
| **Jeffrey Cain** | General Motors, USA |
| **Pieremanuele Canepa** | University of Houston, USA |
| **Mallory Clites** | U.S. Department of Energy, USA |
| **Daniel Cole** | U.S. Army Research Office—Materials Science Division, USA |
| **Vincent Dusastre** | Nature Materials, United Kingdom |
| **Jessica Freyer** | Rhapsody Venture Partners, USA |
| **Chris Heckle** | Argonne National Laboratory, USA |
| **Germano Iannacchione** | National Science Foundation, USA |
| **Caroline Koustis** | Shimadzu Scientific Instruments, USA |
| **Christine Luscombe** | Okinawa Institute of Science and Technology, Japan |
| **Suveen Mathaudhu** | Colorado School of Mines, USA |
| **Lincoln Miara** | Pure Lithium, USA |
| **Jagjit Nanda** | Stanford University, USA |
| **Mihrimah Ozkan** | University of California, Riverside, USA |
| **Gopal Rao** | Materials Research Society, USA |
| **Briana Simms** | University of Cincinnati, USA |
| **Mona Zebarjadi** | University of Virginia, USA |

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## Symposium CH01: *In Situ* Characterization During Thin-Film Processing

Thin films are extremely relevant both scientifically and technologically for several reasons. They provide a model system for studying the fundamental properties of materials, they enable the study of the properties of materials under controlled conditions (including extreme conditions), and they can be used to study the growth and properties of crystals. As a result, thin films find many different applications, including transistors, solar cells, microprocessors, displays, coatings for optical lenses, anti-corrosion coatings, and catalytic converters.

Having the possibility to control their composition and properties during deposition/etch or post deposition treatments offers both fundamental knowledge of the process and accelerates the optimization of the process protocols and the final properties of the materials. For these reasons, *in situ* characterization techniques are widely used and developed by the thin film community. In addition, data obtained *in situ* during deposition or post-processing of thin films can be used to accelerate the optimization of deposition/post-treatment conditions and properties thanks to machine learning (ML) and artificial intelligence (AI).

This symposium will bring together researchers using or interested *in situ* techniques during film processing, who are often dispersed amongst different symposia at application focused conferences, to highlight and discuss recent advancements in the field and to promote cross-fertilization between different *in situ* approaches.

## Topics will include:

- *In Situ* diagnostic of atomic layer processing (ALD, ASD, ALE)
- *In Situ* plasma characterization and its correlation to thin films processing (deposition and etching)
- Optimization of thin film processing through AI/ML and *in situ* combined approaches
- *In Situ* reactor monitoring for control of process uniformity and reproducibility/maintenance
- *In Situ* studies in large research facilities (synchrotron, neutrons, etc)
- *In Situ* characterization of the evolution of thin films properties during post-deposition treatments
- Nucleation and thin film growth from solutions, melts, and vapors.
- Novel in situ characterization approaches for thin film deposition and processing

## Invited speakers include:

| | |
|---|---|
| **Marceline Bonvalot** | Commissariat à l'énergie atomique et aux énergies alternatives, France |
| **Christophe Defranoux** | Semilab, France |
| **Remy Gassilloud** | Commissariat à l'énergie atomique et aux énergies alternatives, France |
| **Agnès Granier** | Institut des Materiaux Jean Rouxel, France |
| **Peter Muller-Buschbaum** | Technische Universität München, Germany |
| **Kevin Musselman** | University of Waterloo, Canada |
| **Shota Nunomura** | National Institute of Advanced Industrial Science and Technology, Japan |
| **Robin Ras** | Aalto University, Finland |
| **Joachim Schnadt** | Lund University, Sweden |
| **Eduardo Solano** | ALBA Synchrotron, Spain |
| **Takayoshi Tsutsumi** | Nagoya University, Japan |
| **Sergey Voronin** | TEL, USA |

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## Symposium CH02: Recent Advancements in Characterization and Modeling of Electrochemical Interfaces

This symposium covers recent progress in in-situ/operando characterizations of electrochemical interfaces and advancements in multiscale modeling and simulations that move beyond idealized systems to understand the atomic origins of macroscopic behaviors in real electrochemical devices. A strong emphasis is placed on the integration between modeling and characterization to understand the fundamental processes, key chemistry and structural features that dictate the performance of electrochemical interfaces. The first part of the symposium focuses on experimental characterization techniques as well as novel cell designs to enable characterization and elucidation of buried electrochemical interfaces, with special emphasis on the development of in-situ/operando characterization techniques and multimodal approaches to probe solid-gas, solid-liquid and solid-solid interfaces that are relevant in rechargeable batteries, fuel cells, electrolysis, and electro deposition processes. The second part of the symposium focuses on modeling of electrochemical interface using techniques such as density functional theory, molecular dynamics, microkinetic modeling, phase field, continuum modeling, and emerging machine learning-based methodologies. A key emphasis is placed on multiscale modeling approaches that can overcome the specific time- and length-scale limitations of individual simulation methods and integrations between modeling and characterization to resolve the structure-properties relationship at the electrochemical interfaces. The contributions address basic scientific challenges, demonstrate new multimodal characterization and multiscale modeling techniques, identify limiting factors, and advise mitigation strategies for interface engineering. Examples of how these approaches have contributed to the fundamental understanding of various interfacial physico-chemical processes and their effects on overall device performance, as well as how this understanding can be directly applied to design more efficient and durable electrochemical interfaces, are particularly welcome.

## Topics will include:

- Advancements in *in situ/operando* characterization techniques
- Integrated characterization and modeling approaches
- Addressing electro-chemo-mechanical coupling at electrochemical interfaces from multiscale modeling
- Electrochemical deposition and corrosion
- Electrocatalysis, including $CO_2$ reduction and water electrolysis
- High-energy-density Li batteries and solid-state batteries
- Understanding interfacial evolution during electrochemical cycling

Joint sessions are being considered with **CH04 - Advanced Characterization Techniques and Methodologies for Battery Materials**.

## Invited speakers include:

| | |
|---|---|
| **Anja Bieberle** | Dutch Institute for Fundamental Energy Research, Netherlands |
| **Long-Qing Chen** | The Pennsylvania State University, USA |
| **Jun Cheng** | Xiamen University, China |
| **Kyung Yoon Chung** | Korea Institute of Science and Technology, Republic of Korea |
| **Beatriz Roldán Cuenya** | Fritz Haber Institute of the Max Planck Society, Germany |
| **Nikita Dutta** | National Renewable Energy Laboratory, USA |
| **Alejandro Franco** | Université de Picardie Jules Verne, France |
| **Edwin Garcia** | Purdue University, USA |
| **Robert Kostecki** | Lawrence Berkeley National Laboratory, USA |
| **Ulrike Krewer** | Karlsruhe Institute of Technology, Germany |
| **Kevin Leung** | Sandia National Laboratories, USA |
| **Ju Li** | Massachusetts Institute of Technology, USA |
| **Y. Shirley Meng** | The University of Chicago, USA |
| **Yue Qi** | Brown University, USA |
| **Kenneth Takeuchi** | Stony Brook University, The State University of New York, USA |
| **Michael Toney** | University of Colorado Boulder, USA |
| **Anton Van Der Ven** | University of California, Santa Barbara, USA |
| **Chongmin Wang** | Pacific Northwest National Laboratory, USA |
| **Johanna Nelson Weker** | SLAC National Accelerator Laboratory, USA |

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## Symposium CH03: Towards Quantitative Characterization of Soft Materials by Scanning Probe Microscopy—Beyond Imaging

Scanning Probe Microscopy (SPM) stands as a formidable technology capable of visualizing, characterizing, and even manipulating nanostructures through the use of a sharp probe. The versatility of SPM makes it a valuable tool for addressing diverse challenges across a wide array of domains considering soft materials, such as energy harvesting, organic electronics, biosensors, self-assembly, biotechnology, life sciences, mechanobiology, cosmetics, and medical applications, particularly in the field of nanomedicine. This cutting-edge field has seen remarkable advancements in recent years, continually introducing new techniques and applications, especially in the realm of soft materials and biological specimens, including disease-related samples with diagnostic potential. Nevertheless, SPM is not without its own set of challenges. Precisely measuring the mechanical properties of materials and effectively handling the substantial amount of data generated by SPM techniques remain major hurdles.

The primary aim of this symposium is to provide an international platform for the exchange of research findings among globally recognized experts actively engaged in the domain of scanning probe microscopy applied to soft polymeric (bio)materials and living organisms. Industrial partners will also be part of the dialogue, facilitating discussions on the potential of novel SPM approaches. This symposium serves as a unique opportunity to both showcase and deliberate on the current state of SPM methods when dealing with challenges and to chart the course for future applications in the context of soft polymeric (bio)materials and living organisms. Furthermore, this symposium is part of the broader Materials Research Society series focused on SPM techniques. The track record of this series in uniting leading figures from academia and industry, as well as attracting budding researchers and students, has been remarkable. Importantly, this event is expected to span a range of disciplines, encompassing material sciences, engineering, biophysics, condensed matter physics, and the development of cutting-edge instrumentation.

## Topics will include:

- Mapping at the nanoscale of the mechanical (and viscoelastic) properties of soft materials (polymer blends, nanocomposites, hydrogels, biopolymers, bioglues …) cells and viruses
- Nano-mechanical properties of soft materials (acquisition and analysis)
- Towards industrial, biological, and medical applications (food, personal care, cosmetics, dermatology)
- Characterization of the next-generation cosmetic bio-sourced materials
- Mechanical manipulation of single molecules
- SPM-based mechanobiology
- Cells nanomechanics as a medical diagnostic tool
- Combined multimodal SPM and correlative imaging modes (Raman, IR, SEM, …)
- High speed and high-resolution SPM (instrumentation and data analysis)
- Novel methodologies/processes for the data analysis including advanced statistics and Machine Learning

## Invited speakers include:

| | | | |
|---|---|---|---|
| **Mathieu Cognard** | Digital Surf, France | **Florian Kumpfe** | Bruker JPK, Germany |
| **Sidney Cohen** | Weizmann Institute of Science, Israel | **Ken Nakajima** | Tokyo Institue of Technology, Japan |
| **Sonia Contera** | University of Oxford, United Kingdom | **Bede Pittenger** | Bruker Nano Inc., USA |
| **Alexandre Dazzi** | Université Paris-Saclay, France | **Roger Proksch** | Oxford Instruments, USA |
| **Rosa Espinoza-Marzal** | University of Illinois at Urbana-Champaign, USA | **Lorena Redondo-Morata** | Institut Pasteur de Lille, France |
| **Georg Fanter** | Ecole Polytechnique Fédérale de Lausanne, Switzerland | **Felix Rico** | Aix-Marseille Université, France |
| **Takeshi Fukuma** | Kanazawa University, Japan | **Simone Ruggeri** | Wageningen University & Research, Netherlands |
| **Nuria Gavara** | Universitat de Barcelona, Spain | **Lanti Yang** | Sabic, Netherlands |
| **Greg Haugstad** | University of Minnesota, USA | **Francesca Zuttion** | L'OREAL, France |
| **Peter Hinterdorfer** | Johannes Kepler Universität Linz, Austria | | |

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## Symposium CH04: Advanced Characterization Techniques and Methodologies for Battery Materials

As the demand for sustainable and affordable energy storage solutions increases, there is a critical need to explore alternative materials beyond those employed in traditional lithium-ion batteries (LIBs). Developing cheaper and safer energy storage materials with higher performance is imperative, but new materials often have compromised electrochemical performance, including lower capacities and poor cycling performance. These issues can be attributed to various factors, including local structural changes, surface degradation, and the formation of unstable solid-electrolyte interphases. To address these challenges, this symposium aims to gather researchers and experts to discuss advanced characterization techniques for energy storage materials for battery applications. The symposium will focus on exploring the latest analytical methods, such as *in situ* transmission electron microscopy (TEM), in-situ atomic force microscopy (AFM), neutron diffraction and pair distribution function (PDF) analysis, 3D tomography, X-ray absorption near edge structure (XANES) with extended X-ray absorption fine structure (EXAFS), and solid-state nuclear magnetic resonance (NMR) spectroscopy. We invite original research submissions on advanced characterizations that improve our understanding of the local structure, composition, and chemical states of energy storage materials under *operando* conditions. The symposium will cover topics such as local structural changes and surface degradation of electrodes, formation and stability of solid-electrolyte interphases, morphology and phase characterization using advanced microscopy techniques, and electrochemical and transport properties under operando conditions. This symposium aims to foster interdisciplinary discussions among researchers in materials science, chemistry, physics, and engineering to advance the development of energy storage materials.

## Topics will include:

- Synchrotron X-ray characterization of electrode materials
- Neutron diffraction and PDF of high energy cathodes
- Spectroscopic studies of solid-electrolyte interphases (SEI)
- *In situ/operando* NMR spectroscopy of battery materials
- X-ray tomography and microscopy for the 3D visualization of energy materials
- Acoustic signals for determining electrochemical system
- Cryo-EM for battery materials and interfaces
- *In situ/operando* optical microscopy for probing interfaces, degradation, deposition and more during the electrochemical process
- Battery performance engineering assisted by advanced atomic force microscopy
- Advanced Raman and infrared spectroscopy for studying battery materials and interfaces

Joint sessions are being considered with **CH02 - Recent Advancements in Characterization and Modeling of Electrochemical Interfaces**.

## Invited speakers include:

| | |
|---|---|
| **Mahalingam Balasubramanian** | Oak Ridge National Laboratory, USA |
| **Frederic Blanc** | University of Liverpool, United Kingdom |
| **Jordi Cabana** | University of Illinois at Chicago, USA |
| **Neil Dasgupta** | University of Michigan, USA |
| **Nuria Garcia-Araez** | University of Southampton, United Kingdom |
| **Clare Grey** | University of Cambridge, United Kingdom |
| **Kelsey Hatzell** | Princeton University, USA |
| **Enyuan Hu** | Brookhaven National Laboratory, USA |
| **Yan-Yan Hu** | Florida State University, USA |
| **Karin Kleiner** | Universität Münster, Germany |
| **James LeBeau** | Massachusetts Institute of Technology, USA |
| **Michal Leskes** | Weizmann Institute of Science, Israel |
| **Xiaolin Li** | Pacific Northwest National Laboratory, USA |
| **Jue Liu** | Oak Ridge National Laboratory, USA |
| **Lauren Marbella** | Columbia University, USA |
| **David Muller** | Cornell University, USA |
| **Akshay Rao** | University of Cambridge, United Kingdom |
| **Jennifer Rupp** | Technische Universität München, Germany |
| **Dan Steingart** | Columbia University, USA |
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## Symposium CH05: Frontiers of Imaging and Spectroscopy in Transmission Electron Microscopy

Instrumentation and methodological advances in electron microscopy over the last few decades have dramatically broadened the range of applications of this cornerstone technique of modern science. While the successful implementation of lens aberration correctors in the late 1990s was the catalyst in ushering this new golden age of electron microscopy, the pace of change has all but accelerated in the last few years. Faster, more sensitive direct electron detectors for both imaging and spectroscopic applications, monochromated electron sources for electron spectroscopy, magnetic-field-free lenses, and the promise of stable sample observation at deep cryogenic temperatures are changing the way (scanning) transmission electron microscopy ((S)TEM) is used to characterize materials at unprecedented levels of resolution and sensitivity, including on beam-sensitive or liquids/gaseous systems. Strategies for handling the large amount of multi-dimensional data generated by modern instruments, alongside novel data analytics are also being facilitated by a concurrent revolution in machine learning and artificial-intelligence based processing methodologies.

This symposium will cover a wide range of topics at the frontiers of electron microscopy, including 4D-STEM, monochromated electron spectroscopies, data-analytics and multi-dimensional imaging, as well as in-situ and ultra-fast microscopy. The integration of image acquisition with machine learning and materials modeling will also be highlighted. The goal of this symposium is to bring together researchers from all corners of this vibrant field, and to reach out to interdisciplinary scientific communities so as to foster new collaborative research and to accelerate the design and developments of novel functional materials and devices.

## Topics will include:

- Transmission electron microscopy
- Electron energy loss spectroscopy
- (S)TEM-based spectroscopies
- 4D-STEM
- *In situ* electron microscopy
- Modelling of scattering in electron microscopy
- Ultra-fast and dynamic imaging
- Machine learning and data analytics in (S)TEM

## Invited speakers include:

| | |
|---|---|
| **Sara Bals** | University of Antwerp, Belgium |
| **Judy Cha** | Cornell University, USA |
| **Maria Chan** | Argonne National Laboratory, USA |
| **Peter Ercius** | Lawrence Berkeley National Laboratory, USA |
| **Joanne Etheridge** | Monash University, Australia |
| **Paulo Ferreira** | International Iberian Nanotechnology Laboratory, Portugal |
| **Berit Goodge** | Max Planck Institute for Chemical Physics of Solids, Germany |
| **Demie Kepaptsoglou** | University of York, United Kingdom |
| **Judy Kim** | University of Oxford, United Kingdom |
| **Andrea Konecna** | Brno University of Technology, Czech Republic |
| **Y. Shirley Meng** | The University of Chicago, USA |
| **Sophie Meuret** | Centre d'Élaboration des Matériaux et d'Etudes Structurales, France |
| **Thomas Pichler** | Universität Wien, Austria |
| **Bryan Reed** | Integrated Dynamic Electron Solutions Inc., USA |
| **Marta Rossell** | Empa–Swiss Federal Laboratories for Materials Science and Technology, Switzerland |
| **Naoya Shibata** | The University of Tokyo, Japan |
| **Kazu Suenaga** | Osaka University, Japan |
| **Eren Suyolcu** | Max Planck Institute for Solid State Physics, Germany |
| **Luiz Tizei** | Université Paris-Saclay, France |
| **Jo Verbeeck** | University of Antwerp, Belgium |
| **Michael Zachman** | Oak Ridge National Laboratory, USA |
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**Robert Klie**

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## Symposium CH06: Exploring Fast and Ultrafast Dynamics of Matter with Electrons and Photons

The development of methods for visualizing the atomic-scale nature of matter has proven to be instrumental for understanding the structural origin of functionality in biological, chemical and materials systems. Due to the dynamic nature of function, the need to understand fast, complex physical phenomena through direct in situ observation has stimulated the development of fast and ultrafast probing techniques based on electrons and photons. The ultrafast probing techniques combined with *in situ* and multimodal acquisition capabilities have been utilized to gain a fundamental understanding of dynamic processes occurring in materials and biological structures. This symposium will focus on the current progress made in the field of advanced fast and ultrafast in situ characterization techniques, including ultrafast electron diffraction and microscopy, X-ray based techniques, and complementary multimodal implementations. Worldwide specialists will present new science, techniques, and data analysis and discuss future directions and exciting emerging research areas.

## Topics will include:

- Structural, electronic, and magnetic dynamics unveiled by ultrafast microscopy, diffraction, and spectroscopy.
- Novel molecular and material processes that have been enable by ultrafast microscopy, diffraction, spectroscopy.
- Photon-electron interactions by femtosecond optical and/or electron pulses, coherent control of quantum system, electron state manipulation
- Multimodality approaches in ultrafast techniques
- *In situ* electron and X-ray-based ultrafast microscopy, diffraction and spectroscopy techniques and their application in materials science.
- Materials under extreme conditions
- Understanding and mitigating high intensity beam effects on materials
- Atomic scale single-particle dynamics and molecular processes
- Fundamental challenges in designing ultrafast coherent and high-brightness probes (source, optical system, and detection)
- Discoveries, new physical insights, and paradigm tests that have occurred because of developments and advancements in ultrafast characterization techniques

## Invited speakers include:

| | |
|---|---|
| **Ilke Arslan** | Argonne National Laboratory, USA |
| **Florian Banhart** | Université de Strasbourg, France |
| **Naomi Ginsberg** | University of California, Berkeley, USA |
| **Kyoko Ishizaka** | The University of Tokyo, Japan |
| **Ido Kaminer** | Technion–Israel Institute of Technology, Israel |
| **Ye-Jin Kim** | California Institute of Technology, USA |
| **Martin Kozak** | Univerzita Karlova, Czech Republic |
| **Oh-Hoon Kwon** | Ulsan National Institute of Science and Technology, Republic of Korea |
| **Bolin Liao** | University of California, Santa Barbara, USA |
| **Aaron Lindenberg** | Stanford University, USA |
| **Ulrich Lorenz** | École Polytechnique Fédérale de Lausanne, Switzerland |
| **Renske M. van der Veen** | Helmholtz-Zentrum Berlin, Germany |
| **Anton Malko** | The University of Texas at Dallas, USA |
| **Keith Nelson** | Massachusetts Institute of Technology, USA |
| **Archana Raja** | Lawrence Berkeley National Laboratory, USA |
| **Chong-Yu Ruan** | Michigan State University, USA |
| **Sascha Schäfer** | University of Regensburg, Germany |
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## Symposium CH07: Cryogenic Electron Microscopy and Correlative Characterization Techniques for Quantum and Energy Materials Research

Cryogenic electron microscopy (EM) has revolutionized our understanding of biological materials at the atomic scale. Despite the research breakthroughs in biology, utilizing cryogenic conditions for EM research of heterogeneous materials is still in its infancy. This symposium is intended to facilitate the exchange of information on the latest developments, challenges, and outlooks in cryogenic EM to probe phenomena in quantum and energy materials. Utilizing cryogenic conditions has allowed researchers to start exploring beam sensitive and liquid phase interfaces found in energy materials and devices such as batteries at the atomic-scale. More recently temperature controlled cryogenic EM hardware is enabling researchers to explore *in situ* low temperature quantum phases. Additionally, recent developments in cryogenic sample preparation, including focused ion and laser beam microscopy, have provided a new platform to probe phenomena in quantum and energy materials that have not been accessible before.

This symposium will also be an opportunity to discuss and identify synergies between complementary cryogenic characterization methods such as *in situ/operando* EM, atom probe tomography and synchrotron beam line techniques. A major challenge in both quantum and energy materials research is linking macro- and micro-scale properties with atomic-scale characterization techniques. Too often, different cryogenic characterization approaches are carried out in isolation, with no straightforward way to combine data from different experimental techniques. We welcome contributions in theoretical and data analysis techniques including AI/ML approaches that are essential to overcome the low signal/noise and instrumentation stability constraints common to cryogenic characterization techniques.

### Topics will include:

- Cryogenic sample preparation techniques including vitrification and cryogenic focused ion beam
- Advancements in cryogenic EM an *in situ* holders, such as temperature control, extreme low liquid helium temperatures, applied bias, magnetic field etc.
- Correlative *in situ* EM and other *in situ* microscopy techniques e.g. liquid cell and gas
- Correlative cryogenic and *in situ* x-ray and neutron beam line techniques
- Correlative cryogenic advanced characterisation techniques e.g. atom probe tomography
- Combination with advanced TEM techniques (phase related, spectroscopy, 4D-STEM)
- Advanced TEM techniques to explore interplay of quantum phenomena such as charge, spin, orbital, lattice correlations
- Applications of cryogenic electron spectroscopy for energy and quantum materials
- Synergies with theoretical methods and data science
- Advanced data acquisition and analysis methods (including AI/ML for EM) for cryogenic microscopy and correlative characterization techniques

A **tutorial** complementing this symposium is tentatively planned. Further information will be included in the MRS Program that will be available online in September.

### Invited speakers include:

| | |
|---|---|
| **Patricia Abellan** | Institut des Matériaux Jean Rouxel, France, France |
| **Eva Bladt** | DensSolutions Inc., Netherlands |
| **Karen Bustillo** | Lawrence Berkeley National Laboratory, USA |
| **Julie Cairney** | The University of Sydney, Australia |
| **Miaofang Chi** | Oak Ridge National Laboratory, USA |
| **Arun Devaraj** | Pacific Northwest National Laboratory, USA |
| **Rafal Dunin-Borkowski** | Forschungszentrum Jülich GmbH, Germany |
| **Berit Goodge** | Max Planck Institute for Chemical Physics of Solids, Germany |
| **Juan Carlos Idrobo** | University of Washington, USA |
| **Katherine Jungjohann** | National Renewable Energy Laboratory, USA |
| **Judy Kim** | University of Oxford, United Kingdom |
| **James LeBeau** | Massachusetts Institute of Technology, USA |
| **Yuzhang Li** | University of California, Los Angeles, USA |
| **Marc Maier** | Ferrovac, Switzerland |
| **Y. Shirley Meng** | The University of Chicago, USA |
| **Ana Pakzad** | Ametek, USA |
| **Lee Penn** | University of Minnesota, USA |
| **Amanda Petford-Long** | Argonne National Laboratory, USA |
| **Noah Schnitzer** | Cornell University, USA |
| **Naoya Shibata** | The University of Tokyo, Japan |
| **Denys Sutter** | CondenZero GmbH, Switzerland |
| **Luizi Tizei** | Université Paris-Saclay, France |
| **Min Wu** | Thermo Fisher Scientific, Netherlands |
| **Michael Zachman** | Oak Ridge National Laboratory, USA |
| **Yimei Zhu** | Brookhaven National Laboratory, USA |

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## Symposium EL01: Low-Dimensional Luminescent Materials and Devices

Low-dimensional luminescent materials including halide perovskites and colloidal quantum dots are crucial for various upcoming applications such as hyper-realistic displays, augmented reality glasses, autonomous vehicles, optical quantum communications, electrically pumped lasing, hyperspectral imaging, and other emerging optoelectronic applications. Recent research in this area is currently focusing on developing high-efficiency, stable materials, and devices, as well as developing environmentally friendly alternatives and understanding the fundamental photophysics behind them.

This symposium aims to discuss cutting-edge research ideas and achievements that would contribute to material innovation in metal halide perovskites, colloidal quantum dots, nanoplatelets, and other low-dimensional nanostructures. The proposed symposium will cover a complete range of topics regarding emerging luminescent low-dimensional materials from fundamental chemistry and physics to related practical applications. The discussion in the proposed symposium will comprehensively encompass precise material synthesis, defect passivation strategies, photophysical analysis, thin-film processing and patterning, and optoelectronic devices including light-emitting diodes, photodetectors, and lasers. Since many of these topics are interrelated, the symposium provides a valuable opportunity for participants to exchange views on state-of-the-art accomplishments and generate insights for future innovative research.

## Topics will include:

- Quasi-2D perovskites and other low-dimensional perovskite structures
- Colloidal perovskite nanocrystals
- Colloidal inorganic quantum dots, nanoplatelets, and other low-dimensional nanostructures
- Lead-free perovskite and perovskite-derivative emitters
- Novel synthetic routes and growth mechanisms of emitters
- Fundamental photophysics of emitters
- Defect passivation strategies
- Interfacial engineering for light-emitting diodes and other optoelectronic devices
- Degradation mechanism of emitters and their devices
- Novel patterning methods
- Down/Up-conversion emitters, films, and display/lighting devices
- Optically or electrically pumped lasing from low-dimensional emitters
- Chiral luminescent materials
- Infrared-emitting materials and devices

## Invited speakers include:

| | |
|---|---|
| **Igor Coropceanu** | Nanosys, USA |
| **Yitong Dong** | The University of Oklahoma, USA |
| **Hongyou Fan** | Sandia National Laboratories, USA |
| **Daniel Gamelin** | University of Washington, USA |
| **Feng Gao** | Linköping University, Sweden |
| **Xiwen Gong** | University of Michigan, USA |
| **Tzung-Fang Guo** | National Cheng Kung University, Taiwan |
| **Zeger Hens** | Ghent University, Belgium |
| **Laura Herz** | University of Oxford, United Kingdom |
| **Bin Hu** | The University of Tennessee, Knoxville, USA |
| **Sohee Jeong** | Sungkyunkwan University, Republic of Korea |
| **Hemamela Karunadasa** | Stanford University, USA |
| **Taekhoon Kim** | Samsung Advanced Institute of Technology, Republic of Korea |
| **Maksym Kovalenko** | ETH Zürich, Switzerland |
| **Tae-Woo Lee** | Seoul National University, Republic of Korea |
| **Xuedan Ma** | Argonne National Laboratory, USA |
| **Liberato Manna** | Istituto Italiano di Tecnologia, Italy |
| **Qibing Pei** | University of California, Los Angeles, USA |
| **Sam Stranks** | University of Cambridge, United Kingdom |
| **Tze-Chien Sum** | Nanyang Technological University, Singapore |
| **William Tisdale** | Massachusetts Institute of Technology, USA |
| **Hendrik Utzat** | University of California, Berkeley, USA |

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## Symposium EL02: Phase-Change Materials for Brain-like Computing, Embedded Memory and Photonic Applications

The rapidly growing demand for data storage and processing, driven by artificial intelligence (AI) and other data-intensive applications, is posing a serious challenge for current computing devices based on the von Neumann architecture. For every calculation, data sets need to be shuffled sequentially between the processor, and multiple memory and storage units through bandwidth-limited and energy-inefficient interconnects, typically causing 40% power wastage. Phase-change materials (PCMs) based on chalcogenides or antinomies show great promise to break this bottleneck by enabling non-volatile memory devices that can optimize the complex memory hierarchy, and neuro-inspired computing devices that can unify computing with storage in memory cells. The basic working principle is that PCMs can be switched between the amorphous and crystalline phase rapidly and reversibly by either electrical or optical pulses. The large contrast in electrical resistance and optical reflectivity between the two solid-state phases defines the logic state “0” and “1” for memory applications, while the continuous and non-linear change in resistance and reflectivity upon partial amorphization or gradual crystallization can be used to emulate neuronal dynamics for brain-like computing. In addition to traditional Ge-Sb-Te based alloys, metal oxides and two-dimensional materials, such as $VO_2$ and $MoTe_2$, have also been utilized for phase-change memory applications, where the switching between different logical states is achieved by transitions between different crystalline phases.

## Topics will include:

- Materials design and characterization
- Crystallization kinetics of PCMs
- Resistance drift phenomenon and multi-level storage
- Brain-like computing devices and modeling
- Threshold switching effect and selector devices
- Cycling endurance and device degradation mechanism
- High-Temperature PCMs and embedded memory
- Optical and thermal properties of PCMs
- Non-volatile photonics and metamaterials
- Atomic imaging and modelling of PCMs

Joint sessions are being considered with **EN04 - Phase Change Materials for Energy Conversion and Storage**.
Also, a **tutorial** complementing this symposium is tentatively planned. Further information will be included in the MRS Program that will be available online in September.

## Invited speakers include:

| | |
|---|---|
| **Jaakko Akola** | Norwegian University of Science and Technology, Norway |
| **Sabrina Calvi** | INFN Roma Tor Vergata, Italy |
| **Stefano Cecchi** | Università degli Studi di Milano-Bicocca, Italy |
| **Hai-Yu Michelle Cheng** | Macronix International, USA |
| **Guy Cohen** | IBM T.J. Watson Research Center, USA |
| **Behrad Gholipour** | University of Alberta, Canada |
| **Shogo Hatayama** | National Institute of Advanced Industrial Science and Technology, Japan |
| **Asir Intisar Khan** | Stanford University, USA |
| **Hyun Jung Kim** | NASA Langley Research Center, USA |
| **Massimo Longo** | Università degli Studi di Roma Tor Vergata, Italy |
| **Riccardo Mazzarello** | Sapienza Università di Roma, Italy |
| **Antonio Mio** | Consiglio Nazionale delle Ricerche, Italy |
| **Timothy Philip** | IBM T.J. Watson Research Center, USA |
| **Stefania Privitera** | Consiglio Nazionale delle Ricerche, Italy |
| **Andrea Redaelli** | ST Microelectronics, Italy |
| **Martin Salinga** | University of Münster, Germany |
| **Aida Todri Sanial** | Technische Universiteit Eindhoven, Netherlands |
| **Ranjan Singh** | Nanyang Technological University, Singapore |
| **Olivier Thomas** | Aix Marseille University, France |
| **Sharon Weiss** | Vanderbilt University, USA |
| **Nathan Youngblood** | University of Pittsburgh, USA |
| **Wei Zhang** | Xi’an Jiaotong University, China |

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**Juejun Hu**

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**Andriy Lotnyk**

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## Symposium EL03: 2D Materials—Nanofabrication and Applications

Internet-of-Things is distinctly new and rapidly expanding field of applied science which collides with 2D materials and devices with boundless future. 2D materials' progression from pure fundamental science to an application-oriented technology has occurred over unprecedented time frames, with many applications nearing market readiness. This symposium covers the state-of-the-art research and development on 2D materials and their innovative momentum in many applications such as flexible or wearable transistors, photodetectors, memristors and other devices through novel nanofabrication, nanolithography, and nanomanufacturing technologies. The scope of this symposium also broadly involves the new device applications, circuits design and system integration by the frontier progress of 2D materials and devices emerging with CMOS technology. The symposium content will include, but not limited to, the application of 2D materials as active and passive materials for electronics (including flexible, bio, and printable), photonics (including sensors, photodetectors, and photovoltaics), twistronics (including topological matter and van der Waals heterostructures), and healthcare (including biosensing and neuroscience). This symposium will provide a uniquely comprehensive experimental overview of 2D materials used for diverse applications. The symposium will provide a portal to attendees on the present state-of-the-art in the research on 2D material-based devices, including the nanofabrication, operation, and integration of 2D material-based devices. The symposium will consider and endorse contributions of works that utilize novel materials beyond graphene, including the emerging family of transition metal dichalcogenides (TMDs), Xenes, MXenes, metal organic frameworks (MOFs), etc. and their heterostructures for various applications. This timely symposium will disseminate the findings in this vogue research field to the broadest audience.

## Topics will include:

- 2D materials synthesis and characterization
- Nanofabrication of advanced 2D materials and devices
- 2D materials for wearable, flexible, and printable nanotechnology
- 2D materials for neuromorphic and AIs technologies
- 2D materials for healthcare bioelectronics
- 2D materials for twisted and topological matter
- Optics and photonics enabled by 2D materials
- Emerging 2D materials and heterostructures for nanotechnology
- Nanolithography and nanomanufacturing of 2D materials

Joint sessions are being considered with **EL06 - 2D Atomic and Molecular Sheets Beyond Graphene—Optical Properties, Optoelectronics and Quantum Optics**.

## Invited speakers include:

| | |
|---|---|
| **Jong-Hyun Ahn** | Yonsei University, Republic of Korea |
| **Camilla Coletti** | Istituto Italiano di Tecnologia, Italy |
| **Saptarshi Das** | The Pennsylvania State University, USA |
| **Xiangfeng Duan** | University of California, Los Angeles, USA |
| **Aaron Franklin** | Duke University, USA |
| **Jose Antonio Garrido** | Catalan Institute of Nanoscience and Nanotechnology, Spain |
| **Mark Hersam** | Northwestern University, USA |
| **Francesca Iacopi** | University of Technology Sydney, Australia |
| **Dmitry Kireev** | University of Massachusetts Amherst, USA |
| **Agnieszka Kuc** | Helmholtz-Zentrum Dresden-Rossendorf, Germany |
| **Max Lemme** | RWTH Aachen University, Germany |
| **Cecilia Mattevi** | Imperial College London, United Kingdom |
| **Arben Merkoçi** | Catalan Institute of Nanoscience and Nanotechnology, Spain |
| **Amalia Patanè** | The University of Nottingham, United Kingdom |
| **Aleksandra Radenovic** | École Polytechnique Fédérale de Lausanne, Switzerland |
| **Iuliana Radu** | Taiwan Semiconductor Manufacturing Company Limited, Taiwan |
| **Tania Roy** | Duke University, USA |
| **Rodney Ruoff** | Center for Multidimensional Carbon Materials, Institute for Basic Science, Republic of Korea |
| **Paolo Samorì** | University of Strasbourg, France |
| **Deblina Sarkar** | Massachusetts Institute of Technology, USA |
| **Hyeon-Jin Shin** | Gwangju Institute of Science and Technology, Republic of Korea |
| **Emanuel Tutuc** | The University of Texas at Austin, USA |
| **Oleg Yazyev** | École Polytechnique Fédérale de Lausanne, Switzerland |
| **Peide Ye** | Purdue University, USA |
| **Cunjiang Yu** | The Pennsylvania State University, USA |

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## Symposium EL04: Recent Advances in Hybrid Perovskites

Halide perovskites are now a well-established class of functional materials with promising device applications ranging from photovoltaics to LEDs and thermoelectrics. Specifically, in the last 15 years the scientific community has witnessed several breakthroughs in optoelectronics (e.g. near unity internal quantum yield, promising self-healing properties, long-lived charge carriers, etc.) as a direct consequence of a better understanding of the correlation between materials' properties, processing, and device performance. This symposium will focus on both the materials' science and engineering aspects related to the modeling, fabrication, characterization, processing, and stability of halide perovskites. The further advancement of devices relies on developing a detailed understanding of the fundamental physical and chemical processes that occur within these materials. Thus, the symposium welcomes presentations related to the implementation of automated experiments and the use of machine learning toward consistent fabrication of devices and to accelerate the understanding of materials properties/stability, respectively. Further, the realization of advanced characterization methods, including microscopy tools and time-dependent techniques are welcome to this discussion forum as they will enable us quantifying carrier-phonon coupling, ion motion, surface-limited chemical reactions, electrical transient responses, the effects of grain boundaries on device performance, among other phenomena.

## Topics will include:

- Synthesis and processing
- Compositional engineering including Sn-Pb alternatives
- Data science, high-throughput, automated, and autonomous experiments
- Characterization methods
- Degradation processes and stability
- Charge carrier dynamics
- Material passivation strategies
- Excitons, phonons, polarons, and carrier-phonon coupling
- Spectroscopy and non-linear optical behavior
- Interfacial engineering in device applications
- Applications: photovoltaics, LEDs, photodetectors, transistors and thermoelectric devices
- PV module testing and reliability

Joint sessions are being considered with **QT01 - Chirality and Spin in Halide Perovskites**.

## Invited speakers include:

| | |
|---|---|
| **Antonio Abate** | Helmholtz-Zentrum Berlin, Germany |
| **Annalisa Bruno** | Nanyang Technological University, Singapore |
| **Tonio Buonassisi** | Massachusetts Institute of Technology, USA |
| **David Ginger** | University of Washington, USA |
| **Laura Herz** | University of Oxford, United Kingdom |
| **Libai Huang** | Purdue University, USA |
| **Sergei Kalinin** | The University of Tennessee, Knoxville, USA |
| **Hemamala Karunadasa** | Stanford University, USA |
| **Yen-Hung Lin** | The Hong Kong University of Science and Technology, Hong Kong |
| **Monica Lira-Cantu** | Catalan Institute of Nanoscience and Nanotechnology, Spain |
| **Monica Morales-Masis** | University of Twente, Netherlands |
| **Annamaria Petrozza** | Istituto Italiano di Tecnologia, Italy |
| **Li Na Quan** | Virginia Tech, USA |
| **Ted Sargent** | Northwestern University, USA |
| **Chenyi Yi** | Tsinghua University, China |
| **Ni Zhao** | The Chinese University of Hong Kong, Hong Kong |

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## Symposium EL05: Materials and Devices for Neuromorphics, Biohybrid Systems and Smart Sensing

The symposium aims to cover the latest advancements in inorganic and organic materials for bio-inspired information processing, bio-computation, and biosensing, showcasing emerging applications in neuromorphic computing, sensing, actuation, and nanoscale bio-interfacing, along with recent advancements in algorithmic development. To highlight the importance of elements with simultaneous memory and processing capabilities towards in-memory computing, local adaptive bio-interfaces, emphasizing fundamental materials properties, novel devices harnessing physical emergent phenomena, new computing paradigms enabled by unconventional materials, and theory and simulation on materials, devices, and architectures.

## Topics will include:

- Bioinspired information processing
- Neuromorphic computing
- Computational primitives for neuromorphic engineering
- Inorganic and organic materials for neuromorphic devices
- Neuromorphic sensing and actuation
- Adaptive bio-interfacing
- Neural interface devices
- Memristive materials/devices at the interface with biology
- Bioelectronics, smart sensors and actuators
- Neuromorphic and memristive sensors and actuators
- Systems neuroscience
- Algorithmic advances for neuro-inspired computing and smart sensing
- Algorithm-hardware co-design for neuro-inspired computing

## Invited speakers include:

| | |
|---|---|
| **Fabio Biscarini** | Università degli Studi di Modena e Reggio Emilia, Italy |
| **Sandro Carrara** | École Polytechnique Fédérale de Lausanne, Switzerland |
| **Erika Covi** | University of Groningen, Netherlands |
| **Regina Dittmann** | Forschungszentrum Jülich GmbH, Germany |
| **Simone Fabiano** | Linköping University, Sweden |
| **Dimitra Georgiadou** | University of Southampton, United Kingdom |
| **Aristide Gumyusenge** | Massachusetts Institute of Technology, USA |
| **Feng Guo** | Indiana University, USA |
| **Hadi Heidari** | University of Glasgow, United Kingdom |
| **Sahika Inal** | King Abdullah University of Science and Technology, Saudi Arabia |
| **Zeinab Jahed** | University of California, San Diego, USA |
| **Dmitry Kireev** | University of Massachusetts Amherst, USA |
| **Geert Langereis** | imec, Netherlands |
| **Tae-Woo Lee** | Seoul National University, Republic of Korea |
| **George Malliaras** | University of Cambridge, United Kingdom |
| **Dante Gabriel Muratore** | Delft University of Technology, Netherlands |
| **Robert Nawrocki** | Purdue University, USA |
| **Andreas Offenhaeusser** | Forschungszentrum Jülich GmbH, Germany |
| **Themis Prodromakis** | University of Edinburgh, United Kingdom |
| **Shahab Rezaei-Mazinani** | École des Mines de Saint-Étienne, France |
| **Jacob Robinson** | Rice University, USA |
| **Alberto Salleo** | Stanford University, USA |
| **John Paul Strachan** | Forschungszentrum Jülich GmbH, Germany |
| **Alec Talin** | Sandia National Laboratories, USA |
| **Ilia Valov** | Forschungszentrum Jülich GmbH, Germany |
| **Stefano Vassanelli** | University of Padova, Italy |
| **Sihong Wang** | The University of Chicago, USA |
| **Joshua Yang** | University of Southern California, USA |

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## Symposium EL06: 2D Atomic and Molecular Sheets Beyond Graphene—Optical Properties, Optoelectronics and Quantum Optics

The study of two-dimensional (2D) materials is a rapidly evolving and interdisciplinary field, with significant potential to revolutionize various existing and emerging technological areas in the future. This symposium will primarily focus on investigating current and future trends in 2D materials research related to photonics, optoelectronics, and quantum optics research, with a particular emphasis on their potential applications in optoelectronics, advanced light-field control, quantum sensing and information processing, and energy. The symposium will cover various topics, such as novel optical properties in 2D materials, 2D heterostructures and twisted 2-D materials, the scalable fabrication of photonic devices using 2D materials, heterogeneous integration of 2D materials with conventional photonic platforms, 2D energy devices, reconfigurable and intelligent 2D optoelectronic devices, nonlinear optics based on 2D materials, 2D polaritons, and 2D materials based quantum optics for quantum sensing, quantum transduction, and quantum information processing. Experts from multiple fields such as materials science, physics, chemistry, and device engineering will be invited to present their research, facilitating discussions on understanding new optical properties and improving the development of these materials for practical applications.

## Topics will include:

- Heterogeneous integration of 2D materials with conventional photonic platforms
- 2D materials devices for optoelectronics, sensors and energy applications
- Scalable 2-D photonic device fabrication and applications
- Novel optical and optoelectronic properties in 2D materials
- Reconfigurable 2D materials devices for advanced light field control
- 2D material quantum optics and devices
- Quantum light-matter interaction in 2D materials
- 2D optical materials: from far-IR to visible
- Polaritons in 2D materials
- Optoelectronics of twisted 2D material systems
- Nonlinear optics in 2D materials

## Invited speakers include:

| | | | |
|---|---|---|---|
| **Ritesh Agarwal** | University of Pennsylvania, USA | **Frank Koppens** | ICFO–The Institute of Photonic Sciences, Spain |
| **Igor Aharonovich** | University of Technology Sydney, Australia | **Mo Li** | University of Washington, USA |
| **Andrea Alu** | The City College of New York, USA | **Tony Low** | University of Minnesota, USA |
| **Moshe Ben Shalom** | Tel Aviv University, Israel | **Thomas Mueller** | Technischen Universität Wien, Austria |
| **Joshua Caldwell** | Vanderbilt University, USA | **Prineha Narang** | University of California, Los Angeles, USA |
| **Alessandra Di Gaspare** | Consiglio Nazionale delle Ricerche, Italy | **Jiwoong Park** | The University of Chicago, USA |
| **Kin Chung Fong** | Harvard University, USA | **Farhan Rana** | Cornell University, USA |
| **Javier Garcia de Abajo** | ICFO–The Institute of Photonic Sciences, Spain | **James Schuck** | Columbia University, USA |
| **Gabriele Grosso** | The City College of New York, USA | **Zhipei Sun** | Aalto University, Finland |
| **Tony Heinz** | Stanford University, USA | **Haoning Tang** | Harvard University, USA |
| **Alexander High** | The University of Chicago, USA | **Chiara Trovatello** | Columbia University, USA |
| **Shengxi Huang** | Rice University, USA | **Ziliang Ye** | University of British Columbia, Canada |
| **Ali Javey** | University of California, Berkeley, USA | **You Zhou** | University of Maryland, USA |
| **Ido Kaminer** | Technion–Israel Institute of Technology, Israel | | |

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## Symposium EL07: Emerging Material Platforms and Fundamental Approaches for Plasmonics, Nanophotonics, and Metasurfaces

The symposium will explore emerging topics in plasmonics, nanophotonics, metamaterials, and metasurfaces to overcome limitations in practical photonic device development. It aims to provide an overview of recent advancements in design concepts, material platforms, fabrication techniques, and their promising applications. Novel approaches in plasmonics and metasurfaces offer great potential for generating, processing, sensing, and detecting signals at the nanometer scale in diverse fields such as photovoltaics, optical communications, quantum information processing, bioimaging, lighting, sensing, chemistry, and medicine. The recent discovery of new plasmonic materials, layered materials, and two-dimensional materials with desirable properties like low loss, tunable optics, and CMOS compatibility can pave the way for breakthroughs in nanophotonics, optical metamaterials, and their applications. The symposium also focuses on exploring novel nonlinear and quantum phenomena, as well as advanced designs utilizing machine learning strategies and new simulation methods for metasurfaces, metamaterials, and plasmonic materials/devices.

### Topics will include:

- Plasmonics: Fundamental and applications
- Advanced nanophotonics and metamaterials
- Alternative plasmonic materials, epsilon-near-zero materials
- Photonics with 2D Materials; All-dielectric metasurfaces
- Active tunable plasmonics and metasurfaces
- Biological and chemical sensing with plasmonics and nanophotonics
- Topological/Bound state in continuum based on metasurfaces
- Quantum/Nonlinear/Thermal plasmonics and metasurfaces
- Photovoltaic applications and radiation engineering using plasmonics
- Waveguides, devices and systems from plasmonics and nanophotonics
- Plasmonic hot-carriers for photodetection and solar energy harvesting devices
- Ultrafast dynamics of plasmonic nanosystems
- On-demand pulse-shaping with plasmonics and metasurfaces
- Nonreciprocal and non-Hermitian photonic metamaterials and metasurfaces

### Invited speakers include:

| | |
|---|---|
| **Andrea Alù** | The City College of New York, USA |
| **Harry Atwater** | California Institute of Technology, USA |
| **Alexandra Boltasseva** | Purdue University, USA |
| **Svetlana Boriskina** | Massachusetts Institute of Technology, USA |
| **Mark Brongersma** | Stanford University, USA |
| **Federico Capasso** | Harvard University, USA |
| **Kuo-Ping Chen** | National Tsing Hua University, Taiwan |
| **Mu Ku Chen** | City University of Hong Kong, Hong Kong |
| **Dmitri Chigrin** | RWTH Aachen University, Germany |
| **Javier García de Abajo** | ICFO–The Institute of Photonic Sciences, Spain |
| **Jennifer Dionne** | Stanford University, USA |
| **Patrice Genevet** | Colorado School of Mines, USA |
| **Seunghoon Han** | Samsung Advanced Institute of Technology, Republic of Korea |
| **Ortwin Hess** | Trinity College Dublin, The University of Dublin, Ireland |
| **Po-Chun Hsu** | The University of Chicago, USA |
| **Min Seok Jang** | Korea Advanced Institute of Science and Technology, Republic of Korea |
| **Boubacar Kanté** | University of California, Berkeley, USA |
| **Laura Kim** | University of California, Los Angeles, USA |
| **Yuri Kivshar** | The Australian National University, Australia |
| **Marina Leite** | University of California, Davis, USA |
| **Stefan A. Maier** | Monash University, Australia |
| **Xingjie Ni** | The Pennsylvania State University, USA |
| **Junsuk Rho** | Pohang University of Science and Technology, Republic of Korea |
| **Vladimir M. Shalaev** | Purdue University, USA |
| **Maxim Shcherbakov** | University of California, Irvine, USA |
| **Junichi Takahara** | Osaka University, Japan |
| **Jason Valentine** | Vanderbilt University, USA |
| **Pin Chieh Wu** | National Cheng Kung University, Taiwan |
| **Anatoly Zayat** | King's College London, United Kingdom |
| **Yang Zhao** | University of Illinois at Urbana-Champaign, USA |

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## Symposium EL08: Diamond Functional Devices—From Material to Applications

Diamond represents a unique carbon material owing to its superb material properties. It is often considered as a material with great potential in many areas, with power and RF electronics, heat spreaders, sensors, MEMs, room temperature quantum applications, tissue engineering and catalysis in extreme environments among the most promising. Importantly, these properties can be controlled by judicious selection of the conditions under which the materials are formed. Single crystal diamond, thin diamond, nanodiamond films, and nanoscale diamond powders are attractive for a wide range of applications including high frequency, high power electronic devices, quantum computing, nanoelectronics, platforms for chemical and biological sensing, bio labeling/drug delivery, bioelectronics, electrochemistry, and protective and biocompatible coatings, etc. Fluorescent nanodiamond particles are now being extensively studied within the biotechnology and biomedical communities for use as biocompatible fluorescent markers for biological molecules or specific cells and for targeted drug delivery. In this respect, contributions dealing with the conjugation of biomolecules/drugs of nanodiamond particles are solicited this year. The symposium will bring together scientists and engineers working at the forefront of microscale and nanoscale diamond material research. Papers are solicited in all areas of high-performance sp3 carbon material research and applications, taking into account the unique combination of their superlative properties including radiation hardness, thermal conductivity, mechanical, electrical, optical, and biological properties.

## Topics will include:

- Synthesis of diamond with intentional incorporation of defects and dopants
- Fabrication of single crystal diamond membranes with low surface roughness for photonic chip and quantum systems
- Recent advancements in large area homo- and hetero-epitaxial growth of single-crystalline diamond (>2 in)
- Diamond-based hetero-structures in thermionic, photo-induced, and field-emission devices
- Magnetometry and quantitative bio-sensing with color centers in diamond surfaces and particles
- Diamond detectors, field-effect transistors and high-current diodes for semiconductor applications
- Superconductivity in diamond and graphite-diamond hybrids
- Elastic strain band gap engineering in semiconductor diamond
- Biocompatible surface functionalization architectures for diamond in bio-imaging, drug delivery, and quantum sensing
- Nanoscopic diamond powders and films for photocatalytic and electrocatalytic applications
- Boron-doped diamond electrochemical sensors for biomedical and environmental applications
- Fiber-integrated diamond photonic sensors and devices, and luminescent diamond composites

Joint sessions are being considered with **QT04 - Molecular Quantum Systems**.
Also, a **tutorial** complementing this symposium is tentatively planned. Further information will be included in the MRS Program that will be available online in September.

## Invited speakers include:

| | |
|---|---|
| **Daniel Araujo** | Universidad de Cádiz, Spain |
| **Alessandro Bellucci** | Consiglio Nazionale delle Ricerche, Italy |
| **Dominik Bucher** | Technische Universität München, Germany |
| **Takeshi Kondo** | Tokyo University of Science, Japan |
| **Anke Krueger** | Universität Stuttgart, Germany |
| **Karin Larsson** | Uppsala University, Sweden |
| **Elison Matioli** | École Polytechnique Fédérale de Lausanne, USA |
| **Aldona Mzyk** | Technical University of Denmark, Denmark |
| **Naka Nobuko** | Kyoto University, Japan |
| **Christian Osterkamp** | Universität Ulm, Germany |
| **Philipp Reineck** | Royal Melbourne Institute of Technology, Australia |
| **Romana Schirhagl** | Groningen University, Netherlands |
| **Shimaoka Takehiro** | National Institute of Advanced Industrial Science and Technology, Japan |
| **Teraji Tokuyuki** | National Institute for Materials Science, Japan |
| **Moshe Tordjman** | Massachusetts Institute of Technology, USA |
| **Zuzana Vlcková** | Czech Academy of Science, Czech Republic |
| **Jelena Vuckovic** | Stanford University, USA |

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Gdansk University of Technology
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## Symposium EN01: Light-Harvesting Materials for Efficient and Stable Solar Fuels Production

Artificial photosynthesis represents a promising pathway toward sustainable fuel production, which includes reactions such as water splitting, $CO_2$ reduction, and organic oxidations to value-added products. A fundamental understanding of the material properties is needed to provide insights into the factors affecting light absorption, catalysis, or degradation mechanisms, which are key for translating this technology from the laboratory scale to practical systems. Accordingly, this symposium will focus on advances in our understanding of the material properties, interfaces, and surfaces of emerging, established, and prospective semiconductors during photochemical and photoelectrochemical reactions or in comparable environments. As such, submissions are particularly welcome on topics including operando material characterization, material and interface modeling, spectroscopic insights into charge recombination, charge transfer and reaction kinetics, and new approaches to material design and discovery. These considerations are applicable to most light absorber families, therefore focused sessions will be dedicated to traditional (oxide, carbon nitride) photo- and photoelectrocatalysts, as well as to chalcogenides, metal halide perovskites, and polymer materials with good prospects. We also welcome submissions from the wider photovoltaics and optoelectronics fields with an emphasis on materials studied under operation in relatively harsh environments of elevated humidity or under reducing/oxidizing atmospheres. The symposium aims to attract a broad audience of researchers working in solar energy conversion on thin film, quantum dot, and other nanostructured light harvesting materials studied in solution and gas-phase environments, making it a fertile ground for cross-disciplinary exchanges that might inspire new material design and characterization directions in solar fuel synthesis.

## Topics will include:

- Advances in photocatalysis and photoelectrocatalysis
- Understanding and trajectory of oxide materials in solar fuel production
- Carbon nitride and carbonaceous photocatalysts
- Chalcogenides and halide perovskites in photo(electro)catalysis or other aqueous/high humidity/reducing/oxidizing environments
- Other earth-abundant, emerging materials for photocatalysis and photoelectrocatalysis
- *Operando* material characterization
- Spectroscopic insights into charge recombination, charge transfer and reaction kinetics
- Degradation mechanisms and passivation strategies, insights into the semiconductor-electrolyte interface
- Approaches to material design and discovery

A **tutorial** complementing this symposium is tentatively planned. Further information will be included in the MRS Program that will be available online in September.

## Invited speakers include:

| | |
|---|---|
| **Demetra Achilleos** | University College Dublin, Ireland |
| **Joel Ager** | University of California, Berkeley, USA |
| **Fiona Beck** | The Australian National University, Australia |
| **Katharina Brinkert** | University of Warwick, United Kingdom |
| **Sonya Calnan** | Helmholtz-Zentrum Berlin, Germany |
| **James Durrant** | Swansea University, United Kingdom |
| **Sixto Giménez** | Universitat Jaume I, Spain |
| **Ronen Gottesman** | Hebrew University of Jerusalem, Israel |
| **Anna Hankin** | Imperial College London, United Kingdom |
| **Robert Hoye** | University of Oxford, United Kingdom |
| **Ji-Wook Jang** | Ulsan National Institute of Science and Technology, Republic of Korea |
| **Prashant Kamat** | University of Notre Dame, USA |
| **Tianquan Lian** | Emory University, USA |
| **Jingshan Luo** | Nankai University, China |
| **Jonathan Major** | University of Liverpool, United Kingdom |
| **Aditya Mohite** | Rice University, USA |
| **Annamaria Pettrozza** | Istituto Italiano di Tecnologia, Italy |
| **David Tilley** | University of Zurich, Switzerland |
| **Aron Walsh** | Imperial College London, United Kingdom |
| **Yanfa Yan** | The University of Toledo, USA |

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## Symposium EN02: Thin Film Chalcogenides for Energy Applications

This symposium will focus on the theory, materials characterization, and electronic performance for thin film chalcogenide-based photovoltaic (PV) and photoelectrochemical (PEC) devices. Chalcogenide-based thin film solar cells have emerged as a genuine alternative to traditional silicon-based cells and have a wider range of applications such as for tandem, indoor-photovoltaics or building integrated PV. The symposium will comprise well-established industrial technologies CIGS and CdTe, along with emerging or high-potential materials such as, but not limited to, CZTS, $Sb_2(S,Se)_3$, SnS, $Bi_2S_3$, $MoSe_2$, $AgBiS_2$, $Cu_2ZnSnS_4$, $Cu_2BaSnS_4$, ketserite inspired compounds and chalcohlaide materials. We will also explore the overlaps where similar thin film chalcogenides are used as the basis for PEC devices for water splitting or $CO_2$ reduction, a promising approach to mitigate greenhouse gas emissions and produce valuable chemical feedstocks. By considering both applications in the same symposium this will allow valuable discussions about what the two technologies can learn from each other, by identifying common approaches and limitations. The symposium will cover techniques for optimizing material properties and device structures, improving light absorption and charge transport, as well as approaches to mitigate degradation and to identify limiting defect mechanisms.

### Topics will include:

- Chalcogenides
- Solar Cells
- Photocatalysis
- Thin Films
- Semiconductors

Joint sessions are being considered with **NM03 - Engineering Ultra-Thin Chalcogenide Films**.

### Invited speakers include:

| | |
|---|---|
| **Julian Bachman** | Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany |
| **Robert Hoye** | University of Oxford, United Kingdom |
| **Oliver Hutter** | Northumbria University, United Kingdom |
| **Rafael Jaramillo** | Massachusetts Institute of Technology, USA |
| **Keith McKenna** | University of York, United Kingdom |
| **Qingbo Meng** | Institute of Physics, Chinese Academy of Sciences, China |
| **David Mitzi** | Duke University, USA |
| **Ilona Oja Acik** | TalTech, Estonia |
| **Alejandro Pérez-Rodríguez** | Institut de Recerca en Energia de Catalunya, Spain |
| **Matt Reese** | National Renewable Energy Laboratory, USA |
| **Alessandro Romeo** | Università degli Studi di Verona, Italy |
| **Sascha Sadewasser** | International Iberian Nanotechnology Laboratory, Portugal |
| **David Scanlon** | University of Birmingham, United Kingdom |
| **Byungha Shin** | Korea Advanced Institute of Science and Technology, Republic of Korea |
| **David Tilley** | University of Zurich, Switzerland |
| **Hao Xin** | Nanjing University of Posts and Telecommunications, China |
| **Gang Xiong** | First Solar, USA |
| **Feng Yan** | Arizona State University, USA |
| **Yanfa Yan** | The University of Toledo, USA |
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## Symposium EN03: Emergent Properties in Actinide Materials—Enabling Next-Generation Nuclear Energy Applications

Actinide materials exhibit an unusually large range of unique physical and chemical properties that include electronic, transport, and magnetic properties. The unique characteristics of actinides stem, in part, from the complexities of their *5f* electronic structure, and have opened avenues for the application of actinide materials in many diverse fields ranging from space exploration, neutron detectors, and medical diagnostics. The most prominent application of actinides, however, is in nuclear energy since actinides form the backbone of current and emerging nuclear fission technologies for energy production. With a global concerted effort of achieving net-zero carbon emissions by 2050, advanced nuclear energy technologies are expected to play a vital role in the worldwide energy economy. The success of implementing next-generation nuclear energy technologies relies on key breakthroughs and fundamental discoveries in the physical and chemical behavior of actinide materials. This symposium will focus on the physics, chemistry, and materials science of actinide materials that can enable innovative nuclear energy technologies. Particular emphasis will be laid on novel experimental and modeling approaches that uncover new phenomena at rapid times scales and small length scales, 5f magnetic and electronic behaviors, chemical segregation and radiation damage, and property evolution under extreme temperature, pressure, and radiation extremes.

## Topics will include:

- Advanced first-principles modeling and simulation approaches that address many-body effects in actinides
- Novel synthesis methods of actinide materials
- Emergent behaviors of 5f-electron systems at low temperatures and high magnetic fields.
- Large-scale experiments that utilize state-of-the-art photon or X-ray sources for advanced material characterizations
- Defect evolution and chemical segregation in nuclear materials using ultrahigh-resolution microscopy
- Thermal, magnetic, optical, and electronic properties of actinides with potential for advanced nuclear fuel properties

## Invited speakers include:

| | |
|---|---|
| **Assel Aitkaliyeva** | University of Florida, USA |
| **Lucia Amidani** | European Synchrotron Radiation Facility, France |
| **Nicholas Butch** | National Institute of Standards and Technology, USA |
| **Lionel Desgranges** | Commissariat à l'énergie atomique et aux énergies alternatives, France |
| **Daniel Gregg** | Australian Nuclear Science and Technology Organisation, Australia |
| **Jean-Christophe Griveau** | European Commission, Germany |
| **Yoshinori Haga** | Japan Atomic Energy Agency, Japan |
| **Mingda Li** | Massachusetts Institute of Technology, USA |
| **J. Matthew Mann** | Air Force Research Laboratory, USA |
| **Binod Rai** | Savannah River National Laboratory, USA |
| **James Tobin** | University of Wisconsin–Oshkosh, USA |
| **Floriana Tuna** | University of Manchester, United Kingdom |
| **Kevin Vallejo** | Idaho National Laboratory, USA |
| **Tonya Vitova** | Karlsruhe Institute of Technology, Germany |
| **Yanwen Zhang** | Idaho National Laboratory, USA |

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## Symposium EN04: Phase Change Materials for Energy Conversion and Storage

Phase transition in materials can be induced with external stimuli such as heat, light, pressure, and electric and magnetic fields. Phase Change materials (PCMs) therefore have applications in a wide range from sensors to information and energy storage and conversion. This symposium aims to bring different aspects and the multidisciplinary nature of PCM design and applications from theory to experiment together. Both solid-liquid and solid-solid transitions are of interest. PCMs are known for their capability of absorbing and releasing a large amount of thermal energy during phase transitions which have been utilized for thermal storage and heat management in buildings, batteries, and energy conversion technologies such as solar thermal, geothermal, ocean thermal, thermoelectric, and magnetocaloric. They are widely used to minimize energy consumption (e.g., to stabilize the indoor temperature within buildings) or facilitate thermal transport (e.g., micro-encapsulated PCM slurry for enhanced convective cooling). In the context of electrochemical energy storage and conversion devices, a stable temperature range is essential to maximize the capacity and lifespan of the materials in the devices. For example, lithium-ion batteries run at an optimum operating temperature range of 20-50 °C. PCMs with a phase change temperature at this temperature range, such as paraffins, hydrates, and composite materials have been tested and exhibited better heat management compared with forced air convection or conventional coolant. In the context of thermoelectrics, several known phase change materials have shown excellent thermoelectric properties. GeTe is an example of this category where the metavalent nature of the bonds is proposed to be related to both the phase change and the excellent thermoelectric properties. Thermally-induced phase change in FeRh is shown to result in large changes in the Seebeck coefficient and hence an extremely large Thomson coefficient is reported in this material which can be used for the design of Thomson coolers and power generators.

In this symposium, attention will be given to fundamental physics, material design, and the applications of PCMs in energy-related fields, which can help to reduce $CO_2$ emissions in the long term. This symposium further extends the topics to cover the latest research on novel thermophysical properties of PCM and advanced thermal characterization tools.

### Topics will include:

- Phase change materials for thermal energy storage
- Phase change materials for solar thermal energy conversion
- Phase change materials in conjunction with thermal to electrical energy conversion, hybrid device design
- Phase change materials as good thermoelectrics both in having a large thermoelectric and thermomagnetic figure of merit and or in exhibiting a large Thomson coefficient.
- Single crystal to single crystal phase transition: properties, applications, and structure change studies
- Single crystal to amorphous phase transition: properties, applications, and structure change studies
- Ferroelectric Phase Transition enabling pyroelectric modules
- Advanced thermal and material characterization tools to study the phase transition

Joint sessions are being considered with **EL02 - Phase-Change Materials for Brain-like Computing, Embedded Memory and Photonic Applications**.

### Invited speakers include:

| | |
|---|---|
| **Seunghyun Baik** | Sungkyunkwan University, Republic of Korea |
| **Keivan Esfarjani** | University of Virginia, USA |
| **Patrick Hopkins** | University of Virginia, USA |
| **Seung Hwan Ko** | Seoul National University, Republic of Korea |
| **Sang-Kwon Lee** | Chung-Ang University, Republic of Korea |
| **Peiwen Li** | University of Arizona, USA |
| **Y. Shirley Meng** | The University of Chicago, USA |
| **Takao Mori** | National Institute for Materials Science, Japan |
| **Rahul Rao** | Air Force Research Laboratory, USA |
| **Sheng Shen** | Carnegie Mellon University, USA |
| **Robert Simpson** | University of Birmingham, United Kingdom |
| **Kenichi Uchida** | National Institute for Materials Science, Japan |
| **Haiyan Wang** | Perdue University, USA |
| **Robert Wang** | Arizona State University, USA |
| **Mary Anne White** | Dalhousie University, Canada |
| **Junqiao Wu** | University of California, Berkeley, USA |
| **Matthias Wuttig** | Rheinisch-Westfälische Technische Hochschule Aachen, Germany |
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*Reminder: In fairness to all potential authors, late abstracts will not be accepted.*

## Symposium EN05: Electrodes for Chemical and Energy Conversion Technologies

This symposium focuses on the design, synthesis, and characterization of electrode materials for chemical and energy conversion technologies and aims to bring together researchers from the field of materials chemistry, electrochemistry, electrochemical synthesis, and electrocatalysis. In this symposium, we will discuss state-of-the-art electrode materials for chemical and energy conversion technologies with a focus on understanding the electron transfer reaction/mechanism at the electrode/electrolyte interface, focusing on how the choice of the electrode material impacts activity, selectivity, and operational stability. We will further discuss state-of-the-art characterization techniques to study the chemical composition of electrode materials during operation (*operando* and *in situ* measurements) as well as cover recent findings from computational studies addressing fundamental and applied questions of chemical and energy conversion technologies. Submissions of abstracts covering the design, synthesis, and characterization of novel electrode materials are encouraged!

## Topics will include:

- Materials chemistry for developing efficient electrodes for chemical and energy conversion technologies
- Next-generation electrode materials for chemical and energy conversion technologies
- Computational chemistry for designing efficient electrodes
- Efficient electrode materials for electrochemical synthesis
- *Operando* characterization of redox-active materials
- Investigation of the electron transfer mechanism for chemical and energy conversion technologies

## Invited speakers include:

| | |
|---|---|
| **Sneha Akhade** | Lawrence Livermore National Laboratory, USA |
| **Teresa Andreu** | Universitat de Barcelona, Spain |
| **Michael Busch** | Luleå University of Technology, Sweden |
| **Egon Campos dos Santos** | Universidade de São Paulo, Brazil |
| **Tej Choksi** | Nanyang Technological University, Singapore |
| **William Chueh** | Stanford University, USA |
| **Tomas Edvinsson** | Uppsala University, Sweden |
| **Sergey Koroidov** | Stockholm University, Sweden |
| **Antoni Llobet** | Institute of Chemical Research of Catalonia, Spain |
| **Mathilde Luneau** | Chalmers University of Technology, Sweden |
| **Daniel Martin Yerga** | University of Jyväskylä, Finland |
| **Tyler Mefford** | University of California, Santa Barbara, USA |
| **Miguel Modestino** | New York University, USA |
| **Joseph Montoya** | Toyota Research Institute, USA |
| **Erin Ratcliff** | Georgia Institute of Technology, USA |
| **Jan Rossmeisl** | Copenhagen University, Denmark |
| **Paula Sebastian Pascual** | KTH Royal Institute of Technology, Sweden |
| **Yang Shao-Horn** | Massachusetts Institute of Technology, USA |
| **Magda Titirici** | Imperial College London, United Kingdom |
| **Francesca Maria Toma** | Helmholtz Center Hereon, Germany |
| **Siegfried Waldvogel** | Johannes Gutenberg-Universität Mainz, Germany |
| **Anna Wuttig** | The University of Chicago, USA |

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## Symposium EN06: Redox Flow-Based Electrochemical Systems

Redox flow batteries are considered a highly promising approach to stationary energy storage that addresses the intermittency challenge of renewable energies. Although significant progress has been achieved, materials development is a common challenge that has hampered the widespread commercial implementation of this technology. In particular, fundamental understanding of the electrochemical processes and mechanisms by which these systems operate is limited, including experimental and computational approaches for elucidating solvation structures, electrolyte/electrode interfaces, new membranes and electrodes, failure/degradation pathways, and transport properties. This knowledge is critically important to achieve technical breakthroughs that will enable the ubiquitous implementation of these technologies. Moreover, high-level developmental needs have been identified for system-level optimizations of the state-of-the-arts, such as stack prototype, flow field, safety diagnostics, cost analysis, and field analytics. Recently, the redox flow concept has been extended to other fields including solar flow, redox targeting, desalination, carbon capture, flow synthesis, etc. These new applications have opened promising new avenues that have the potential to solve the challenges of these fields. This symposium will encourage the discussion of new concepts and challenges at the cutting-edge of fundamental and applied studies of materials and systems for redox flow-based electrochemical devices. It will also bring together a diverse, international mix of leading researchers and emerging talents to promote further synergy across these fields.

## Topics will include:

- Advanced electrolytes and solvation chemistry for flow batteries
- Inorganic, organic, polymeric and suspension redox materials
- Ion exchange membranes and porous separators
- Electrodes and electro-catalysts
- Failure/degradation mechanisms
- Transport of heat, mass, and charge
- Computational modeling
- Flow field design and stack prototyping
- Solar flow batteries
- Redox targeting flow batteries
- Redox flow electrolysis
- Redox flow desalination
- Redox flow $CO_2$ capture
- Flow synthesis

## Invited speakers include:

| | |
|---|---|
| **Ertan Agar** | University of Massachusetts Lowell, USA |
| **Michael Aziz** | Harvard University, USA |
| **Qing Chen** | The Hong Kong University of Science and Technology, Hong Kong |
| **Dafei Feng** | University of Wisconsin–Madison, USA |
| **Imre Gyuk** | U.S. Department of Energy, USA |
| **Yunlong Ji** | University of the Chinese Academy of Sciences, China |
| **Song Jin** | University of Wisconsin–Madison, USA |
| **David Kwabi** | University of Michigan, USA |
| **Xianfeng Li** | Dalian Institute of Chemical Physics, Chinese Academy of Sciences, China |
| **Zhenxing Liang** | South China University of Technology, China |
| **Tianbiao Liu** | Utah State University, USA |
| **Ellen Matson** | University of Rochester, USA |
| **Matthew Mench** | The University of Tennessee, Knoxville, USA |
| **Shelley Minteer** | The University of Utah, USA |
| **Trung Nguyen** | The University of Kansas, USA |
| **Pekka Peljo** | University of Turku, Finland |
| **Joaquín Rodríguez-López** | University of Illinois at Urbana-Champaign, USA |
| **Ulrich Schubert** | Friedrich-Schiller-Universität Jena, Germany |
| **Katheryn Toghill** | Lancaster University, United Kingdom |
| **David Waite** | University of New South Wales, Australia |
| **Qing Wang** | National University of Singapore, Singapore |
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| **Tongwen Xu** | University of Science and Technology of China, China |
| **Zhengjin Yang** | University of Science and Technology of China, China |
| **Guihua Yu** | The University of Texas at Austin, USA |
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## Symposium EN07: Multijunction Devices for Solar Energy Conversion -

Photovoltaics (PV) is currently at an exciting point in its trajectory. Having recently passed 1 TW of installed capacity world-wide, PV is delivering on its promise to supply the globe with clean energy. However, to meet the growing electricity demand that is required to decarbonize multiple sectors, the growth rate must continue to increase for several more decades. Tandem or multijunction solar cells offer the clearest path to high efficiency and high areal energy density photovoltaic energy conversion, with a great deal of recent effort focused on metal halide perovskite materials. Theoretically and at the laboratory scale, increasing the number of junctions is a simple way to create a record-setting device. Tandem devices can be made using sub-cells out of the same material system with tunable bandgaps (e.g all III-V or all-perovskite tandems) or by combining different material systems into “hybrid tandem” devices (e.g. perovskite/Si tandems). There are multiple approaches to interconnecting the sub-cells in a tandem stack that have different trade-offs in terms of efficiency, cost, and manufacturability. There are also other energy conversion applications, such as the photoelectrochemical production of chemical fuels through the reduction of water or $CO_2$, or thermophotovoltaic devices that can convert heat to electricity.

To continue advances in tandem and multijunction devices, sustained material research in key and emerging areas along the value chain is vital, including: (i) high efficiency device concepts and architectures for multi-junction solar cells; (ii) development of transparent, carrier-selective contact layers and interfaces; (iii) modeling the performance and energy yield of tandem devices; (iv) advances in packaging and outdoor performance of multijunction devices, and (v) unique reliability challenges of tandem devices, particularly those containing metal halide perovskites. The proposed *Multijunction devices for solar energy conversion* symposium focuses on these topics but more generally seeks to encompass any materials research with the potential to advance multijunction devices for energy conversion.

## Topics will include:

- Demonstrations of multijunction solar cells and modules
- Novel architectures for tandem/multijunction devices
- Development of new absorber materials (including metal halide perovskites)
- Materials and interfaces for multijunction devices (e.g. passivation layers, transparent conductive oxides)
- Manufacturing considerations for tandem devices
- Novel application for tandem devices (e.g. thermophotovoltaics, photoelectrochemistry using tandem photoelectrodes)
- Modeling approaches for tandem performance (e.g. energy yield modeling)
- Advances in packaging and outdoor performance of tandem/multijunction devices

Joint sessions are being considered with **EL04 - Recent Advances in Hybrid Perovskites**, **EN01 - Light-Harvesting Materials for Efficient and Stable Solar Fuels Production**, and **EN02 - Thin Film Chalcogenides for Energy Applications**.

## Invited speakers include:

| | |
|---|---|
| **Steve Albrecht** | Helmholtz-Zentrum Berlin, Germany |
| **Henk Bolink** | Universitat de València, Spain |
| **Gianlucca Coletti** | TNO, Netherlands |
| **Adriene Creatore** | Technische Universiteit Eindhoven, Netherlands |
| **Stefaan De Wolf** | King Abdullah University of Science and Technology, Saudi Arabia |
| **Marika Edoff** | Uppsala University, Sweden |
| **Giles Eperon** | Swift Solar Inc., USA |
| **Pilar Espinet Gonzales** | The Aerospace Corporation, USA |
| **Tyler Grassmann** | The Ohio State University, USA |
| **Zachary Holman** | Beyond Silicon, USA |
| **Bill McMahon** | National Renewable Energy Laboratory, USA |
| **Laura Miranda** | OxfordPV, Germany |
| **Nakita Noel** | University of Oxford, United Kingdom |
| **Ulrich Paetzold** | Karlsruhe Institute of Technology, Germany |
| **Erin Sanehira** | CubicPV, USA |
| **Vera Steinman** | First Solar, USA |
| **Eva Unger** | Helmholtz Zentrum Berlin, Germany |
| **Menglei Xu** | JinkoSolar, China |
| **Xiaodan Zhang** | Nankai University, China |
| **Kai Zhu** | National Renewable Energy Laboratory, USA |

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## Symposium EN08: Materials Design and Discovery for Next-Generation Energy Storage Systems

This symposium will cover material design and discovery for next-generation energy storage systems. Two major parts will be included: 1) novel synthesis and advanced characterization of energy materials and 2) artificial intelligence (AI) / machine learning (ML) assisted discovery of new materials and mechanism study.

The first part highlights efforts to develop new solid-state materials for next generation battery chemistries and their advanced characterizations related . New superionic materials are critical to enabling stable cycling and safe operation of future high-energy-density electrode materials. Furthermore, developing beyond lithium-ion chemistries based on Na, Zn, K, or Al and other working ions requires developing new electrolyte and electrode materials. Symposium contributions should address the fundamental science and technology for materials design and applications and discuss X-ray, electron- and neutron characterization techniques and approaches for electrochemical energy storage applications.

The second part covers the discovery of novel materials via AI/ML and simulation of interfaces and mechanisms that can aid the adoption of next generation energy storage systems. The ambitious goal of decarbonizing our economy relies on the improvement of renewable energy technology, which require the design, discovery and synthesis of new and sustainable materials. AI and ML provide new approaches for accelerating the availability of new energy storage materials, which enables predictive models from existing material data and establish a new understanding of material behavior, ultimately leading to the development of more cost-effective and high-performance energy storage systems. This symposium will provide state-of-the-art modeling, simulation methods, and complex algorithms that have been developed for energy storage materials. The discussion on interface mechanisms study by AI/ML, the phase diagram for new materials, prediction of their properties and synthesizability, and potential applications will also be extensively included. Abstracts will be solicited in the following areas: design and synthesis of superionic conductors, advanced characterizations on structure/interfaces, new materials beyond lithium battery chemistries, AI/ML applications on mechanism study, and new materials discovery for next-generation energy storage systems.

## Topics will include:

- Novel superionic conductors for Na, K, Zn etc.
- New design of solid electrolytes and their interfaces with electrodes.
- Interfacial characterization to understand the charge transfer.
- Characterizing fast conducting battery materials and interfaces that are challenging for conventional techniques.
- AI/ML-guided energy storage materials design and characterization.
- Advanced simulations of electrochemical interfaces.

Joint sessions are being considered with **CH01 - *In Situ* Characterization During Thin-Film Processing**.

## Invited speakers include:

| | |
|---|---|
| **Wurigumula Bao** | The University of Chicago, USA |
| **Anja Bielefeld** | Justus-Liebig-Universität Giessen, Germany |
| **Mei Cai** | General Motors, USA |
| **Rachel Carter** | U.S. Naval Research Laboratory, USA |
| **Miaofang Chi** | Oak Ridge National Laboratory, USA |
| **Olivier Delaire** | Duke University, USA |
| **Betar Gallant** | Massachusetts Institute of Technology, USA |
| **Rafael Gomez-Bombarelli** | Massachusetts Institute of Technology, USA |
| **Akitoshi Hayashi** | Osaka Prefecture University, Japan |
| **Subramanya Herle** | Applied Materials, USA |
| **Maria K. Chan** | Argonne National Laboratory, USA |
| **Chen Ling** | Toyota Research Institute of North America, USA |
| **Lauren Marbella** | Columbia University, USA |
| **Christian Masquelier** | Université de Picardie Jules Verne, France |
| **Peter Nellist** | University of Oxford, United Kingdom |
| **Shyue Ping Ong** | University of California, San Diego, USA |
| **Tod Pascal** | University of California, San Diego, USA |

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## Symposium EN09: Innovations in Materials and Processes for Printed, Flexible and Stretchable Energy-autonomous Sensing Systems

Our current society demands an urgent increase in the efficiency and the sustainability of all processes that surround us, from industries to agriculture and even how we track our health. To optimize and improve those processes, we need to collect as much data as possible, developing and adopting new versatile and ubiquitous sensing systems. Often, we also need coupled actuators triggered by the sensed signals. Concepts like the Internet of Things (IoT), and wearable or plant electronics capitalize on these needs and provide new sensing/actuating technologies with unconventional form factors, such as large-area, mechanical flexibility and/or stretchability, and environmentally friendliness. Nevertheless, such sensors/actuators and the associated electronics that drive and read them require energy. However, plugging them into the grid or to conventional bulky power sources is in most cases not feasible either because the systems are highly distributed or because they need to remain soft and flexible to adapt to curved surfaces or to be worn comfortably. This has triggered the need for suitable energy harvesters and storage systems with compatible form factors. The efficient production of such sensing and actuating systems requires sustainable and low-cost materials, both inorganic and organic/polymeric; as well as techniques to process them, for which solution processing and 2D/3D printing are the most appealing avenues. In this symposium, we provide a venue for discussion of both fundamental and applied research progress in this broad field.

## Topics will include:

- Ultra-low power or energy-autonomous flexible, stretchable, and printable sensors and actuators for the body, plants, and other curved surfaces with compatible read-out electronics.
- Flexible, stretchable, and printable energy harvesters such as photovoltaics, thermoelectric, triboelectric, piezoelectric, etc. for the body, plants, and other curved surfaces.
- Flexible, stretchable, and printable energy storage solutions including (super)capacitors, batteries, fuel cells, etc.
- 3D-printed functional materials and devices for energy-efficient sensing, actuating or energy harvesting/storage.
- Flexible, stretchable, and printable autonomous sensing/actuating architectures for wearables and the IoT, including flexible low-power electronics, antennas, etc.
- Large-area sensing and actuating systems, energy harvesters and energy storage solutions for autonomous smart textiles, e-skin and robotic skin.
- Advanced manufacturing techniques for large-area, flexible, stretchable, and printed sensors/actuators, such as 3D printing, roll-to-roll fabrication, etc.

Joint sessions are being considered with **SB10 - Soft Materials for Sensors and Actuators in e-textiles and e-skins**.

## Invited speakers include:

| | |
|---|---|
| **Levent Beker** | Koc University, Turkey |
| **Paul R. Berger** | The Ohio State University, USA |
| **Francesca Brunetti** | Università degli Studi di Roma Tor Vergata, Italy |
| **Mario Caironi** | Istituto Italiano di Tecnologia, Italy |
| **Ravinder Dahiya** | Northeastern University, USA |
| **Simone Fabiano** | Linköping University, Sweden |
| **Kenjiro Fukuda** | RIKEN, Japan |
| **Martin Kaltenbrunner** | Johannes Kepler Universität Linz, Austria |
| **Ying-Chih Lai** | National Chung Hsing University, Taiwan |
| **Pooi See Lee** | Nanyang Technological University, Singapore |
| **Antonietta Loi** | University of Groningen, Netherlands |
| **Tse Nga (Tina) Ng** | University of California, San Diego, USA |
| **Thuc-Quyen Nguyen** | University of California, Santa Barbara, USA |
| **Almudena Rivadeneyra** | Universidad de Granada, Spain |
| **John Rogers** | Northwestern University, USA |
| **Francesca Santoro** | Rheinisch-Westfälische Technische Hochschule Aachen, Germany |
| **Ravi Silva** | University of Surrey, England |
| **Jae Sung Son** | Pohang University of Science and Technology, Republic of Korea |
| **Eleni Stavrinidou** | Linkoping University, Sweden |
| **Benjamin C. K. Tee** | National University of Singapore, Singapore |
| **Andres Vasquez Quintero** | Azalea Vision, Belgium |
| **Naveen Verma** | Princeton University, USA |

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## Symposium EN10: Critical Materials for Energy—Extraction, Functionality and Recycling

The goal of this symposium is to provide an interactive forum for scientists from various fields who work towards novel and more efficient extraction and utilization of critical materials and minerals to enable sustainable energy technologies. Critical materials and minerals, including rare-earth elements (REE), platinum group elements (PGE), and lithium/cobalt/nickel that possess unique electronic, magnetic, catalytic, transport, and luminescent properties, are key components of many clean energy and high-tech applications that enable wind turbines, solar panels, electric vehicles, and energy-efficient lighting and transportation for accelerating decarbonization economy and realizing Net-Zero-World ecosystem. However, uneven resource distribution and limited as well as vulnerable supply chains of critical materials pose an immense risk to the development and deployment of clean energy technologies both domestically and globally. Therefore, a sustained, multidisciplinary effort by integrating scientific research and engineering innovation to develop diverse solutions across the materials lifecycle, including mineral processing, materials manufacturing, elemental substitution, efficient use, and end-of-life recycling is timely and highly needed. To address the pressing opportunities and challenges, we envision this symposium to highlight most recent trends in fundamental and applied research on enhancing functional behavior and discovery of new properties of REE/PGE-based materials, mining, harnessing, substituting, and recycling critical materials in a wide range of energy and information technology applications. This symposium will bridge expertise on theoretical materials design, materials synthesis, functional measurement/control, advanced characterization, high-throughput computations and machine-learning/artificial intelligence methods. Particular attention will be paid to advancing our understanding of how critical elements impart materials and molecules the unique properties that are valuable for clean energy and climate solution technologies; predictive design of atom-efficient critical materials for energy and electronic applications; identifying new sources or facilitating reuse and recycling of existing critical materials, and reducing and eliminating the need for critical elements.

## Topics will include:

- Extraction and separation of critical elements from natural sources
- Recycling of critical elements from man-made materials and components
- Approaches to energy-efficient and atom-efficient circular economy
- Life cycle analysis and assessment strategies on critical materials for environmental sustainability and socio-economic viability
- Enhanced functional behavior of rare-earth element (REE) and platinum-group element (PGE)-enabled materials in energy technologies
- Progress and challenges with substituting REE/PGE with more abundant elements
- Predictive design of functional materials based on the critical materials
- Methodological advances in synthesis, characterization, theory, high-throughput computations, and data-science approaches
- *In situ* visualization and manipulation of critical elements at heterogeneous interfaces

A **tutorial** complementing this symposium is tentatively planned. Further information will be included in the MRS Program that will be available online in September.

## Invited speakers include:

| | |
|---|---|
| **Rebecca Abergel** | University of California, Berkeley, USA |
| **Laura Calvillo** | Università degli Studi di Padova, Italy |
| **Joseph Cotruvo** | The Pennsylvania State University, USA |
| **Beatriz Roldan Cuenya** | Fritz Haber Institute of the Max Planck Society, Germany |
| **Zdenek Dohnalek** | Pacific Northwest National Laboratory, USA |
| **Yingge Du** | Pacific Northwest National Laboratory, USA |
| **Livia Giordano** | Università degli Studi di Milano-Bicocca, Italy |
| **Graeme Henkelman** | The University of Texas at Austin, USA |
| **Hideo Hosono** | Tokyo Institue of Technology, Japan |
| **Santa Jansone-Popova** | Oak Ridge National Laboratory, USA |
| **Sven Jantzen** | Umicore, Germany |
| **Emma Kendrick** | University of Birmingham, United Kingdom |
| **Masaaki Kitano** | Tokyo Institue of Technology, Japan |
| **Laura Lewis** | Northeastern University, USA |
| **Jessica Durham Macholz** | Argonne National Laboratory, USA |
| **Judson Marte** | MP Materials, USA |
| **Jeremy Mehta** | Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy, USA |
| **George Schatz** | Northwestern University, USA |
| **Rachel Segalman** | University of California, Santa Barbara, USA |
| **Marlies Van Bael** | Hasselt University, Belgium |
| **Anna Vanderbruggen** | Helmholtz-Zentrum Dresden-Rossendorf, Germany |
| **Yan Wang** | Worcester Polytechnic Institute, USA |
| **Chao Yan** | Princeton NuEnergy, USA |
| **David Yancey** | Dow Chemical Company, USA |

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## Symposium EN11: Nitrogen-doped Carbon—From Fundamental Understanding to Applications in Electrochemical Devices

Nitrogen doping in conductive nanostructures like graphene, carbon nanotubes, and mesoporous carbon has spurred a wide array of research topics, primarily due to the improved electrochemical properties imparted by this doping. The advent of single atom catalysts (SACs) has further highlighted N-doped graphene as an ideal substrate, given its remarkable catalytic activity in electrochemical processes. This encompasses a deep dive into the underlying science of diverse electrochemical processes and reaction mechanisms, understanding the roles played by different nitrogen species within the carbon matrix, and the methodologies to enrich these structures with specific nitrogen species. Such foundational knowledge is increasingly being applied in areas addressing global challenges like environmental remediation through advanced oxidation processes, supercapacitors or zinc-air battery cathodes for energy storage solutions, and fuel cell electrodes in alternative energy conversion devices. These applications necessitate a close association with advanced characterization techniques and theoretical modeling to fully understand the physicochemical attributes of N-doped graphitic structures.

This symposium will serve as an interactive platform for scientists from various disciplines to further our collective understanding of N-doped graphitic nanostructures. The focus is on assembling these materials into functional entities with enhanced electrocatalytic properties, positioning them as viable, Earth-abundant alternatives to precious metal electrocatalysts in various electrochemical processes. It will cover a broad spectrum of topics: from the basic understanding of electrochemical processes and mechanisms to the synthesis and post-treatment of N-doped materials, their assembly into macroscopic functional forms, and the exploration of emerging applications at both atomic and device scales. Emphasis will also be on advanced characterization techniques, first-principles calculations, theoretical modeling, and the role of SACs in this exciting field. Contributions that shed light on the latest concepts and applications of these materials are highly encouraged.

## Topics will include:

- Novel experimental synthesis methods or post-treatments to achieve N-doping with selectivity of the N species present.
- Advanced characterization methods for evaluating the structure of N-doped materials.
- *In situ* and *operando* methods for elucidating to formation or degradation of active species.
- Advanced electrochemical microscopy and related techniques for in depth evaluation of the electrochemical activity of the N-doped Carbon materials.
- Dynamic modeling of active nitrogen species or understanding the interactions between the single atoms and their support.
- Electrochemical reactions mechanism elucidation and selectivity (*e.g.* ORR, HER, OER, $CO_2$RR) on N-doped graphtic nanostructures.
- Assembly methods and novel 3D or 2D assembled architectures of N-doped Graphitic nanostructures into macroscopic materials.
- N-doped materials for energy storage (*e.g.* supercapacitors or zinc-air battery cathodes) or conversion (*e.g.* fuel cells) applications.
- N-doped graphitic materials as electrocatalysts for the generation of environmentally friendly fuels.
- Water quality improvement aided by *on-site* $H_2O_2$ generation through ORR with N-doped graphitic materials.
- Recent concepts and emerging applications with N-doped graphitic materials at the atomic scale and device level.

## Invited speakers include:

| | |
|---|---|
| **Paola Ayala** | Universität Wien, Austria |
| **Gabriela Borin** | Empa–Swiss Federal Laboratories for Materials Science and Technology, Switzerland |
| **Paula Colavita** | Trinity College Dublin, The University of Dublin, Ireland |
| **Lior Elbaz** | Bar-Ilan University, Israel |
| **Jingsong Huang** | Oak Ridge National Laboratory, USA |
| **Frederic Jaouen** | Institut Charles Gerhardt, France |
| **Ulrike Kramm** | Technische Universität Darmstadt, Germany |
| **Deborah Myers** | Argonne National Laboratory, USA |
| **Teresita Oropeza** | Instituto Tecnológico de Tijuana Calzada Del, Mexico |
| **Francisco Ruiz-Zepeda** | National Institute of Chemistry, Slovenia |
| **Mauricio Terrones** | The Pennsylvania State University, USA |
| **Haotian Wang** | Rice University, USA |

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## Symposium EN12: Scientific Basis for Nuclear Waste Management

Nuclear waste management is a complex and multidisciplinary field that requires scientific expertise, technological advancements, regulatory frameworks, and public involvement. Ongoing research and development efforts aim to enhance understanding of waste management practices, improve and advance novel waste treatment technologies, and explore advanced disposal options to address long-term safety concerns and minimize environmental impacts.

This MRS symposium, first held in 1978, is the premier international meeting to address the fundamental and applied science of materials in the context of the safe and effective management of nuclear wastes. The special topics of interest include material development and characterization, processing, and practical aspects of their deployment. Other topics will address: 1) design, formulation, fabrication, and durability testing of waste forms; 2) effect of disposal conditions and radiation on properties of waste forms; 3) melt processing in joule-heated ceramic melters and cold crucibles, hot isostatic pressing, cementation, and steam reforming; 4) disposal concepts, designs, and materials including container corrosion; 5) engineered barrier systems; 6) radionuclide solubility, speciation, sorption, and migration; 7) methods and techniques, including the development of analytical methods for nuclear forensics advancement; and 8) recent developments and novel techniques in solid and liquid characterization, sensing and monitoring of radionuclides, and modeling tools.

## Topics will include:

- Waste forms
- Development and scale up of waste processing technologies
- Behavior of spent nuclear fuel materials in different disposal environments
- Geological disposal of radioactive wastes
- Off-gas management for reprocessing, vitrification, and molten salt reactors
- Strategies, processes and materials for the disposition of plutonium and fissile materials from civil and defense stockpiles
- International research and waste management programs
- Development and enhancement of safeguards concepts
- Cross-cutting topics

## Invited speakers include:

| | |
|---|---|
| **Nicolas Dacheux** | Université de Montpellier, France |
| **Pavel Ferkl** | Pacific Northwest National Laboratory, USA |
| **Stephane Gin** | Commissariat à l'énergie atomique et aux énergies alternatives, France |
| **Christophe Jegou** | Commissariat à l'énergie atomique et aux énergies alternatives, France |
| **Maik Lang** | The University of Tennessee, Knoxville, USA |
| **Thierry Mennecart** | Belgian Nuclear Research Centre, Belgium |
| **Gabriel Murphy** | Forschungszentrum Jülich GmbH, Germany |
| **Ian Pegg** | The Catholic University of America, USA |
| **Karin Popa** | European Commission, Germany |
| **Nieves Rodriguez-Villagra** | Centre for Energy, Environmental and Technological Research, Spain |
| **Clare Thorpe** | University of Sheffield, United Kingdom |

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## Symposium MT01: Dynamics of Defects Under Extreme Environments

There has been a long-standing notion in the materials science community that materials' functional properties are strongly tied to the underlying defect substructure. Metals, for instance, consist of complex hierarchical networks of crystalline defects (i.e. vacancies, interstitials, dislocation loops, and grain boundaries) that have a strong bearing on the associated mechanical response (hardness, plasticity, fracture toughness, creep properties). Nevertheless, the nature of such inherent microstructure-property correlations under extreme conditions remains elusive to this date. In response to high deformation rates, elevated temperatures, and/or high-dose irradiation effects, crystalline flaws often interplay and evolve in highly nonlinear and stochastic ways, making the property prediction based on structural metrics a formidable task. Empirical frameworks conventionally describe these correlations by a fairly small set of "descriptors" largely ignoring inherent scale hierarchies and intricate topology of defect networks at micro/nano-structural levels. Multi-scale simulations have fairly limited applicability/predictability due to modeling gaps in transferring physics-based information across length/time-scales. Experimental investigations can only explore a small portion of the immense combinatorial space spanned by varying environments and different elemental compositions.

The above limitations demand applications of machine learning (ml) that can help establish robust relationships between defects' heterogeneous microstructure and materials' response within a "microstructural informatics" framework. The latest developments include deep-learned data mining for feature extraction, neural net-based interatomic potentials for complex defects, and graph network representations of heterogeneous microstructures. Obvious questions and challenges have yet to be fully addressed: 1) accurate identification and classification of topological defects through robust ml-based metrics that fully account for associated spatio-temporal variations under extreme conditions 2) construction of efficient ml force fields for strongly interacting defects to model their collective behavior with ab-initio accuracy but beyond atomistic scales 3) applications of ml to bridge existing gaps across scales in physics-based simulations to accelerate the design process of heterogeneous materials and microstructural tailoring 4) leverage the notion of "tractability" and "interpretability" given the multi-combinatorial descriptors' phase space via effective reduced-complexity models and feature engineering leading to the extraction of fundamental physics and underlying mechanisms. To address these challenges, the proposed symposium will aim to conduct a thorough survey of the current state-of-the-art in data mining and pattern detection, feature extraction and analysis, and interpretation of ml predictions relevant to defects' characterization and associated physics under harsh environments. We invite relevant contributions from academia and industry employing advanced computational/experimental techniques powered by ml to explore microstructure-property correlations in a broad range of contexts including chemically complex alloys and composites, amorphous particulate systems, metallic glasses, two-dimensional heterostructures and irradiated materials.

## Topics will include:

- Applications of deep learning in image processing of defects, pattern detection, and physics extraction
- Hybrid physics-based machine-learned simulations of complex defects and heterogeneous structures across scales
- Development of machine-learned interatomic potentials via ab initio calculations
- Inverse design and microstructural/topological optimization: data-centric machine learning approaches
- Graph neural networks: micromechanics of defects and property predictions
- Machine-learned microstructural predictors of yielding and failure in heterogeneous systems
- Ml-assisted composition search strategies for targeted functional properties under extreme environments

## Invited speakers include:

| | | | |
|---|---|---|---|
| **David Aristoff** | Colorado State University, USA | **Mathew Nithin** | Los Alamos National Laboratory, USA |
| **Silvia Bonfanti** | National Centre for Nuclear Research, Poland | **Stefanos Papanikolaou** | National Centre for Nuclear Research, Poland |
| **Jacqueline Cole** | University of Cambridge, United Kingdom | **Stefan Sandfeld** | Forschungszentrum Jülich GmbH, Germany |
| **Elizabeth Holm** | University of Michigan, USA | **Subramanian Sankaranarayanan** | Argonne National Laboratory, USA |
| **Noel Jakse** | Université Grenoble Alpes, France | **Jun Song** | McGill University, Canada |
| **Surya Kalidindi** | Georgia Institute of Technology, USA | **Thomas Swinburne** | Aix-Marseille Universite, France |
| **Javier Llorca** | IMDEA Materials Institute, Spain | **Milica Todorovic** | University of Turku, Finland |
| **Cosmin Marinica** | Commissariat à l'énergie atomique et aux énergies alternatives, France | **Blas Uberuaga** | Los Alamos National Laboratory, USA |
| **Normand Mousseau** | Université de Montréal, Canada | **Jan Wróbel** | Warsaw University of Technology, Poland |

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## Symposium MT02: Machine Learning in Action—Automated and Autonomous Experiments

The conventional materials innovation cycle heavily relies on human decision-making and manual operation of scientific tools, leading to slow progress. Pressing challenges like the electrification of everything, large-scale materials synthesis, waste stream upconversion, and energy conversion and storage demand a transformative approach to accelerate material discoveries. In this symposium, we aim to explore innovative methods that combine experimental automation and machine learning to conduct materials research at or beyond the state of the art. This convergence presents a unique opportunity for machine learning-driven autonomous experimentation, promising improved efficiency, accuracy, and reproducibility in materials synthesis and characterization, thus accelerating breakthroughs in materials and physics.

The symposium's primary focus is on showcasing the applications of machine learning in experimental tasks, with an emphasis on materials synthesis and characterization. The topics to be covered include automated and autonomous experiment workflow design, development of task-specific algorithms for experimentation, high-throughput synthesis and characterization, and the creation of digital twins for laboratories. By bringing together researchers from both the material science and machine learning communities, we aim to facilitate knowledge exchange, share recent advancements, and discuss the opportunities and challenges in this rapidly evolving field.

## Topics will include:

- Computer-vision based automated experiments
- Modular high-throughput experiments
- AI-driven autonomous experiments
- Multi-fidelity workflow design
- Algorithms for microscopy, spectroscopy, diffraction, and electrochemical experiments
- Data-driven experiment planning, realization, and review
- Automation beyond the benchtop, integration across the lab and countries
- Digital twins and Ontologies in academic research contexts
- Orchestration of autonomous campaigns with multiple tenants
- Autonomous research data management

## Invited speakers include:

| | |
|---|---|
| **Milad Abolhasani** | North Carolina State University, USA |
| **Mahshid Ahmadi** | The University of Tennessee, Knoxville, USA |
| **Alan Aspuru-Guzik** | University of Toronto, Canada |
| **Hannah-Noa Barad** | Bar-Ilan University, Israel |
| **Keith Brown** | Boston University, USA |
| **John Gregoire** | California Institute of Technology, USA |
| **Jason Hattrick-Simpers** | University of Toronto, Canada |
| **Kedar Hippalgaonkar** | National University of Singapore, Singapore |
| **Pinshane Huang** | University of Illinois at Urbana-Champaign, USA |
| **Yoosung Jung** | Korea Advanced Institute of Science and Technology, Republic of Korea |
| **Eun-Ah Kim** | Cornell University, USA |
| **Alfred Ludwig** | Ruhr-Universität Bochum, Germany |
| **Benji Maruyama** | Air Force Research Laboratory, USA |
| **Nicola Marzari** | École Polytechnique Fédérale de Lausanne, Switzerland |
| **Thomas Morris** | Brookhaven National Laboratory, USA |
| **Dan Olds** | Brookhaven National Laboratory, USA |
| **Kishna Rajan** | University at Buffalo, The State University of New York, USA |
| **Sebastian Siol** | Empa–Swiss Federal Laboratories for Materials Science and Technology, Switzerland |
| **Steven R. Spurgeon** | Pacific Northwest National Laboratory, USA |
| **Esther Tsai** | Brookhaven National Laboratory, USA |
| **Daniela Ushizima** | Lawrence Berkeley National Laboratory, USA |
| **Rama K. Vasudevan** | Oak Ridge National Laboratory, USA |
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## Symposium MT03: Synthesis of 2D Materials—Theory and Simulation

The synthesis of 2D materials has attracted significant attention in recent years due to their unique properties and potential applications in various fields such as electronics, energy, and catalysis. The stacked van der Waals heterostructures, in particular, are emerging as a prime candidates for quantum material design. However, the lack of controllable and reproducible synthesis methods is a significant hurdle to their industrial application. This is due to the lack of a comprehensive understanding of crucial growth mechanisms and the absence of real-time in-situ access to growth states for feedback process control. Experimental synthesis of these materials is often done by trial-and-error, leading to low reproducibility and controllability. The objective of this symposium is to bring together experts in the field to discuss theoretical, computational, and machine-learning methods for designing and synthesizing 2D materials beyond graphene.

Theoretical, computational, and machine learning methods and tools can assist and guide the design and synthesis of 2D materials beyond graphene. The symposium aims to focus on these methods at multiple length and time scales to provide a comprehensive understanding of growth mechanisms and enable real-time in-situ access to growth states, particularly it focuses on: (1) Nanoscale atomistic simulations, including density functional theory calculations and molecular dynamics simulations; (2) Mesoscale methods such as phase-field method, understanding the microstructure of 2D materials; (3) Macroscale continuum approaches, coupling thermal and chemical transport equations; (4) Machine learning models of growth and synthesis, providing predictive insights into the growth process.

## Topics will include:

- Nanoscale atomistic simulations of the growth, including density functional theory calculations and molecular dynamics simulations
- Mesoscale methods such as phase-field method, understanding the microstructure of 2D materials
- Macroscale continuum approaches, coupling thermal and chemical transport equations
- Machine learning models of growth and synthesis, providing predictive insights into the growth process
- Verification and sensitivity analysis of mathematical and computational models

## Invited speakers include:

| | | | |
|---|---|---|---|
| **Hamed Attariani** | Wright State University, USA | **Samir Farhat** | LSPM - CNRS, France |
| **Vincent Crespi** | The Pennsylvania State University, USA | **Susan Sinnott** | The Pennsylvania State University, USA |
| **Feng Ding** | Ulsan National Institute of Science and Technology, Republic of Korea | **Priya Vashishta** | University of Southern California, USA |
| **Süleyman Er** | DIFFER, Netherlands | **Boris I. Yakobson** | Rice University, USA |

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## Symposium MT04: Next-Generation AI-Catalyzed Scientific Workflow for Digital Materials Discovery

Emerging data-driven techniques based on statistics, machine learning, and artificial intelligence (AI) have shown great potential for improving effectiveness of the scientific workflow in material discovery. To widen their application and speed up material innovation, this symposium aims to bring together researchers from interdisciplinary knowledge domains (materials, engineering, computer science, statistics, and robotics) to discuss the fundamental challenges and innovative methodologies of applying emerging AI algorithms to catalyze the scientific workflow in material discovery. The scope of the discussion includes integration of physics/chemistry laws, human intelligence within AI systems, how emerging AI algorithms can be applied to material design and computation, and how big material data can be visualized. The materials are defined in a wide sense, including the building blocks used to create, e.g., molecules, polymers, or metals, and semiconductors. The broad implications resulting from the fruitful discussions will inspire researchers working across research fields to move forward and promote the basic knowledge development and technology deployment.

## Topics will include:

- Physics- and chemistry-informed, explainable machine learning for material development
- High throughput material simulation enabled by machine learning algorithms
- Large language models for materials development
- Generative models for materials design
- Fuzzy AI and AI with human reasoning for materials development
- Human-machine interactions, human-machine hybridized intelligence in materials development
- Data generation & curation
- Data tools (visualization, dimension reduction) and software
- AI ethics

## Invited speakers include:

| | |
|---|---|
| **Raymundo Arroyave** | Texas A&M University, USA |
| **Alan Aspuru-Guzik** | University of Toronto, Canada |
| **Samuel Blau** | Lawrence Berkeley National Laboratory, USA |
| **Gerbrand Ceder** | University of California, Berkeley, USA |
| **Michele Ceriotti** | École Polytechnique Fédérale de Lausanne, Switzerland |
| **Stefano Curtarolo** | Duke University, USA |
| **Pascal Friederich** | Karlsruhe Institute of Technology, Germany |
| **Janine George** | Federal Institute for Materials Research and Testing, Germany |
| **Renana Gershoni-Poranne** | Technion–Israel Institute of Technology, Israel |
| **Brian Giera** | Lawrence Livermore National Laboratory, USA |
| **Richard Gottscho** | Lam Research Corporation, USA |
| **Ganna Gryn'ova** | Heidelberg Institute for Theoretical Studies, Germany |
| **Boris Kozinsky** | Harvard University, USA |
| **Heather Kulik** | Massachusetts Institute of Technology, USA |
| **Ying Li** | University of Wisconsin–Madison, USA |
| **Kohei Nakajima** | The University of Tokyo, Japan |
| **Kristin Persson** | Lawrence Berkeley National Laboratory, USA |
| **Rampi Ramprasad** | Georgia Institute of Technology, USA |
| **Semion Saikin** | Kebotix, USA |
| **Aron Walsh** | Imperial College London, United Kingdom |
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## Symposium NM01: Nanotubes, Graphene and Related Nanostructures

Carbon nanotubes, graphene, and other related nanostructures (including those of boron nitride, and boron), have attracted tremendous attention for their intriguing properties. These nanomaterials have been widely investigated, from theory, synthesis, and characterization to applications in electronic devices, mechanical reinforcement, energy conversion and storage, biological and chemical sensors, etc. This symposium will emphasize the physical, chemical, and biological aspects of these carbon and non-carbon nanostructures as well as emerging technologies that aid in the understanding and preparation of such materials, such as artificial intelligence and additive manufacturing. We will bring together researchers from different disciplines to discuss the fundamental and industrial aspects of theory, synthesis, characterization, chemical and biochemical methods for purification and assembly, toxicity and bio-compatibility, and applications in electronics, chemistry, biochemistry, mechanical reinforcement, etc.

## Topics will include:

- Synthesis, doping, and characterization
- Theoretical study of growth, doping, and emerging behavior including electronic and magnetic structure, and properties
- Electron transport and scanning tunneling microscopy studies.
- Machine learning and artificial intelligence
- Energy harvesting, conversion, and storage
- Optical spectroscopy
- Applications in transparent and flexible conductors, actuator, sensor, transistors, etc.
- Molecular approaches for purification, modification, and sorting
- CNT, BNNT as well as their 2D counterpart on biomolecule interactions: biochemical applications and toxicity studies
- Synthesis and characterization of B-C-N thin films and other novel structures, Hierarchical organization
- One-dimensional carbon-based heterostructures including functionalized carbon nanotubes
- Graphene nanoribbons, nanoflakes, and other novel carbon-based nanostructures such as carbyne and graphdiyne

A **tutorial** complementing this symposium is tentatively planned. Further information will be included in the MRS Program that will be available online in September.

## Invited speakers include:

| | |
|---|---|
| **Placidus B. Amama** | Kansas State University, USA |
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| **Jeffrey Fagan** | National Institute of Standards and Technology, USA |
| **Aaron Franklin** | Duke University, USA |
| **Il Jeon** | Sungkyunkwan University, Republic of Korea |
| **Tanja Kallio** | Aalto University, Finland |
| **Katalin Kamaras** | Wigner Research Centre for Physics, Hungary |
| **Efthimios Kaxiras** | Harvard University, USA |
| **Mijin Kim** | Georgia Institute of Technology, USA |
| **Xuedan Ma** | Argonne National Laboratory, USA |
| **Naoyuki Matsumoto** | National Institute of Advanced Industrial Science and Technology, Japan |
| **Vincent Meunier** | The Pennsylvania State University, USA |
| **Yutaka Ohno** | Nagoya University, Japan |
| **Alister Page** | The University of Newcastle, Australia, Australia |
| **Swapan Pati** | Jawaharlal Nehru Center for Advanced Scientific Research, India |
| **Amitava Patra** | Institute of Nano Science and Technology, India |
| **Jiang Pu** | Tokyo Institute of Technology, Japan |
| **Rahul Rao** | Air Force Research Laboratory, USA |
| **Stephanie Reich** | Freie Universität Berlin, Germany |
| **Ming Xu** | Huazhong University of Science and Technology, China |
| **Boris Yakobson** | Rice University, USA |
| **Yoke Khin Yap** | Michigan Technological University, USA |
| **Nazmiye Yapici** | StabiLux Biosciences, USA |
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## Symposium NM02: Atomic Precision in Nanocluster Engineering

This symposium will bring together leading experts in atom-precise nanocluster science and engineering. Atomic precision represents the ultimate control over the structure and properties of matter. Advances in synthetic chemistry now enable synthesis of a wide variety of nanoclusters with atom-precise structures and exciting emergent properties, from photoluminescence to enhanced catalytic activity. Emerging research is showing that nanoclusters can serve as synthetic seeds for synthesizing larger nanomaterials and can be assembled into hierarchically-ordered nanocluster superlattices. To fully realize the promise of atom-precise materials systems composed of nanocluster “building blocks,” and thereby pave the way for applications in energy, photonics, sensing, and biomedicine, it is critical to bring together complementary expertise in nanocluster synthesis and characterization, computational modeling, materials integration, and emerging applications.

This symposium focuses on the latest advances in atom-precise metal, semiconductor, and carbon nanoclusters and on efforts to harness nanoclusters for higher-order materials and applications. Abstracts are welcomed in the following areas: advanced synthesis methods for atomically precise nanoclusters that increase the level of control over materials structure; computational methods to simulate nanocluster electronic structure, self-assembly, and emergent properties of nanocluster arrays; advanced structural characterization of nanocluster materials including X-ray diffraction and electron or scanning probe microscopies; ultrafast spectroscopy for characterization of ground-state and excited-state properties of atom-precise nanomaterials; applications of nanocluster materials, such as clean energy technologies, biomedical imaging, and sensing. By bringing together synergistic expertise, this symposium aims to catalyze new collaborations and research innovations that will advance the state-of-the-art in nanocluster-based materials.

## Topics will include:

- Synthetic control of atomically precise nanoclusters
- Advanced structure determination for nanoclusters
- Advanced computational modeling of nanoclusters
- Ultrafast spectroscopic characterization
- Assembly of hierarchical materials from atom-precise building blocks
- Near-field effects in nanocluster arrays
- Catalytic activity and applications in heterogeneous catalysis
- Photonics applications of nanoclusters
- Biomedical applications of nanoclusters

A **tutorial** complementing this symposium is tentatively planned. Further information will be included in the MRS Program that will be available online in September.

## Invited speakers include:

| | | | |
|---|---|---|---|
| **Christopher Ackerson** | Colorado State University, USA | **Richard Robinson** | Cornell University, USA |
| **Sara Bals** | University of Antwerp, USA | **Xavier Roy** | Columbia University, USA |
| **Quiang Cui** | Boston University, USA | **Kevin Stamplecoskie** | Queen's University, Canada |
| **Nicola Gaston** | The University of Auckland, New Zealand | **Dmitri Talapin** | The University of Chicago, USA |
| **Rebecca Gieseking** | Brandeis University, USA | **Tom Vosch** | Copenhagen University, Denmark |
| **Robert Green** | Alabama State University, USA | **Tao Wei** | University of South Carolina, USA |
| **Kenneth Knappenberger** | The Pennsylvania State University, USA | **Bryan Wong** | University of California, Riverside, USA |
| **Jarad Mason** | Harvard University, USA | **Jianping Xie** | National University of Singapore, Singapore |
| **Sara Mason** | Brookhaven National Laboratory, USA | **Chenjie Zeng** | University of Florida, USA |
| **Maria Matus** | University of Jyväskylä, Finland | | |

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## Symposium NM03: Engineering Ultra-Thin Chalcogenide Films

Layered chalcogenide-based materials have been shown to possess highly sought-after properties such as non-trivial topologies in metals and insulators, superconductivity, semiconductors with high carrier mobilities, piezo- and ferro-electricity, as well as a high performance in opto- and photo-electronics. As much as interest in those materials in the form of ultra-thin films has gained momentum for future high-performing applications, so have efforts of their fabrication and characterization. However, their layered van der Waals nature poses an obstacle for the bottom-up synthesis of large-scale thin film growth of precise thickness. Layer-by-layer growth – a prerequisite to achieve even film coverage with a defined number of layers, is suppressed by the ultra-low surface energy of the van der Waals planes. High-angle rotational domain formation is prevalent due to the weak substrate-film and interlayer interactions across the van der Waals gap. Probing film properties thoroughly in the ultra-thin to single layer limit is time-consuming and expensive. Furthermore, in the ultra-thin limit, defects and impurities stemming from the synthesis process may mask the intrinsic properties of the materials. Achievements in synthesis that translate into progress for device applications are tied to studies of thin film growth kinetics and the properties of ultra-thin films to further our understanding of the early stages of growth. This symposium will bring together a diverse set of researchers – from academia to national labs and fundamental physics and materials science to synthesis and devices – who are at the forefront of advancing the understanding of layered chalcogenide-based materials thin film growth and their potential. We aim to cover the wide range of bottom-up synthesis of layered chalcogenide-based materials chemistries such as mono-, di-, tri-, transition metal-, sesqui-, group-III-, and group-IV-chalcogenides in thin film form, their characterization and potential for applications.

## Topics will include:

- Engineering of chalcogenide-based layered thin films and heterostructures – doping, alloying or defect control
- Characterization of thin and ultra-thin films
- Structure-property correlation-electronic, optical, and magnetic properties of layered chalcogenides
- Theory and simulation of chalcogenide thin film growth processes and properties for predictive engineering
- Applications of layered chalcogenide thin films
- Solar Cells
- Photocatalysis

Joint sessions are being considered with **EN02 - Thin Film Chalcogenides for Energy Applications**.

## Invited speakers include:

| | |
|---|---|
| **Zakaria Al Balushi** | University of California, Berkeley, USA |
| **Nicholas Borys** | Montana State University, USA |
| **Kenneth Burch** | Boston College, USA |
| **Yufeng Hao** | Nanjing University, China |
| **Danielle Hickey** | The Pennsylvania State University, USA |
| **Rafael Jaramillo** | Massachusetts Institute of Technology, USA |
| **Deep Jariwala** | University of Pennsylvania, USA |
| **Kibum Kang** | Korea Advanced Institute of Science and Technology, Republic of Korea |
| **Yu Lei** | Tsinghua University, China |
| **Saurabh Lodha** | Indian Institute of Technology Bombay, India |
| **Marcelo Lopes** | Paul Drude Institute for Solid State Electronics, Germany |
| **Nadire Nayir** | Istanbul Technical University, Turkey |
| **Tianchao Niu** | Institute of International Innovation Beihang University, China |
| **Seongshik Oh** | Rutgers University, USA |
| **Frank Peiris** | Kenyon College, USA |
| **Michael Pettes** | Los Alamos National Laboratory, USA |
| **Lin Wang** | Shanghai Jiao Tong University, China |
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## Symposium NM04: Exploring the Properties and Applications of Freestanding Membranes—From 2D to 3D

The goal of the symposium is to allow the community to come together to advance the freestanding nano-membrane-related research from 2D materials to ultra-thin 3D materials with electronic, photonic, and electrochemical applications. The technological innovation in microelectronic devices has been led by silicon owing to its mature processing, but the increasing demand for ultra low-power electronics and miniaturization urges to develop new types of materials and architectures that have superior performances and properties as well as design flexibility for integration. Recently, emerging freestanding nano-membranes including 2D materials and ultrathin 3D materials have been developed, merging epitaxial complex oxides with the successful methodology from low-dimensional (Van der Waals (VdW) heterostructures) systems as a new material building block to create new functional devices and discover new physical phenomena. The freestanding membranes can substantially bring a new paradigm in the electrical, magnetic, optical, and thermal properties, leading to abundant intriguing functionalities. Thus, a great deal of effort has been made to innovate device architectures. To obtain high-quality freestanding nano-membranes, significant progress has been made in *in situ* growth or *ex situ* transfer techniques. These are critical approaches to obtaining extensive and flexible designs of novel structures. In this symposium, we provide the opportunity for speakers and audience to share their latest progress in the research of novel freestanding thin films, including the methods for synthesis, fabrication, layer lift-off, transfer, and stack as well as their scaling-up for device applications. The symposium will cover a complete range of topics related to various freestanding thin films from fundamentals to applications. Interdisciplinary topics related to physics, materials science, and engineering will be connected by invited talks to accelerate the development of various freestanding nano-membranes and their applications. The session will also be dedicated to motivating discussions toward emerging technology to develop new types of integrated structures using 2D materials, and ultra-thin 3D materials.

## Topics will include:

- Remote epitaxy and van der Waals epitaxy of semiconductors, complex oxides, and 2D materials
- Synthesis science with remote epitaxy for novel structures and physical phenomena
- Novel sacrificial layer of complex oxides and semiconductors
- Stacking and twisting of complex oxides and semiconductors
- Layer lift-off technology (mechanical, optical, chemical, and so on)
- Synthesis of various 2D materials and 3D thin films as well as their heterostructures
- The role of interfaces in determining the properties
- Heterogeneous integration of freestanding material films and their applications
- Optical, electrical, and magnetic interaction at the hetero-interface
- Strain engineering in freestanding materials

A **tutorial** complementing this symposium is tentatively planned. Further information will be included in the MRS Program that will be available online in September.

## Invited speakers include:

| | | | |
|---|---|---|---|
| **Jong-Hyun Ahn** | Yonsei University, Republic of Korea | **Yu Jung Lu** | Academia Sinica, Taiwan |
| **Andrea Caviglia** | Delft University of Technology, Netherlands | **Judith L. MacManus-Driscoll** | University of Cambridge, United Kingdom |
| **Woo Seok Choi** | Sungkyunkwan University, Republic of Korea | **Feng Miao** | Nanjing University, China |
| **Chang-Beom Eom** | University of Wisconsin–Madison, USA | **Abdallah Ougazzaden** | Georgia Tech Lorraine, France |
| **Stephen Forrest** | University of Michigan, USA | **Aaron Ptak** | National Renewable Energy Laboratory, USA |
| **Rachel S. Goldman** | University of Michigan, USA | **Paolo G. Radaelli** | University of Oxford, United Kingdom |
| **Felix Gunkel** | Forschungszentrum Jülich GmbH, Germany | **Joan Redwing** | The Pennsylvania State University, USA |
| **Yimo Han** | Rice University, USA | **Kate Reidy** | Massachusetts Institute of Technology, USA |
| **Mark Hersam** | Northwestern University, USA | **Frances Ross** | Massachusetts Institute of Technology, USA |
| **Harold Hwang** | Stanford University, USA | **Jutta Schwarzkopf** | Leibniz-Institut für Kristallzüchtung, Germany |
| **Thomas Sand Jespersen** | Technical University of Denmark, Denmark | **Jian Shi** | Rensselaer Polytechnic Institute, USA |
| **Hyun S Kum** | Yonsei University, Republic of Korea | **Michel Snure** | Air Force Research Laboratory, USA |
| **Chun Ning Lau** | The Ohio State University, USA | **Stephanie Tomasulo** | U.S. Naval Research Laboratory, USA |
| **Kyusang Lee** | University of Virginia, USA | **Vincent Tung** | The University of Tokyo, Japan |
| **Xiuling Li** | The University of Texas at Austin, USA | **Mona Zebarjadi** | University of Virginia, USA |

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## Symposium NM05: Structural Control and Design of 2D Layered Materials and Heterostructures Towards Novel Functionalities

The structural control of 2D layered materials and heterostructures plays a crucial role in shaping their physical properties, presenting an exciting avenue for uncovering exceptional characteristics, advancing novel functionalities and developing sustainable electronics. Phase engineering methods allow for fine-tuning the material's electronic properties, such as conductivity, charge carrier mobility and band alignment which are crucial for applications. Extensive phase engineering endeavors encompass a wide spectrum of approaches, ranging from planar control to vertical stacking engineering, leading to the development of multifunctional heterostructures with applications in optoelectronics, energy-efficient memory, and moiré physics. This symposium will explore the structure-property relationship and their functionalities in 2D layered materials and heterostructures, focusing on (a) atomistic modeling to study the formation and stability of various structures during synthesis, fabrication, and external stimuli; (b) engineering methods to control structures; (c) experimental characterization of atomic to mesoscopic structures, revealing new optical, electronic, and spintronic functionalities; and (d) design and implementation of innovative devices based on controllable 2D materials and heterostructures for applications such as neuromorphic computing, high-speed transistors and energy harvesters. Presenters and invited speakers from diverse disciplines such as chemistry, physics, engineering, and materials science will foster enriching interdisciplinary discussions.

## Topics will include:

- Structural control techniques for 2D layered materials
- Synthesis techniques for various heterostructures, such as vertical, lateral, wrap-around, and mixed dimensional heterostructures.
- Creating structural and functional properties of 2D materials by external stimuli
- Experimental characterization of structure-property relationships in 2D materials.
- Twistronics and Moire physics of heterostructures
- Heterostructures for applications, including optoelectronics, energy-efficient memory, neuromorphic computing, energy harvesting and photoelectrocatalysis.
- Atomistic modeling to understand the formation and stability of various structures.
- Theoretical understanding of structure-property relationship in heterostructures
- Device structure and modeling

## Invited speakers include:

| | |
|---|---|
| **Deji Akinwande** | The University of Texas at Austin, USA |
| **Anasori Babak** | Purdue University, USA |
| **Hyeonsik Cheong** | Sogang University, Republic of Korea |
| **Mark Hersam** | Northwestern University, USA |
| **Long Ju** | Massachusetts Institute of Technology, USA |
| **Jennie Lau** | The Ohio State University, USA |
| **Max Lemme** | RWTH Aachen University, Germany |
| **Xiaoqin Li** | The University of Texas at Austin, USA |
| **Jun Lou** | Rice University, USA |
| **Steven Louie** | University of California, Berkeley, USA |
| **Feng Miao** | Nanjing University, China |
| **Xiaofeng Qian** | Texas A&M University, USA |
| **Joan Redwing** | The Pennsylvania State University, USA |
| **Hyeon Suk Shin** | Ulsan National Institute of Science and Technology, Republic of Korea |
| **Joonki Suh** | Ulsan National Institute of Science and Technology, Republic of Korea |
| **Vincent Tung** | The University of Tokyo, Japan |
| **Jun Xiao** | University of Wisconsin–Madison, USA |
| **Xiao-xiao Zhang** | University of Florida, USA |
| **Yang Zhang** | University of Tennessee, USA |
| **Shuyun Zhou** | Tsinghua University, China |
| **You Zhou** | University of Maryland, USA |
| **Xiaoyang Zhu** | Columbia University, USA |

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## Symposium NM06: Emerging Trends in Nano- and Micro-structured Bioinspired Materials

Mimicking and adapting the function of naturally occurring materials to new systems presents opportunities for the sustainable development of highly functional nanomaterials for pressing technological needs. This includes a wide range of both organic/protein-based materials to inorganic nanostructures generated and employed at relatively ambient conditions. This symposium on bioinspired materials would bring together researchers from various fields who are interested in the design, synthesis, and application of nanomaterials that recapitulate the properties and structures found in nature. The talks will focus on experimental synthesis, processing characterization, multi-scale computational modeling, and data science approaches to bioinspired nano- and micro-structured materials based on various building blocks such as proteins, polysaccharides, nucleic acids, and nanoparticles (both inorganic and organic). Contributions that feature the integration of both experiments with computational analyses with validation studies are highly encouraged.

### Topics will include:

- Combined experimental and theoretical studies of nano- and micro-structured bioinspired materials
- Theoretically assisted design of biomimetic and bio-inspired materials
- Multi-scale modeling methods of biomimetic, bioinspired, and bioderived systems
- Experiment and simulations of the directed and self-assembly of biopolymers, polymers, and colloids
- Integration of biomolecules into protective matrices (e.g., metal-organic frameworks, composites)
- Incorporating biological or biomimetic function into synthetic materials
- Design of bioinspired hierarchical composites, self-healing materials, superhydrophobic surfaces, adhesives, functional nanocomposites, and biomimetic membranes
- Application of machine learning and data science approaches to the study, understanding, and replication of bioinspired systems and processes

### Invited speakers include:

| | | | |
|---|---|---|---|
| **Nurit Ashkenasy** | Ben-Gurion University of the Negev, Israel | **Sebastien Lecommandoux** | Université de Bordeaux, France |
| **Helena Azevedo** | University of Porto, Portugal | **Andrea Merg** | University of California, Merced, USA |
| **Oleg Gang** | Brookhaven National Laboratory, USA | **Valeria Milam** | Georgia Institute of Technology, USA |
| **Dominic Glover** | University of New South Wales, Australia | **Fiorenzo Omenetto** | Tufts University, USA |
| **David Kaplan** | Tufts University, USA | **Siddharth Patwardhan** | The University of Sheffield, United Kingdom |
| **David Kisailus** | University of California, Irvine, USA | **Nathaniel Rosi** | University of Pittsburgh, USA |
| **Abigail Knight** | University of North Carolina at Chapel Hill, USA | **Vladimir Tsukruk** | Georgia Institute of Technology, USA |

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## Symposium NM07: Building Advanced Materials via Aggregation and Self-assembly

This symposium will cover a broad of topics about building advanced materials using aggregation or self-assembly techniques, both experimental and theoretical. Aggregation and self-assembly play crucial roles in the natural formation of minerals and have become increasingly important in the fabrication of advanced materials at both laboratory and industrial scales. Over time, numerous materials synthesized via these methods have found applications in fields such as biomedicine, energy, environment, catalysis, and optics. For instance, interconnected nanoparticle superlattices fabricated through self-assembly of $Fe_3O_4$ nanoparticles have been utilized as anodes to enhance lithium-ion battery performance, while advanced luminescent materials have been created through aggregation-induced emission (AIE) of intrinsically non-emissive molecules. However, one of the major challenges facing this rapidly expanding field is the development of a fundamental understanding of aggregation and self-assembly mechanisms, which will be a key focus of the symposium. Contributions to the event will encompass a wide array of topics, including but not limited to: 1) Recent advances in the synthesis of advanced materials using aggregation or self-assembly methods; 2) Investigations into the mechanisms underlying aggregation and self-assembly processes; 3) Observation of these processes via in situ techniques; 4) Theoretical developments on particle-based crystallization; and 5) Materials with AIE and their practical applications. This symposium will provide researchers with updated information on aggregation and self-assembly research. The symposium has also been designed to help experienced researchers deepen their knowledge on the development of new techniques, particularly state-of-the-art *in situ* characterization tools that can aid in understanding aggregation and self-assembly mechanisms.

## Topics will include:

- Building advanced materials via cluster, biomaterials or particle aggregation and/or self-assembly
- Observation of the aggregation and/or self-assembly pathways via *in situ* techniques
- Mechanism studies of aggregation or self-assembly pathways
- Control of morphology and size during the synthesis of advanced materials via aggregation and/or self-assembly pathways
- Driving forces for particle interactions
- Fluorescent and phosphorescent AIE-based polymers, oligomers, and molecules
- Design principles and operational mechanisms of the AIE-based molecules
- Biocompatible AIE probes for sensing, imaging, and other biomedical applications
- Applications of these advanced materials in areas of energy, environment, biomedicine, etc.

A **tutorial** complementing this symposium is tentatively planned. Further information will be included in the MRS Program that will be available online in September.

## Invited speakers include:

| | |
|---|---|
| **Lluis Blancafort** | Universitat de Girona, Spain |
| **James De Yoreo** | Pacific Northwest National Laboratory, USA |
| **Julia Dshemuchadse** | Cornell University, USA |
| **Hongyou Fan** | Sandia National Laboratories, USA |
| **Kristen Fichthorn** | The Pennsylvania State University, USA |
| **Oleg Gang** | Brookhaven National Laboratory, USA |
| **Pupa Gilbert** | University of Wisconsin–Madison, USA |
| **Yuning Hong** | La Trobe University, Australia |
| **Rongrong Hu** | South China University of Technology, China |
| **Cherie Kagan** | University of Pennsylvania, USA |
| **Nicholas Kotov** | University of Michigan, USA |
| **Eugenia Kumacheva** | University of Toronto, Canada |
| **Dongsheng Li** | Pacific Northwest National Laboratory, USA |
| **Xiaoding Lou** | China University of Geoscience, China |
| **Chad Mirkin** | Northwestern University, USA |
| **Jungwon Park** | Seoul National University, Republic of Korea |
| **Qian Peng** | University of the Chinese Academy of Sciences, China |
| **Kanyi Pu** | Nanyang Technological University, Singapore |
| **Andrea Pucci** | Università di Pisa, Italy |
| **Eric Rivard** | University of Alberta, Canada |
| **Dmitri Talapin** | The University of Chicago, USA |
| **Ben Zhong Tang** | Chinese University of Hong Kong, China |
| **Wei Tao** | Harvard University, USA |
| **Dong Wang** | Shenzhen University, China |
| **Xingchen Ye** | Indiana University Bloomington, USA |
| **Ali K. Yetisen** | Imperial College London, United Kingdom |
| **Haoke Zhang** | Zhejiang University, China |
| **Y. Shrike Zhang** | Harvard University, USA |
| **Haimei Zheng** | Lawrence Berkeley National Laboratory, USA |
| **Minjiang Zhong** | Yale University, USA |

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## Symposium PM01: Crystal Clear—Recent Advances in Biogenic and Synthetic, Organic and Inorganic Crystallization

This symposium focuses on the latest advances in crystallization and biocrystallization. The symposium will explore recent discoveries on the fundamentals of crystal nucleation, growth and assembly, from biologically-controlled to bio-inspired systems. Crystallization is a vital process in biological and materials science with countless applications, from classic cements and seashell/bone formation to perovskite solar cells and advanced electronics. Despite its long history, classical theories of crystallization are now being challenged, and the subject continues to evolve at the forefront of emerging fields in materials chemistry. Truly understanding crystallization mechanisms and how to manipulate them is a grand challenge in materials chemistry with significant potential for future developments.

The symposium is structured into four sections, with the first covering our current understanding of crystal nucleation, growth, and assembly. We will address ongoing debates in the field, such as the role of prenucleation clusters in the crystal formation and the multiple pathways involved in crystal growth or assembly. The second section will focus on biogenic crystallization and bio-inspired crystallization, discussing the use of biological strategies to control crystal morphology, orientation, and size, to produce materials with unique and desirable structures and properties. This session highlights recent exciting discoveries in biogenic organic crystallization which unlock the potential to create materials with emergent properties that have not been thought about previously. We are excited to discuss the unifying concepts underpinning biological crystallization in this section. The third section will feature interfaces for crystallization, and the last section will focus on recent advances in characterization techniques to investigate crystal formation. The state-of-the-art characterization tools have advanced the field of crystal nucleation and growth and opened up new areas of research. This section also discusses topics such as new synchrotron applications, microfluidics, and continuous and high throughput crystallization systems. We will also highlight the significant development in electron tomography and in-situ analysis.We are confident that this symposium will provide delegates with the latest insights on crystallization relevant to their research.

### Topics will include:

- Classical vs. non-classical nucleation: experiments and modelling
- Particle-mediated crystallization
- Liquid-like materials and amorphous materials
- Biocrystallization: unifying inorganic and organic crystallization
- Emerging properties from biogenic and bio-inspired materials
- Organic-inorganic hybrid materials/composites
- Interfacial and templated crystallization and thin film formation
- *State-of-the-art* characterizations for crystallisation
- Cryo and liquid-phase electron microscopy characterization
- Imaging: electron crystallography and tomography
- Microfluidics, High-throughput screening and continuous crystallisation

### Invited speakers include:

| | | | |
|---|---|---|---|
| **Andrew Alexander** | The University of Edinburgh, United Kingdom | **Willeim Noorduin** | AMOLF, Netherlands |
| **Henrik Birkedal** | Aarhus University, Denmark | **Pablo Piaggi** | Princeton University, USA |
| **James De Yoreo** | Pacific Northwest National Laboratory, USA | **Boaz Pokroy** | Technion–Israel Institute of Technology, Israel |
| **Lara Estroff** | Cornell University, USA | **Yael Politi** | Technische Universität Dresden, Germany |
| **Kathryn Grendfield** | McMaster University, Canada | **Jeffery Rimer** | University of Houston, USA |
| **Dvir Gur** | Weizmann Institute of Science, Israel | **Matteo Salvalaglio** | University College London, United Kingdom |
| **Derk Joester** | Northwestern University, USA | **Netta Vidavsky** | Ben-Gurion University of the Negev, Israel |
| **Dongsheng Li** | Pacific Northwest National Laboratory, USA | **Avital Wagner** | Ben-Gurion University of the Negev, Israel |
| **Marianne Liebi** | École Polytechnique Fédérale de Lausanne, Switzerland | **Jessica Walker** | Diamond Light Source, United Kingdom |
| **Nadine Nassif** | Sorbonne Université, France | **Stephan Wolf** | Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany |

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2024 MRS® FALL MEETING & EXHIBIT

December 1–6, 2024 | Boston, Massachusetts

# CALL FOR PAPERS

**Abstract Submission Opens–Friday, May 24, 2024**
**Abstract Submission Closes–Monday, June 24, 2024 (11:59 pm ET)**

*Reminder: In fairness to all potential authors, late abstracts will not be accepted.*

## Symposium PM02: Additive and Digital Manufacturing of Multifunctional Materials

Progress in additive and digital manufacturing has presented scientists and engineers with a revolutionary capability: the design of novel material systems with tailored, spatially programmed properties and structures. From new bioinspired composites and architected materials to forms of soft robotic and living matter, designer materials assembled through additive and digital means are driving innovations across myriad applications. Still, barriers to continued progress lie in the materials, computational tools, hardware, build resolutions, and throughput of these manufacturing methods. This symposium aims to bring together researchers from materials science and engineering, computational materials design, materials chemistry, and more to share interdisciplinary research and insights to continue advancing materials design through additive and digital manufacturing.

This symposium is structured around three core themes. The first, "New Material Chemistries and Designs", will focus on developments in new chemistries and design strategies tailored for 3D printing and the digital assembly of materials. The second, "Novel Capabilities", will focus on emerging strategies for additively and digitally fabricating materials that overcome current limitations. The third, "Data-Driven Design", will highlight advances in computational materials design and engineering. The symposium will also broadly showcase new opportunities for innovating through additive and digital manufacturing of multifunctional materials.

## Topics will include:

- New material functionalities via additive and digital assembly
- Hybrid manufacturing methods for multifunctional materials
- Printing bioinspired, hierarchical, and architected materials
- Chemistry-driven innovations in multi-material printing
- Sustainable materials in additive manufacturing
- Stimuli-responsive adaptive / intelligent soft materials
- High performance 3D-printable polymers
- Multimaterial additive manufacturing methods
- Data-driven, computational design and optimization methods for 3D printing

## Invited speakers include:

| | | | |
|---|---|---|---|
| **Alexandra Bayles** | University of Delaware, USA | **Jennifer Lewis** | Harvard University, USA |
| **Eva Blasco** | Heidelberg University, Germany | **Barbara Mazzolai** | Istituto Italiano di Tecnologia, Italy |
| **J. William Boley** | Boston University, USA | **Chad Mirkin** | Northwestern University, USA |
| **Keith Brown** | Boston University, USA | **Zak Page** | The University of Texas at Austin, USA |
| **Joseph DeSimone** | Stanford University, USA | **Emily Pentzer** | Texas A&M University, USA |
| **Julia Greer** | California Institute of Technology, USA | **Shu Yang** | University of Pennsylvania, USA |
| **Mina Konaković Luković** | Massachusetts Institute of Technology, USA | **Xiaoyu Zheng** | University of California, Berkeley, USA |

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## Symposium PM03: Plasmas for Materials Science—Opportunities at the Interface

Plasmas are unique tools for materials science in terms of both versatility and complexity. Plasma-enhanced processes have been crucial for the growth of the semiconductor industry. Today, plasmas continue to be at the cutting edge of materials research. Their use for atomic layer deposition and etching, for the processing of 2D materials, and for the synthesis of materials for quantum computing underscores their critical role in the microelectronics industry. Their inherent state of thermodynamic non-equilibrium sets them apart from any other materials processing technique, enabling access to materials that would be otherwise unachievable. These novel materials offer immense potential in applications such as photonics, energy storage, and biotechnology, among others. Exciting new opportunities are being explored with respect of driving surface chemistry on plasma-exposed catalysts and initiating electrochemical reactions in liquids.

This symposium will bring together the diverse group of researchers, from both academia and industry, that dedicate their efforts to plasma science and technology at the forefront of materials research. It will provide them with an opportunity to showcase their most recent contributions related to plasma-material interfaces. The complexity of these interfaces creates a vast opportunity for discovery, and the growing prevalence of plasma science in materials fields confirms the importance of this area. This symposium will include topics that relate to diagnostics of the plasma-materials interface, ab-initio atomistic modelling of materials under plasma exposure, use of machine learning to investigate interfacial phenomena, and finally the leveraging of the interface to achieve materials with new functionalities.

## Topics will include:

- Plasma for 2D materials synthesis and processing
- Plasma synthesis and processing of nanomaterials and quantum materials
- Modelling of plasma-materials interaction
- Plasma synthesis and processing of materials for energy harvesting and storage
- Plasma catalysis and plasma synthesis of materials for catalysis
- Machine Learning and artificial intelligence for autonomous plasma processes
- Diagnostics and fundamental plasma science at materials interfaces
- Plasma surface and interface engineering
- Plasma synthesis and processing of materials for extreme conditions
- Plasma processes for biosensors and biomaterials

## Invited speakers include:

| | | | |
|---|---|---|---|
| **Peter Bruggeman** | University of Minnesota, USA | **Taesung Kim** | Sungkyunkwan University, Republic of Korea |
| **Emily Carter** | Princeton University, USA | **Mark Kushner** | University of Michigan, USA |
| **Fabio Di Fonzo** | X-nano Srl, Italy | **Claudia Lopez-Camara** | Technische Universiteit Eindhoven, Netherlands |
| **Zachary Holman** | Arizona State University, USA | **Gottlieb Oerhlein** | University of Maryland, USA |
| **Brian Jurczyk** | Starfire, USA | **Alok Ranjan** | Advanced Materials, USA |
| **Holger Kersten** | Christian-Albrechts-Universität zu Kiel, Germany | **Mohan Sankaran** | University of Illinois at Urbana-Champaign, USA |
| **Erwin Kessels** | Technische Universiteit Eindhoven, Netherlands | **Sedina Tsikata** | Georgia Institute of Technology, USA |
| **Tae-hee Kim** | Wonkwang University, Republic of Korea | **Meng-Jiy Wang** | National Taiwan University of Science and Technology, Taiwan |

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## Symposium QT01: Chirality and Spin in Halide Perovskites

Halide perovskites have emerged as a new class of semiconductors with exceptional material properties, making them promising candidates for a plethora of spin- and optoelectronic applications. Despite their rapid development, halide perovskites remain highly enigmatic, simultaneously featuring properties reminiscent of organic and traditional inorganic semiconductors. The origin and extent of novel features, such as defect tolerance or high ion mobility, are not fully understood. Even much less is known about these materials with respect to the influence of structural chirality on their properties. Spin properties in halide perovskites are in early infancy, despite their great potential due to an inverted spin-orbit coupling structure originating from lead atoms as well as chirality. To date, a lack of comprehensive insight into the interplay between structure and morphology, composition, dimensionality, and impact of electronic and phononic response in these materials, impedes the further advancement of halide perovskites for spin-optoelectronic applications.

This symposium will be a platform for researchers whose work addresses underlying fundamental material aspects related to chirality and spin in halide perovskites. Research topics covered in the symposium will include, among others, the latest advances in photophysics, charge and spin transport, ultrafast spectroscopy, band-structures and spin textures, phonon-carrier interactions, magneto-optical properties, circularly polarized light emission, and mapping/imaging techniques. As the prevalence of individual features can depend on the perovskite morphology, submitted abstracts may focus on bulk-like 3D thin films and single crystals or explore low-dimensional structures, such as 2D Ruddlesden-Popper phases or nanocrystals. Sessions focusing on the theoretical description of these phenomena and the development of new computational methods and approaches, for example, machine learning, will complement the experimental parts of this symposium.

## Topics will include:

- Chiral perovskites: synthesis & properties
- Experimental & computational characterization of charge & spin transport
- Ultrafast processes in halide perovskites (hot carriers, localization, spin depolarization etc.)
- Micro- and nano-scale imaging of perovskites
- Coupling of charge carriers, excitons, phonons, polarons to spin
- Low-dimensional perovskites (nanocrystals, layered perovskites, 2D heterostructures)
- Magnetic dopants and their spin-properties
- Band structure calculations & theoretical modelling of optoelectronic properties; materials discovery
- Emerging properties & applications (ferroelectricity, polaritonics, chiral light emission, quantum applications, etc.)

Joint sessions are being considered with **EL04 - Recent Advances in Hybrid Perovskites**.

## Invited speakers include:

| | |
|---|---|
| **Michal Baranowski** | Politechnika Wroclawska, Poland |
| **Matthew Beard** | National Renewable Energy Laboratory, USA |
| **Daniel Gamelin** | University of Washington, USA |
| **Libai Huang** | Purdue University, USA |
| **Young Chul Jun** | Ulsan National Institute of Science and Technology, Republic of Korea |
| **Maksym Kovalenko** | ETH Zürich, Switzerland |
| **Leeor Kronik** | Weizmann Institute of Science, Israel |
| **Dennis Kudlacik** | Technical University of Dortmund, Germany |
| **Linn Leppert** | University of Twente, Netherlands |
| **Dehui Li** | Huazhong University of Science and Technology, China |
| **Efrat Lifshitz** | Technion–Israel Institute of Technology, Israel |
| **Haipeng Lu** | The Hong Kong University of Science and Technology, Hong Kong |
| **David Mitzi** | Duke University, USA |
| **Angshuman Nag** | Indian Institute of Science Education and Research, Pune, India |
| **Barbara Pietka** | University of Warsaw, Poland |
| **Yuan Ping** | University of Wisconsin–Madison, USA |
| **Peter Sercel** | Center for Hybrid Organic Inorganic Semiconductors for Energy, USA |
| **Dali Sun** | North Carolina State University, USA |
| **Shuxia Tao** | Technische Universiteit Eindhoven, Netherlands |
| **Zhi-Gang Yu** | Washington State University, USA |

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## Symposium QT02: Interfaces in Spintronics

*Interfaces* between materials that are characterized by different chemical, structural, magnetic, and/or (magneto)-transport properties play a crucial role in *spintronics*. In fact, the functionalities of any spintronic device are intimately interlaced with the electron's spin degree of freedom, and with its control and/or creation and/or manipulation across interfaces between neighboring materials. The symposium will discuss the development of novel materials (topological matter, low-dimensional ferromagnets, Heusler alloys, high T(C) superconductors, emerging ferroics, …) and their interfacing towards their use in spintronic devices. The constant decrease in devices' dimensions brings to the point where the interfaces become the device. It is therefore of paramount importance to achieve an increasingly high control on their quality and understanding of their physical properties. Within this symposium, contributions focusing on understanding the direct link between interface properties in driving devices' functionalities are very welcome, together with studies addressing the comprehensive characterization of interfaces by making use of wide range of analytical tools, such as (but not limited to) spin-orbit torque, terahertz spectroscopy, ferromagnetic resonance, hyperfine methods, synchrotron-based techniques, ... Thanks to the expected highly multidisciplinary contributions, the symposium will serve as a basis to establish fruitful connections among research groups with complementary expertise, thus bringing the community towards fruitful collaborations with the aim of addressing present and future open questions in spintronics, and to shape the next generation of spintronic devices.

## Topics will include:

- Heterostructures combining topological matter, multiferroics, high temperature superconductors, 2D materials, synthetic antiferromagnets…
- Spintronic devices: magnetic tunnel junctions, SOT-MRAM, racetracks, MESO device, spin logic, probabilistic and neuromorphic computing, …
- Spin-Charge interconversion phenomena
- Skyrmions' hosting systems
- Topological superconductivity for quantum applications
- Interface-sensitive methods (experiment and theory)
- Magneto-electric effects at interfaces
- Light effects on interface properties
- Magneto-ionic effects at interfaces
- Tailoring magnetic properties with molecules

## Invited speakers include:

| | |
|---|---|
| **Johan Akerman** | University of Gothenburg, Sweden |
| **Onur Can Avci** | ICMAB-CSIC, Spain |
| **David Awschalom** | The University of Chicago, USA |
| **Agnes Barthelemy** | CNRS/Thales, France |
| **Geoffrey S.D. Beach** | Massachusetts Institute of Technology, USA |
| **Saroj Prasad Dash** | Chalmers University of Technology, Sweden |
| **José Maria De Teresa** | INMA Facultad de Ciencias, Spain |
| **Valentin Alek Dediu** | Consiglio Nazionale delle Ricerche, Italy |
| **Atanasious Dimoulas** | INN, Greece |
| **Shunsuke Fukami** | Tohoku University, Japan |
| **Eric Fullerton** | University of California, San Diego, USA |
| **Marcos H. D. Guimarães** | University of Groningen, Netherlands |
| **Luis E. Hueso** | CIC nanoGUNE, Spain |
| **Benjamin Jungfleisch** | University of Delaware, USA |
| **Andrew Kent** | New York University, USA |
| **Mathias Kläui** | Johannes Gutenberg-University, Germany |
| **Xiaoqin Elaine Li** | The University of Texas at Austin, USA |
| **Robert G. Moore** | Oak Ridge National Laboratory, USA |
| **Branislav Nikolic** | University of Delaware, USA |
| **Stuart Parkin** | Max Planck Institute of Microstructure Physics, Germany |
| **Ramamoorthy Ramesh** | University of California, Berkeley, USA |
| **Dafine Ravelosona** | Université Paris-Saclay, France |
| **Evgeny Tsymbal** | University of Nebraska, USA |
| **Sergio Valenzuela** | ICN2, Spain |
| **Peng Xiong** | Florida State University, USA |
| **Hongxin Yang** | Zhejiang University, China |
| **Lijun Zhu** | Institute of Semiconductors, Chinese Academy of Sciences, China |

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## Symposium QT03: Topological Materials—Growth, Theoretical Models and Applications

Topological materials are a new class of materials that can, thanks to their extraordinary properties, project us in the Beyond CMOS world. The symposium will cover the growth, the theoretical models on physics and the applications for topological materials. The first part will focus on the growth of this new kind of exotic materials. The growth of a new generation of topological materials, which is one of the fundamental aspects to trigger the discovery of new phenomema, will be presented and will have an important place. We will highlight the issues concerning the capacity to obtain materials that do not react with ambient environment using opportune protection without changing the materials properties and their functionalization for band gap engineering. The second part of the symposium will deal with the theoretical models explaining the topological behavior. A part will be devoted to the way and the conditions for the Quantum Spin Hall effect (QSH) to take place in 2D and 3D Topological insulators and also to new topological features in Weyl semimetal. Theoretical models that will link the QSH with other properties, such as ZT (figure of merit) for Thermoelectrics (TE) materials will be also be highlighted. The way to decouple phonon and charge in these materials exploiting functionalization or adding defects will be pointed out in this session. In the third part of the symposium, first applications of these materials will be presented. Computational materials contributions thta deal with the prediction of new topological materials will also been considered. Topological materials can be a game changer in different fields such as TE with large ZT (i.e. avionics, space, energy consumption reduction in new intelligent buildings), new forms of quantum computing/memories at subatomic level and beyond CMOS electronics exploiting spin transport with very low energy consumption. From the point of view of low TRL physics, we can also consider the potential for Majorana Fermion detection that can be implemented with 3D topological insulators. Abstract discussing potential applications but also exploratory research in these fields will be strongly solicited.

## Topics will include:

- Growth of topological materials, Chemical synthesis approach for topological materials, Ambient stability of topological materials
- Surface functionalization, Theoretical modelling of topological materials, Quantum transport
- Thermoelectric properties and devices, Sub-atomic quantum computing based on materials
- Beyond CMOS electronics based on topological materials, Topological effects and strain
- Topological insulators, Weyl semimetals, Computational materials predictive model

## Invited speakers include:

| | |
|---|---|
| **Gabriel Aeppli** | ETH Zürich, Switzerland |
| **Pantelis Bampoulis** | University of Twente, Netherlands |
| **Claudia Felser** | Max Planck Institute for Chemical Physics of Solids, Germany |
| **Lydie Ferrier** | INSA Lyon, France |
| **Benedetta Flebus** | Boston University, USA |
| **Duncan Haldane** | Princeton University, USA |
| **Zahid Hasan** | Princeton University, USA |
| **Thomas Heine** | Technische Universität Dresden, Germany |
| **Mathieu Jamet** | Commissariat à l'énergie atomique et aux énergies alternatives, France |
| **Charles Kane** | University of Pennsylvania, USA |
| **Alessandra Lanzara** | Lawrence Berkeley National Laboratory, USA |
| **Gil-Ho Lee** | Pohang University of Science and Technology, Republic of Korea |
| **Frederic Leroy** | Aix-Marseille Université, France |
| **Mingda Li** | Massachusetts Institute of Technology, USA |
| **Eugene J Mele** | University of Pennsylvania, USA |
| **Laurens W. Molenkamp** | Julius-Maximilians-Universität Würzburg, Germany |
| **Jagadeesh Moodera** | Massachusetts Institute of Technology, USA |
| **Lukas Muechler** | The Pennsylvania State University, USA |
| **Camelia Prodan** | New Jersey Institute of Technology, USA |
| **Raquel Queiroz** | Columbia University, USA |
| **niels schroeter** | Max Planck Institute, Germany |
| **Susanne Stemmer** | University of California, Santa Barbara, USA |
| **Alberto Verdini** | Consiglio Nazionale delle Ricerche, Italy |
| **Maia G. Vergniory** | Donostia International Physics Center, Spain |
| **Hanno Weitering** | The University of Tennessee, Knoxville, USA |
| **Justin Wells** | University of Oslo, Norway |
| **Bohm Jung Yang** | Seoul National University, Republic of Korea |
| **Junji Yuhara** | Nagoya University, Japan |

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## Symposium QT04: Molecular Quantum Systems

Quantum technologies are expected to revolutionize the way in which we process, communicate and secure information, and provide novel methods to detect fields and analytes with unprecedented sensitivity. However, current quantum technology platforms face challenges related to scalability, positioning of individual qubits, and the influence and correction of errors. To overcome these challenges, molecular qubits, which can be tailored with atomic precision, and lattice defects in wide bandgap semiconductors offer promising solutions. Besides, they are fascinating systems for research, with a focus on controlled formation of spin qubits and external error resilience. In the case of molecules, chemical design and synthesis afford creating highly reproducible, yet also tunable, spin qubits, enable accurately positioning and assembling them within each molecule, but also in large 3D or 2D arrays, and can engineer states that allow an efficient control and readout, e.g. by optical addressing.

The symposium will cover the latest advances in the fabrication and characterization of atomic and molecular qubits and their potential applications in quantum technology. Topics include the design and synthesis of molecular magnets and atomic defects in solids, their spectroscopic and theoretical investigation, as well as potential applications in quantum sensing. The development of hybrid qubit systems and the implementation of spin-photon interfaces for quantum control, communication, and computing will also be discussed.

Experts from different fields including chemistry, physics, and engineering will come together to provide a comprehensive overview of the current state-of-the-art in the field, discuss future challenges and opportunities, and inspire new collaborations and directions for future research.

## Topics will include:

- New molecular quantum bits with improved coherence times
- Few-qubit molecular quantum systems: design, synthesis, characterization, quantum gate operations
- Molecular qubit arrays, local addressing
- Investigation of decoherence mechanisms, decoherence free subspaces
- Optimal control of molecular quantum bits
- Optically addressable molecular quantum bits
- Electrical addressing of molecular quantum bits
- Strong coupling phenomena with molecular quantum bits
- Molecular quantum bit devices
- Quantum sensing, simulation, and computing with molecular quantum bits
- Color centers as atomic defects in diamond and related materials (in joint session with diamond symposium)

Joint sessions are being considered with **EL08 - Diamond Functional Devices—From Material to Applications**.
Also, a **tutorial** complementing this symposium is tentatively planned. Further information will be included in the MRS Program that will be available online in September.

## Invited speakers include:

| | | | |
|---|---|---|---|
| **Ken Albrecht** | Kyushu University, Japan | **Shang-Da Jiang** | South China University of Technology, China |
| **David Awschalom** | The University of Chicago, USA | **Heike Riel** | IBM Research-Zurich, Switzerland |
| **Paola Cappelaro** | Massachusetts Institute of Technology, USA | **Mario Ruben** | Karlsruhe Institute of Technology, Germany |
| **Eugenio Coronado** | Universitat de València, Spain | **Roberta Sessoli** | Universita degli Studi di Firenze, Italy |
| **Selvan Demir** | Michigan State University, USA | **Floriana Tuna** | The University of Manchester, United Kingdom |
| **Emrys Evans** | Swansea University, United Kingdom | **Joris van Slageren** | University of Stuttgart, Germany |
| **Giulia Galli** | The University of Chicago, USA | **Joseph Zadrozny** | Colorado State University, USA |
| **Stephen Hill** | Florida State University, USA | | |

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## Symposium QT05: Quantum Phenomena, Measurements and Engineering in Materials

Solid-state materials set the ideal platform for future devices with quantum applications, such as quantum computing, quantum simulations, quantum communications, and quantum sensing. This rapidly evolving field calls for profound understanding of quantum phenomena in materials and quantitative measurements of entanglement in real time and in operando. Together with these understanding and measurements comes the engineering and design of quantum materials. This includes the design of new material structures exhibiting novel quantum phenomenon and the control of existing quantum materials for application purpose. All these quantum material applications have been driven by the synergy of experiments and theory in recent decade. Given these rapidly evolving applications, we feel obliged to organize a symposium to address the three aspects of quantum materials and how these research studies can lead to new revolutions in industry. We envision this first part of this symposium to highlight the most recent progress in novel quantum phenomenon in materials with, such as topological superconductivity, quantum spin liquidity, many-body localization, and Wigner crystallization. This symposium should also cover as it second objective the experimental techniques for quantum materials characterization and theoretical proposals about for novel quantum measurements, such as coherent spectroscopy, color-center measurements, and quantum noise. Finally, we emphasize the engineering of quantum materials in samples and devices and their potential connections to industrial applications. The goal of this symposium is to provide an interactive forum to facilitate materials scientists from all these three fields to communicate cutting-edge progress and discuss synergistic collaborations. Specific sessions will be organized regarding the scientific theme topics to benefit cross-fertilization.

### Topics will include:

- Topological quantum materials; Strongly correlated quantum materials
- Photonic quantum materials; Quantum simulations based on materials
- Phonon spectroscopy for quantum measurements
- Microscopy probe for quantum entanglement
- Ultrafast quantum control; Interface control of quantum states
- Synthesis of quantum materials; Quantum sensors

A **tutorial** complementing this symposium is tentatively planned. Further information will be included in the MRS Program that will be available online in September.

### Invited speakers include:

| | | | |
|---|---|---|---|
| **Igor Aharonovich** | University of Technology Sydney, Australia | **Hae-Young Kee** | University of Toronto, Canada |
| **Peter Armitage** | Johns Hopkins University, USA | **Junichiro Kono** | Rice University, USA |
| **Leon Balents** | University of California, Santa Barbara, USA | **Ju Li** | Massachusetts Institute of Technology, USA |
| **Dmitri Basov** | Columbia University, USA | **Charles Marcus** | University of Washington, USA |
| **Denitsa Baykusheva** | Institute of Science and Technology Austria, Austria | **Janina Maultzsch** | Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany |
| **Mona Berciu** | The University of British Columbia, Canada | **Matteo Mitrano** | Harvard University, USA |
| **Laurent Cognet** | Université de Bordeaux, France | **Prineha Narang** | University of California, Los Angeles, USA |
| **Maria Daghofer** | Universität Stuttgart, Germany | **Titus Neupert** | University of Zurich, Switzerland |
| **Eugene Demler** | ETH Zürich, Switzerland | **Elke Neu-Ruffing** | RPTU Kaiserslautern, Germany |
| **Michel Devoret** | Yale University, USA | **Branislav Nikolic** | University of Delaware, USA |
| **Chunhui Du** | Georgia Institute of Technology, USA | **Markus Oberthaler** | Heidelberg University, Germany |
| **Universität Düsseldorf** | Heinrich-Heine-Universität Düsseldorf, Germany | **Hongkun Park** | Harvard University, USA |
| **Danna Freedman** | Massachusetts Institute of Technology, USA | **Friedrich Prinz** | Stanford University, USA |
| **Kai-Mei Fu** | University of Washington, USA | **Stephanie Reich** | Freie Universität Berlin, Germany |
| **Liang Fu** | Massachusetts Institute of Technology, USA | **Ivano Tavernelli** | IBM Research-Zurich, Switzerland |
| **Tony Heinz** | Stanford University, USA | **Lieven Vandersypen** | Delft University of Technology, Netherlands |
| **James Hone** | Columbia University, USA | **Shuo Yang** | Tsinghua University, China |
| **Ania Jaych** | University of California, Santa Barbara, USA | **Yi Yin** | Zhejiang University, China |

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## Symposium SB01: Electrifying Biomaterials—Frontiers of Biohybrid Devices

New sustainable processes are needed to meet the increasing energy and materials demands of our society. Applications ranging from the chemical synthesis and power generation to agriculture, sensing, and waste treatment all contribute to this growing demand. Biological materials offer a promising basis for replacing current energy and material-intensive processes with more sustainable solutions. The advantages of these materials are amplified when coupled with abiotic components that can augment biological performance with increased control on functionality.

Recent efforts have focused on the use of biomaterials in biohybrid electrochemical systems. These systems incorporate biological components such as enzymes, extracted scaffolds, organelles, and even intact photosynthetic organisms like macroalgae and plants for applications in energy and sensing. However, these technologies suffer from bottlenecks such as limited electron transfer, diminished signal transduction, long term instability, and low yields. An interdisciplinary approach is therefore needed to overcome these bottlenecks, with joint efforts from material scientists, chemists, synthetic biologists, microbiologists, and engineers. We aim to create a symposium that brings together diverse scientists and engineers with the complementary expertise needed to realize the breadth of emerging technologies. The symposium will also include an open discussion session on the future research needs that the biomaterials society is called to address. Such a discussion will foster future collaborations and openness among researchers in all stages of their career.

## Topics will include:

- Electroactive biomaterials
- Bio-based and biodegradable electrodes
- Semi-artificial photosynthesis
- Artificial biofilms
- Bio-photovoltaics
- Bioelectrosynthesis of valuable compounds
- Biohybrids systems for biomedical applications
- Redox polymers
- Biocatalyst engineering
- Biomaterials for sensing
- Waste treatment

## Invited speakers include:

| | |
|---|---|
| **Caroline Ajo-Franklin** | Rice University, USA |
| **Arpita Bose** | Washington University in St. Louis, USA |
| **David Cliffel** | Vanderbilt University, USA |
| **Gianluca Farinola** | Università degli Studi di Bari Aldo Moro, Italy |
| **Renee Kroon** | Linköping University, Sweden |
| **Seonyeong Kwak** | Seoul National University, Republic of Korea |
| **Rossella Labarile** | Consiglio Nazionale delle Ricerche, Italy |
| **Ross Milton** | Université de Genève, Switzerland |
| **Nicolas Plumere** | Technische Universität München, Germany |
| **Melania Reggente** | École Polytechnique Fédérale de Lausanne, Switzerland |
| **Achilleas Savva** | Delft University of Technology, Netherlands |
| **Lior Sepunaru** | University of California, Santa Barbara, USA |
| **Federico Tasca** | Universidad de Santiago de Chile, Chile |
| **Claudia Tortiglione** | Consiglio Nazionale delle Ricerche, Italy |
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## Symposium SB02: Biotronics—Soft Ionic and Electronic Devices for Biological Applications

The intrinsic bioelectric activities at the cellular level result in ionic activities and charge gradients in the bioenvironment surrounding the cell. This charge gradient is a key component of inter- and intra-cellular signaling and process control. This symposium explores the domain of biotronics, which concerns the study of ionic and/or electronic devices that emulate and function at the interface of biology at the cellular level through interactions with the bioenvironment. This symposium highlights the recent advancements in ionic and electronic materials, technologies, and biotronics for *in vivo* and *in vitro* applications. The symposium will consist of two main segments: the first segment will be primarily dedicated to the design of materials and material interfaces for biotronics, including soft polymeric nanocomposites, biomaterials, nanomaterials, 2D and 3D nanostructured materials (*e.g.*, graphene, MXenes, MOFs, COFs, etc.), and cell-inspired surfaces. The other segment will be focused on the design and fabrication of various biotronics, including soft biotronics, bioelectronics, organ-on-a-chip devices with integrated biotronics, and emerging *in vivo* and *in vitro* applications of biotronics, as well as emerging technological breakthroughs, including signal processing and computing capabilities of biotronics. This interdisciplinary symposium would bring together emerging and cutting-edge advancements at the intersection of materials science, biology, nanotechnology, electronics, and ionics to shape the future of biotronics.

## Topics will include:

- Soft bioionics and bioelectronics
- Organic bioionics and bioelectronics
- Emerging materials for biotronics/bioelectronics
- 2D electronic materials for biotronics/bioelectronics
- 3D frameworks for biotronics/bioelectronics
- Biomolecular and biomembrane biotronics/bioelectronics
- Ionic transistors and transistor-like devices for biotronics/bioelectronics
- Bioelectronics for system-on-a-chip applications
- Bioelectronics for cellular & subcellular interfaces and models

Joint sessions are being considered with **SB04 - Materials and Devices for *in vitro* Cell—Tissue-Electronic Interfaces**.

## Invited speakers include:

| | | | |
|---|---|---|---|
| **Mohammad Reza Abidian** | University of Houston, USA | **Stéphanie P. Lacour** | École Polytechnique Fédérale de Lausanne, Switzerland |
| **Polina Anikeeva** | Massachusetts Institute of Technology, USA | **Nanshu Lu** | The University of Texas at Austin, USA |
| **Ana Claudia Arias** | University of California, Berkeley, USA | **Katherine Mirica** | Dartmouth College, USA |
| **Zhenan Bao** | Stanford University, USA | **Roisin Owens** | University of Cambridge, United Kingdom |
| **David Cahen** | Weizmann Institute of Science, Israel | **Xing Sheng** | Tsinghua University, China |
| **Huanyu Chen** | The Pennsylvania State University, USA | **Bozhi Tian** | The University of Chicago, USA |
| **Susan Daniel** | Cornell University, USA | **Luisa Torsi** | Università degli Studi di Bari, Italy |
| **Martin Kaltenbrunner** | Johannes Kepler Universität Linz, Austria | **Klas Tybrandt** | Linköping University, Sweden |
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| **Dae-Hyeong Kim** | Seoul National University, Republic of Korea | | |

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## Symposium SB03: Wood Nanoscience, Nanoengineering and Materials

Wood is the most extensively used biological material ascribing to its nature-designed hierarchical structure. Within the concept of the circular bioeconomy, many new opportunities are being uncovered considering a sustainable society while simultaneously lowering the net carbon footprint. Wood and derived materials are accessed as suitable solutions to fulfill the needs of a range of technologies beyond traditional applications. There are grand challenges in the fundamental research to bring wood and wood-based materials closer to a fossil-free future, many of which relate to the fractionation, handling and processing in ways that diverge from practices that are currently applied. Tailoring the nanostructure and resultant properties of wood, for instance, in the design of advanced materials demands new approaches and fundamental understanding beyond the existing ones. On top of that, novel devices with both excellent functionality and mechanical flexibility call for system-level integration. Finally, efficient use and increase of wood resources will secure the circularity of the bioeconomy if green and energy-efficient processing and recycling/recovery/reuse is ensured.

This symposium aims to bring together scientists and engineers from diverse and multidisciplinary fields with a strong interest in wood and wood-derived materials science and related fields. We provide a forum to communicate recent achievements, to exchange the latest knowledge, and discuss the possibilities of implanting wood and wood-derived materials for advanced materials and systems towards a real sustainable bioeconomy.

## Topics will include:

- Fundamental science of wood: Formation, Nanostructure understanding and multi-scale modeling, chemical, mechanical, thermal, acoustic, and optical properties, interaction with water/moisture, diffusion, etc.
- Nanocellulose, lignin, hemicellulose, and their functional structures: Characterizing cellulosic materials, lignin, hemicellulose, and hierarchical structures, multifunctional composites, functionalization, lightweight and strong composites, transparent substrates, magnetic nanostructures, 3D aerogel, hydrogel.
- Wood nanoengineering: Wood nanostructural control, functional materials design, composite materials, biorefinery (chemicals, biofuel), nanomanufacturing.
- Electronics: Flexible and printed electronics, optoelectronics, actuators, liquid crystals, and displays, piezo electronics.
- Bioengineering: Microfluidics, Biosensors, cellulose plasmonics and nanofluidics, bioactive materials, biomedical.
- Energy management: Solar cells, batteries, power generators, novel carbon and fuel cells, flexible energy storage, water splitting, energy storage, thermal insulation.
- Water treatment: Water purification, solar water evaporation, water oil separation, metal ion adsorption.
- Other Emerging applications: Smart materials, emerging membranes.
- Circularity: Green chemistry, energy-efficient processing, recycling, circular economy, resources increase and efficient use.

## Invited speakers include:

| | | | |
|---|---|---|---|
| **Federico Bella** | Politecnico di Torino, Italy | **Pedro Sarmento** | The Navigator Company, Portugal |
| **Bernard Cathala** | Institut National de la Recherche Agronomique, France | **Gilberto Siqueira** | Empa–Swiss Federal Laboratories for Materials Science and Technology, Switzerland |
| **Reverant Crispin** | Linköping University, Sweden | **Emil Thybring** | University of Copenhagen, Denmark |
| **Feng Jiang** | The University of British Columbia, Canada | **Xiaoqing Wang** | Chinese Academy of Forestry, China |
| **Martin Lawoko** | KTH Royal Institute of Technology, Sweden | **Lining Yao** | Carnegie Mellon University, USA |
| **Anna Loromaine** | Institute of Materials Science of Barcelona, Spain | **Yao Yuan** | Yale University, USA |
| **Shuangxi Nie** | Guangxi University, China | **Hongli Zhu** | Northeastern University, USA |
| **Tiina Nypelö** | Aalto University, Finland | **Junyong Zhu** | United States Department of Agriculture, USA |
| **Hugh O'Neill** | Oak Ridge National Laboratory, USA | | |

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## Symposium SB04: Materials and Devices for *in vitro* Cell—Tissue-Electronic Interfaces

Over the last two decades, the field of bioelectronics has greatly progressed due to parallel advances in materials chemistry, bioengineering, and electronics. This progress has been further amplified by the advent of organic and 2D electronic materials that can be used as alternatives to traditional electronics. These materials not only can promote the seamless connection and communication with the biological content, but also allows for the efficient transduction and amplification of biological signals using bioelectronic devices both *in vivo* and *in vitro*.

This symposium will provide a timely opportunity to discuss advances in *in vitro* bioelectronics, covering a range of multifunctional materials (from organics to hybrids and 2D materials) for interfacing with biological systems at different scales and complexity levels. It will focus on novel *in vitro/on-chip* bioelectronic device designs and functions, as well as on fabrication techniques and real world biomedical applications. This symposium aims to bring together scientists working in academia and industry in the fields of chemistry, physics, biomaterials, bioengineering and electrical engineering. Topics of interest include bioelectronics for *in vitro* cell models, cell-based biosensing, biointegrated electronics, bioprinting/biofabrication, 3D bioelectronics, cell-free biological models (cell membranes, vesicles etc.).

## Topics will include:

- Bioelectronics for cellular & subcellular interfaces and models.
- 2D electronic materials for biotronics/bioelectronics
- Bioelectronics for system-on-a-chip applications (organ- /membrane-on-chips, electrophoretic chips, wound healing assays etc.)
- Bioinspired and biomimetic electronic materials and architectures
- Cell-electronics interface engineering (i.e., functionalization, micro-/nano-structuring)
- Electrochemical cell-based biosensors
- Bioelectronics for *in vitro* tissue regeneration
- Additive manufacturing technologies (i.e. bioprinting) for functional tissue-electronic interfaces
- Electro-responsive systems for controlled drug release & delivery
- Interfacing subcellular components (i.e., organelles, vesicles etc) with bioelectronics

Joint sessions are being considered with **SB02 - Biotronics—Soft Ionic and Electronic Devices for Biological Applications**.

## Invited speakers include:

| | | | |
|---|---|---|---|
| **Herdeline Ann Ardoña** | University of California, Irvine, USA | **Anna Maria Pappa** | Khalifa University, United Arab Emirates |
| **Magnus Berggren** | Linköping University, Sweden | **Agneta Richter Dahlfors** | Karolinska Institutet, Sweden |
| **Susan Daniel** | Cornell University, USA | **Marco Rolandi** | University of California, Santa Cruz, USA |
| **Tal Dvir** | Tel Aviv University, Israel | **Francesca Santoro** | Forschungszentrum Jülich GmbH, Germany |
| **Vasiliki Giagka** | Delft University of Technology, Netherlands | **Xenophon Strakosas** | Linköping University, Sweden |
| **Sahika Inal** | King Abdullah University of Science and Technology, Saudi Arabia | **Bozhi Tian** | The University of Chicago, USA |
| **Sungjune Jung** | Pohang University of Science and Technology, Republic of Korea | **Luisa Torsi** | Università degli studi di Bari Aldo Moro, Italy |
| **Massimo Mastrangeli** | Delft University of Technology, Netherlands | **Christina Tringides** | Harvard University, USA |

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## Symposium SB05: Biomaterials for Regenerative Engineering

Regeneration of damaged tissues represents a major medical need. A promising approach for development of properly functioning tissue replacements is to utilize engineered biomaterials. Regenerative engineering aims to repair and regenerate damaged or diseased tissues and organs by converging materials science, developmental biology, stem cell incorporation, and clinical approaches.

This symposium will cover interdisciplinary topics such as materials science, chemistry, cell biology, physics, engineering, and medicine. The sessions of this symposium will emphasize material properties and applications of biomaterials (polymers, hydrogels, ceramics, metals, elastomers, fibers, composites, gradients) for regenerative tissue engineering. Additionally, we will cover delivery of small molecules (proteins, peptides, growth factors, drugs, micro/nanoparticles, DNA, RNA), and applications of micro- nano-technologies to control cell behavior. We will also emphasize the importance of translation of bench information into patient care by facilitating discussions between engineers, clinicians, and medical device companies. Professionals from different areas of expertise including materials scientists, members of national laboratories, professors, students (undergraduate/gradate), early career scientists, industry members, biotechnology experts, and medical practitioners will be interested in this symposium. This multidisciplinary symposium will serve towards the objectives of the MRS by contributing to education and training of the next generation of materials researchers, providing opportunities for career and professional development of materials scientists, and help broaden diversity.

## Topics will include:

- Hydrogels to control and direct cellular behavior
- Synthetic biomaterials for fabrication of implantable scaffolds
- Scaffolds from biomaterials of natural origin
- Stimuli-responsive polymers and intelligent materials for regenerative medicine
- Rapid prototyping approaches to generate tissue-mimetics
- Biomaterials as artificial tissue replacements
- Cardiovascular biomaterials
- Instructive materials to modulate stem cell behavior
- Micro- nano- technologies for fabrication of tissue scaffolds
- Composite hydrogels and multi-network biomaterials
- Clinical translation of bench information into bed-side care
- High-throughput approaches for synthesis and screening of biomaterials
- Biomaterials for musculoskeletal tissue engineering

## Invited speakers include:

| | | | |
|---|---|---|---|
| **Francois Berthiaume** | Rutgers University, USA | **Cato Laurencin** | University of Connecticut Health Center, USA |
| **George Christ** | University of Virginia, USA | **Milica Radisic** | University of Toronto, Canada |
| **Murat Guvendiren** | New Jersey Institute of Technology, USA | **Kaushal Rege** | Arizona State University, USA |
| **Ana Jaklenec** | Massachusetts Institute of Technology, USA | **Basak Uygun** | Massachusetts General Hospital, Harvard, USA |
| **Roger Kamm** | Massachusetts Institute of Technology, USA | **Shyni Varghese** | Duke University, USA |
| **Srivatsan Kidambi** | University of Nebraska–Lincoln, USA | **Ruogang Zhao** | University at Buffalo, The State University of New York, USA |

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## Symposium SB06: 2D Materials for Theranostics

Nanomedicine in oncology potentiates great innovations, by the synergy of two or more forms of treatment and diagnostic techniques, aka theranostics. Specifically, two dimensional (2D) materials are considered as promising nanotheranostic tools since they can act as imaging agents for cancer detection/visualization with customized therapeutic properties and/or as vectors for controlled drug/gene release. They have outstanding properties, such as light weight, flexibility, high surface-to-volume ratio, highly efficient light absorption and high reactivity to high energy excitations. Hence, 2D materials enable the combination of multiple imaging modalities and therapeutic functions, such as passive/active targeting of tumors, and stimuli-responsive, controlled drug release, into a single nanoplatform. The symposium focuses on the *state-of-the-art* research of 2D materials in theranostics, extending to large-scale material production for biological applications, functionalization and conjugation, integration with other nanomaterials, applications to cancer treatment and other novel applications, such as anti-viral and anti-bacterial ones. The symposium addresses the fundamental principles of 2D materials; their interaction with biological systems, including safety assessment (a prerequisite for the successful translation to clinical research); their hazard potential, including the presence of endotoxins, bio-distribution, degradation and excretion from the body. Contributions on graphene-like (graphene, graphene oxide, boron nitride) and beyond-graphene materials, (transition metal dichalcogenides, MXenes, black phosphorus and more) will be considered.

## Topics will include:

- 2D materials fabrication and properties (including large scale production)
- Layered materials based nanostructures for bio-applications: quantum dots, nanoparticles, nanoflakes, etc.
- Functionalization of 2D materials (including chemical conjugation)
- Smart multi-functional 2D nanoplatforms and composites for theranostic applications
- Single cell interactions
- Nanotoxicology and biocompatibility
- Degradation and excretion of 2D materials from the body
- Cancer cell targeting with polymeric and bio inspired approaches
- *In vitro* and *in vivo* imaging methods
- Drug and/or gene delivery
- 2D materials for Photo Thermal Therapy / Photo Dynamic Therapy (including ROS production)
- Anti-viral and anti-bacterial applications
- 2D materials as radiosensitizing agents
- Excitation with high energy particles (X-ray, gamma ray, electrons and protons)
- Immunomodulation and nano-immunity

Joint sessions are being considered with **EL04 - Recent Advances in Hybrid Perovskites**.

## Invited speakers include:

| | | | |
|---|---|---|---|
| **Christoffer Åberg** | University of Groningen, Netherlands | **David Leong** | National University of Singapore, Singapore |
| **Francesco Bonaccorso** | BeDimensional, Italy | **Xia Li** | National Institute for Materials Science, Japan |
| **Mattia Bramini** | Universidad de Granada, Spain | **Cecilia Mattevi** | Imperial College London, United Kingdom |
| **Cinzia Casiraghi** | The University of Manchester, United Kingdom | **Giancarlo Salviati** | Consiglio Nazionale delle Ricerche, Italy |
| **Lucia Gemma Delogu** | Università degli Studi di Padova, Italy | **Paolo Samori** | Université de Strasbourg, France |
| **Bengt Fadeel** | Karolinska Institutet, Sweden | **Avi Schroeder** | Technion–Israel Institute of Technology, Israel |
| **Akhilesh Gaharwar** | Texas A&M University, USA | **Zdenek Sofer** | University of Chemistry and Technology. Prague, Czech Republic |
| **Robert Hurt** | Brown University, USA | **Michael Strano** | Massachusetts Institute of Technology, USA |

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## Symposium SB07: 3D Bioinspired Biomaterials

This symposium will be focused on a grand challenge in biomaterials science, which is the design of bioinspired materials to support active processes in nature by materials, which can interact with biological systems at different scales. In vivo materials often contain pores, are soft and react in an autonomous way, e.g., in healing. A particular focus will be on the molecular understanding and manufacturing of porous, conductive and responsive materials, to mimic the responsiveness, activity and self-healing ability of living systems. This is an emerging topic in materials research with the potential for large-scale impact, ranging from optimizing implants for living systems to organoid and disease models. The first part of the symposium will focus on the molecular mechanisms leading to soft, porous and responsive materials. The second part will cover larger scale systems, with a particular focus on porous and biohybrid systems that can host living cells and can be controlled by external stimuli. The meeting will bring together researchers with different interdisciplinary materials science background in order to generate novel ideas and applications in the field.

Contributions can address topics including 3D biomaterials that mimic biology from a structural perspective (e.g., porous materials, 3D printed materials) or mechanical properties (e.g., viscoelastic properties). In addition, responsive materials, particularly in conjunction with biological systems (e.g., synthesis of responsive molecules, responsive materials, mechanical control of materials), and methods to generate biohybrid systems based on such materials are welcomed.

## Topics will include:

- Methods to generate and analyse 3D biomaterials
- 3D (bio)printing methods and advanced manufacturing for biomaterials
- Viscoelastic properties of biomaterials and biological systems
- Characterization of biological systems in the context of 3D materials
- Responsive molecules and materials
- Self-healing biomaterials
- Applications of 3D materials in tissue engineering
- Controlling multicellular systems in 3D materials
- Biohybrid 3D systems engineering

## Invited speakers include:

| | |
|---|---|
| **Nasim Annabi** | University of California, Los Angeles, USA |
| **Aysu Arslan** | BionInx Inc., Belgium |
| **Cecile Bidan** | Max Planck Institute for Colloids and Interfaces, Germany |
| **Eva Blasco** | Heidelberg University, Germany |
| **Aránzazu del Campo** | INM–Leibniz Institute for New Materials, Germany |
| **Zvonomir Dogic** | University of California, Santa Barbara, USA |
| **John Dunlop** | Paris-Lodron-Universität Salzburg, Austria |
| **Akhilesh Gaharwar** | Texas A&M University, USA |
| **John Hardy** | Lancaster University, United Kingdom |
| **Julianne Holloway** | Arizona State University, USA |
| **Don Ingber** | Harvard University, USA |
| **Roger Kamm** | Massachusetts Institute of Technology, USA |
| **Kristopher Kilian** | University of New South Wales, Australia |
| **John Klier** | The University of Oklahoma, USA |
| **Aldo Leal-Egana** | Heidelberg University, Germany |
| **Cornelia Lee-Thedieck** | Hannover University, Germany |
| **Berit Lokensgaard Strand** | Norwegian University of Science and Technology, Norway |
| **Mary Beth Monroe** | Syracuse University, USA |
| **Humberto Palza** | Universidad de Chile, Chile |
| **Benjamin Richter** | Nanoscribe Inc., Germany |
| **Adrianne Rosales** | The University of Texas at Austin, USA |
| **Shane Scott** | McMaster University, Canada |
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December 1–6, 2024 | Boston, Massachusetts

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## Symposium SB08: Smart and Living Materials for Advanced Engineering Systems

This symposium will broadly cover the current status and future research trends in emerging smart and living materials. Smart materials can be defined as stimuli-responsive materials, capable of sensing external stimuli and responding to them through physical, chemical or biological changes, allowing their usage in a wide variety of applications. Among several families of responsive materials, living materials with embedded archaea, bacteria, and eukaryotic cells, are emerging as the most promising ones in recent years due to their "living" features, including self-healing and self-regeneration. Given the extensive landscape of smart and living materials and the radical change due to the development of design and fabrication (including 3D and 4D (bio)printing) of these matters in unprecedented ways, it is fundamental to exchange good practices and strategies for effectively utilizing these materials and empowering them towards true societal transformations. In this symposium, we aim to bring together the community of living materials and abiotic smart materials to initiate a knowledge exchange and strengthen mutual interests and overlaps. The symposium will focus on the evolution of smart and living materials, their underlying working principles, process development, and integration into devices. The emphasis will be on the engineering of these materials and derived structures and applications, starting from the basic scientific principles, mathematical modeling, and processing through novel fabrication technologies, including synthetic biology, 3D bioprinting, additive manufacturing, and electrohydrodynamic printing, to name a few, and their deployment to a broader range of end-use cases. Smart and living materials may include but are not limited to, shape-morphing materials, shape-memory materials, electroactive materials, responsive biofilms, biohybrid materials, and biohybrid actuators. The speakers in the symposium should address the fundamental scientific background to their topic, scientific challenges, the involvement of smart or living materials in their solution, and future directions in the interface between materials science, synthetic biology and engineering design.

## Topics will include:

- Smart materials and structures for intelligent engineering systems
- Engineered living materials, including biohybrid living materials and biological living materials
- Biohybrid materials, devices, systems, living smart matter
- Stimuli responsive materials with bioinspired and biomimetic features
- Biomimetic materials, structures, and architectures with quasi living behabior
- Synthetic biology for engineering materials: current capabilities and challenges
- Novel synthesis routes through chemical, mechanical or biological self-assembly
- Fabrication and characterization of living and smart materials
- Applications of living and smart materials
- Ethical, legal, and social aspects related to the technological development of smart and living materials
- Sustainable design approaches and life cycle assessment of smart and living materials for advanced engineering systems

## Invited speakers include:

| | |
|---|---|
| **Caroline Ajo-Franklin** | Rice University, USA |
| **Mahdi Bodaghi** | Nottingham Trent University, United Kingdom |
| **Aránzazu del Campo** | INM–Leibniz Institute for New Materials, Germany |
| **Mette Ebbesen** | Aalborg University, Denmark |
| **Christoph Eberl** | Fraunhofer Institute for Mechanics of Materials IWM, Germany |
| **Matthew Fields** | Montana State University, USA |
| **Zhibin Guan** | University of California, Irvine, USA |
| **Chris Hernandez** | University of California, San Francisco, USA |
| **Aitziber Lopez Cortajarena** | CIC biomaGUNE, Spain |
| **Anne Meyer** | University of Rochester, USA |
| **Jon Molina Aldareguia** | IMDEA Materials Institute, Spain |

| | |
|---|---|
| **Sara Molinari** | University of Maryland, USA |
| **Alisa Morss Clyne** | University of Maryland, USA |
| **Alshakim Nelson** | University of Washington, USA |
| **Jenny Sabin** | Cornell University, USA |
| **Thomas Speck** | University of Freiburg, Germany |
| **Will V Srubar III** | University of Colorado Boulder, USA |
| **Taylor Ware** | Texas A&M University, USA |
| **Tak-Sing Wong** | The Pennsylvania State University, USA |
| **Ryo Yoshida** | The University of Tokyo, Japan |
| **Rayne Zhang** | University of California, Berkeley, USA |

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## Symposium SB09: Fundamental Processes at Electroactive Biological Interfaces

This symposium will cover the fundamental processes at the interface between biological systems and electroactive materials, including experimental and simulation-based studies. In this context, biological systems refer to living matter at different scales, from extracted cells and unicellular organisms to higher-order animals and plants, which have been used to explore phenomena at the interface between electroactive materials and biological systems. Our objective is to stimulate a discussion on how the different classes of electroactive materials, such as conducting polymers, metals, metal oxides, inorganic semiconductors and carbon-based materials affect the efficiency of signal transfer at the biotic-abiotic interface. Our symposium will cover monitoring of the biological systems but also aspects of the active stimulation of biological functions by electroactive systems. The symposium will address how physical stimulation (e.g., electrical, electromagnetic, mechanical) can impact the biointerface and the fate and behaviour of the biological counterpart under analysis.

We expect this symposium to attract a broad multidisciplinary audience, including materials scientists and engineers, biologists as well as neuroscientists and medical doctors, from academia, national laboratories, and industry. The symposium will last 3 days and will be tentatively divided into three parts: 1) emerging materials for electroactive interfaces, 2) progress in active bio-stimulation, 3) *in vitro* and *in vivo* characterization of electroactive bio-interfaces.

### Topics will include:

- Electroactive materials (carbon-based, silicon-based, polymer-based)
- Fundamental investigation of the biointerfaces
- Bioelectrochemistry
- Electroactive monitoring of biological systems
- Physical stimulation
- Numerical simulations

### Invited speakers include:

| | |
|---|---|
| **Oliya Abdullaeva** | Luleå University of Technology, Sweden |
| **Maria Rosa Antognazza** | Istituto Italiano di Tecnologia, Italy |
| **Eric D. Glowacki** | CEITEC - Central European Institute of Technology, Czech Republic |
| **Sohini Kar-Narayan** | University of Cambridge, United Kingdom |
| **Sam Kassegne** | San Diego State University, USA |
| **Christopher Proctor** | University of Oxford, United Kingdom |
| **Xenofon Strakosas** | Linköping University, Sweden |
| **Claudia Tortiglione** | Consiglio Nazionale delle Ricerche, Italy |
| **Maria Vomero** | NeuroOne Medical Technologies, USA |
| **Tomoyuki Yokota** | The University of Tokyo, Japan |
| **Myung-Han Yoon** | Gwangju Institute of Science and Technology, Republic of Korea |

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## Symposium SB10: Soft Materials for Sensors and Actuators in e-textiles and e-skins

E-textiles and e-skins with embedded sensors and electronics receive widespread interest for applications ranging from health monitoring, tactile devices to displays and antennas, as well as energy harvesting and storage. At the same time there is growing interest in actuating e-textiles for adapting shape, supporting motion of limbs, haptic feedback, or even acting as exoskeletons. For these e-textile actuators, high-performance materials are combined with soft robotic approaches. The sensitivity of e-skins is often coupled with artificial intelligence to enable autonomy in driving e-textile actuators.

Some key challenges of e-textiles include (1) transferring actuation approaches into development of fibers, yarns and fabrics with an optimal combination of electrical and mechanical properties, (2) energy efficiency (3) developing effective manufacturing methods (4) issues of use, ‘wear’ and ‘washing’ and (5) methods to reuse and recycle. Some key challenges in e-skins include (1) compact integration methodologies to include advanced bionic features, (2) constructing stretchy structures, (3) enhancing sensitivity, selectivity, and reliability of the sensors.

This symposium will provide a forum for collaborative discussions to address these challenges, in order to address both academic and industrial research needs and further developments. It will bring together researchers from highly diverse, interdisciplinary backgrounds such as materials engineers, polymer chemists, device physicists as well as entrepreneurs from industry.

Sessions will be dedicated to the selection of materials and development of yarns and fibres, approaches to implement actuation in textiles, and failure mechanisms and modelling. Sessions will also focus on the materials and devices developed to establish the form factor of e-skins and on the applications for e-textiles, wearables, nearables, and soft robotic hybrids will be reported. Challenges in commercializing the e-textile and e-skin devices will be discussed from both academia and industry perspectives.

## Topics will include:

- Tailored materials for e-textiles and e-skins
- Wearability, washability, and reliability
- Commercialization for various applications
- Sensing and actuating in textiles and garments
- Tactile sensors and haptic feedback
- Conformable and/or stretchable sensor skins
- Soft robotics for exoskeletons and protection
- Soft and wearable actuators
- Sustainability and recycling
- Mechanical/thermal/electrical modelling
- Interconnects and interfacing
- Innovative device structures

Joint sessions are being considered with **EN09 - Innovations in Materials and Processes for Printed, Flexible and Stretchable Energy-autonomous Sensing Systems**.

## Invited speakers include:

| | |
|---|---|
| **Ana Claudia Arias** | University of California, Berkeley, USA |
| **Michael Bartlett** | Virginia Tech, USA |
| **Stephen Beeby** | University of Southampton, United Kingdom |
| **Tricia Breen Carmichael** | University of Windsor, Canada |
| **Anastasia Elias** | University of Alberta, Canada |
| **Tae-Il Kim** | Sungkyunkwan University, Republic of Korea |
| **Ahyeon Koh** | Binghamton University, The State University of New York, USA |
| **Pooi See Lee** | Nanyang Technological University, Singapore |
| **Darren Lipomi** | University of California, San Diego, USA |
| **Jose Martinez** | Linköping University, Sweden |
| **Aurelie Mosse** | Ecole Nationale Supérieure des Arts Décoratifs, France |
| **Nils-Krister Perrson** | University of Boras, Sweden |
| **Vanessa Sanchez** | Rice University, USA |
| **Anne Ladegaard Skov** | Technical University of Denmark, Denmark |
| **Chad Webb** | Rhaeos Inc., USA |
| **Myung-Han Yoon** | Gwangju Institute of Science and Technology, Republic of Korea |

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## Symposium SB11: Biological and Bioinspired Polymers

Life relies on naturally occurring polymers (including melanins, cellulose, lignin, biosilica, and structural proteins like silk fibroins and collagen) that perform diverse and complex biological functions in living organisms. Biological polymers have been increasingly utilized in designing advanced materials that mimic nature, owing to their molecular functionalities, macromolecular structures, and versatile material properties for photonics, electronics, sustainable wearable products and architectural design, and nanotechnology. While natural sources provide an abundant supply of biological polymers, chemical modifications and implementation into hybrid architectures offer promising avenues for the development of advanced materials with superior performances.

The 2nd edition of the MRS Fall Symposium on Biological and Bio-Inspired Polymers aims to bring together leading scientists from diverse backgrounds and technical fields across academia and industry to share cutting-edge progress and challenges on biological and bio-inspired polymers. Discussion will focus on the materials aspect with applications discussed to complement and illustrate underlying chemical and physical properties. These will include biosynthesis, self-assembly, chemical or biological modification, and generation of new bio-hybrid systems, with the ultimate goal of unravelling the physical properties of complex chemical and biological systems. Advanced materials based on bio-inspired nano- and micro-structures will be covered, as well as devices and applications in photonics, electronics, biomedicine, and energy.

### Topics will include:

- Biological polymers as materials
- Biological materials for electronics and photonics, structural and product design
- Bio-inorganic materials (including biosilica, calcite, structural materials)
- Synthesis of bio-mimetic and bio-inspired polymers
- Chemical modification of bio-polymers
- Biotechnological production of bio-materials
- Bio-photonic and bioelectronic devices
- Bio-materials for biomedical devices
- Bioinspired functional materials and devices

### Invited speakers include:

| | |
|---|---|
| **Jinhye Bae** | University of California, San Diego, USA |
| **Davide Blasi** | Università degli Studi di Bari Aldo Moro, Italy |
| **Ardemis Boghossian** | École Polytechnique Fédérale de Lausanne, Switzerland |
| **Luisa De Cola** | Università degli Studi di Milano, Italy |
| **Michele Di Lauro** | Istituto Italiano di Tecnologia, Italy |
| **Gianluca Maria Farinola** | Università degli Studi di Bari, Italy |
| **Javier G. Fernandez** | Singapore University of Technology and Design, Singapore |
| **Neil Gershenfeld** | Massachusetts Institute of Technology, USA |
| **Seung Goo Lee** | University of Ulsan, Republic of Korea |
| **Giulia Guidetti** | Tufts University, USA |
| **Kenichiro Iuchi** | Canon Virginia, USA |
| **Jonathan Kluge** | Vaxess Technologies Inc., USA |
| **Guglielmo Lanzani** | Istituto Italiano di Tecnologia, Italy |
| **Yuhan Lee** | Harvard Medical School, USA |
| **Benedetto Marelli** | Massachusetts Institute of Technology, USA |
| **Fiorenzo Omenetto** | Tufts University, USA |
| **Changhyun Pang** | Sungkyunkwan University, Republic of Korea |
| **Melania Reggente** | École Polytechnique Fédérale de Lausanne, Switzerland |
| **Young Min Song** | Gwangju Institute of Science and Technology, Republic of Korea |
| **Eleni Stavrinidou** | Linköping University, Sweden |
| **Tzu-Chieh Tang** | Harvard University, USA |
| **Serpil Tekoglu** | Johannes Kepler Universität Linz, Austria |
| **Massimo Trotta** | Consiglio Nazionale delle Ricerche, Italy |
| **Silvia Vignolini** | Max Planck Institute of Colloids and Interfaces, Germany |
| **David D. Weitz** | Harvard University, USA |
| **Jonathan Wilker** | Purdue University, USA |
| **Shu Yang** | University of Pennsylvania, USA |
| **Lining Yao** | Carnegie Mellon University, USA |

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## Symposium SB12: Conductive Biological Materials

Electronic materials are conventionally the domain of human-made devices, but recent discoveries in cross-disciplinary areas have established that Nature makes materials that transport charges over long length scales as part of normal biological processes. Conductivity in such unconventional electronics materials, made of amino and nucleic acids and other biopolymers, are often poorly described by conventional transport models and require new theory for understanding long-range conductivity. These bioelectronic materials aim to interface synthetic electronic devices with biological systems, from biomolecules to cells, tissues, and entire organisms. Biological materials are ideal building blocks for satisfying these criteria due to their properties of biocompatibility, self-assembly and molecular recognition. In addition, the chemical diversity and specificity of sequence-programmable biopolymers can be designed to drive the formation of functional nanostructures and interfaces. The construction of electronic materials from biological building blocks also represents a promising approach to autonomous assembly of electronic devices from engineered organisms, including new electronic inputs and outputs for synthetic biology systems. In this symposium we will highlight work shedding light on mechanisms of charge transport in biological materials as well as bring together researchers from across traditional disciplinary boundaries to understand the guiding physical, chemical, and biological principles underlying conductivity in biological materials. The community studying these materials is spread across biology, physics, chemistry and engineering, but with recent advances in experimental and computational tools to probe these systems, there is a timely opportunity to convene a discussion on how these insights inform a materials science understanding of structure-processing-property relationships in these materials and resulting devices. In addition, this proposed symposium will highlight ways in which synthetic biology can be used to create functional bioelectronic interfaces in innovative device designs. We invite abstracts related to electronic conductivity in peptide- and protein-based materials, proton and other ion conductivity in biological materials, synthetic biology approaches to bioelectronic interfaces, structure and properties of novel conductive biological materials, the stimuli responsive assembly of conductive biomolecular materials, and bioelectronic interfaces and devices based on biological materials.

## Topics will include:

- Electronic conductivity in peptide and protein based materials
- Structure and properties of novel conductive biological materials
- Synthetic biology approaches to bioelectronic interfaces
- Computational approaches to understanding conductivity in biological materials
- Bioelectronic interfaces and devices based on biological materials
- Proton and other ion conductivity in biological materials

## Invited speakers include:

| | | | |
|---|---|---|---|
| **Caroline Ajo-Franklin** | Rice University, USA | **Filip Meysman** | University of Antwerp, Belgium |
| **Nurit Ashkenasy** | Ben-Gurion University of the Negev, Israel | **Ron Naaman** | Weizmann Institute of Science, Israel |
| **David Beratan** | Duke University, USA | **Ki Tae Nam** | Seoul National University, Republic of Korea |
| **Jochen Blumberger** | University College London, United Kingdom | **Christian Nijhuis** | University of Twente, Netherlands |
| **Ismael Diez-Perez** | King's College London, United Kingdom | **Marco Rolandi** | University of California, Santa Cruz, USA |
| **Moh El-Naggar** | University of Southern California, USA | **Clara Santato** | Polytechnique Montréal, Canada |
| **Ariel Furst** | Massachusetts Institute of Technology, USA | **Sahar Sharifzadeh** | Boston University, USA |
| **Pau Gorostiza** | Institute for Bioengineering of Catalonia, Spain | **David Waldeck** | University of Pittsburgh, USA |
| **Stuart Lindsay** | Arizona State University, USA | **Jonathan Yuly** | Princeton University, USA |
| **Nikhil Malvankar** | Yale University, USA | | |

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## Symposium SB13: Soft Materials for Harsh Environments

This symposium will delve into the transformative impact of soft materials on electronics for extreme environments, redefining our approach, particularly in aerospace applications. Extreme environments, characterized by factors such as ionizing and non-ionizing radiation, temperature cycling, vacuum, and atomic oxygen, pose unique challenges for electronics. Recent insights have reshaped our understanding and highlighted that while traditional semiconductors tolerate these stressors, they lack the lightweight, flexible, and cost-effective attributes offered by soft materials.

While the symposium will primarily focus on soft materials, it will also incorporate talks on the effects of extremes on traditional materials. This intentional cross-pollination aims to spark innovative ideas for discovering the next generation of soft, reconfigurable materials tailored for applications in these challenging conditions. Metal-halide perovskite and organic semiconductors will be specifically discussed. Expert discussions will cover topics such as radiation tolerance, self-healing properties, and efficient packaging designs, with abstract submissions encouraged in areas including radiation tolerance of perovskites and organic semiconductors, next-gen concepts for extreme-tolerant soft materials, lightweight device architectures using traditional semiconductors, and robust packaging designs.

## Topics will include:

- Next-generation electronics for harsh environments
- Radiation-tolerant perovskite, organic, and low-dimensional semiconductors
- Mechanistic understanding of self healing
- Radiation detection and temperature sensing using soft materials
- Radiation tolerant biofilms and biomaterials
- Space effects in biological systems
- Thermal and mechanical stressing
- Lightweight packaging for harsh environments
- Technoeconomic analysis for next-generation space electronics

A **tutorial** complementing this symposium is tentatively planned. Further information will be included in the MRS Program that will be available online in September.

## Invited speakers include:

| | |
|---|---|
| **Antonio Abate** | Helmholtz-Zentrum Berlin, Germany |
| **Niaz Abdolrahim** | University of Rochester, USA |
| **Christos Athanasiou** | Georgia Institute of Technology, USA |
| **Mario Borunda** | Oklahoma State University, USA |
| **Jean-Luc Bredas** | University of Arizona, USA |
| **Sergio Brovelli** | Università degli Studi Milano-Bicocca, Italy |
| **Stefania Cacovich** | Centre National de la Recherche Scientifique, France |
| **Romain Cariou** | Commissariat à l'énergie atomique et aux énergies alternatives, France |
| **Jeffery Chancellor** | Louisiana State University, USA |
| **Giles Eperon** | Swift Solar Inc., USA |
| **Beatrice Fraboni** | Università di Bologna, Italy |
| **Sean Garner** | Corning Incorporated, USA |
| **Aman Haque** | The Pennsylvania State University, USA |
| **Jinsong Huang** | University of North Carolina at Chapel Hill, USA |
| **Seth Hubbard** | Rochester Institute of Technology, USA |
| **Stephen Jesse** | Oak Ridge National Laboratory, USA |
| **Oana Jurchescu** | Wake Forest University, USA |
| **Yosuke Kanai** | University of North Carolina at Chapel Hill, USA |
| **Arkady Krasheninnikov** | Helmholtz-Zentrum Dresden-Rossendorf, Germany |
| **Lyndsey McMillon-Brown** | NASA, USA |
| **Wanyi Nie** | Los Alamos National Laboratory, USA |
| **Sokrates Pantelides** | Vanderbilt University, USA |
| **Adam Printz** | University of Arizona, USA |
| **Bibhudutta Rout** | University of North Texas, USA |
| **Laura Schelhas** | National Renewable Energy Laboratory, USA |
| **Michael Short** | Massachusetts Institute of Technology, USA |
| **Samuel Stranks** | University of Cambridge, United Kingdom |
| **Xueju Wang** | University of Connecticut, USA |
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## Symposium SF01: Bulk Metallic Glasses

The ability to create bulk metallic alloys lacking long-range order and grain boundaries has attracted significant attention in both the academic and commercial communities. These materials, called bulk metallic glasses (BMGs) They exhibit unique properties, including near theoretical strength, high elastic strain limit and wear resistance along with excellent soft-magnetic and catalytic properties. Modern BMGs can also show processing advantages, and additive manufacturing recently has enabled large scale components to be produced. They have established themselves as a viable class of engineering materials with exciting opportunities in fundamental science and broad potential commercial applications. The continuation of rapid growth in the field of BMGs can be attributed to advancements in our fundamental understanding of their structure and deformation, improved understanding of the liquid structural state, the development of BMG forming alloys based on elements essentially covering all transition metals, and new processing methods such as thermo-plastic forming and additive manufacturing. The unique vitrification behavior of BMGs allows them to be processed similar to both plastics and metals. Various plastic processing and fabrication techniques have been adapted and tailored to the specific characteristics of BMGs. The sluggish crystallization kinetic, coupled with the absence of an intrinsic feature size limitation enables one to use BMGs over a wide range of length scales. Novel insights into processing has also been explored for improving and tailoring properties of BMGs. From a fundamental point of view, recent research progress has involved micromechanistic models for processing-structure-property relationships of BMGs, which has been a significant challenge due to the lack of long-range order, grains and their boundaries, and other typical structural features observed in metals.

## Topics will include:

- Atomic structure of bulk metallic glasses and its relationship with properties
- Manipulation strategies of properties through atomic structure, including rejuvenation and relaxation
- Glass formation motifs, theories, and development strategies
- Processing methods and opportunities including additive manufacturing
- Mechanical properties and mechanisms of plastic deformation and failure
- Functional physical properties including magnetism and catalysis
- Application opportunities
- Vitrification kinetics and atomic mobility

## Invited speakers include:

| | |
|---|---|
| **Ralf Busch** | Universität des Saarlandes, Germany |
| **Na Chen** | Tsinghua University, China |
| **Wen Chen** | University of Massachusetts Amherst, USA |
| **Karin A. Dahmen** | University of Illinois at Urbana-Champaign, USA |
| **Takeshi Egami** | Oak Ridge National Laboratory, USA |
| **Michael Falk** | Johns Hopkins University, USA |
| **Michael Ferry** | University of New South Wales, Australia |
| **Katherine Flores** | Washington University in St. Louis, USA |
| **Lindsay Greer** | University of Cambridge, United Kingdom |
| **Douglas Hofmann** | NASA Jet Propulsion Laboratory, USA |
| **Lina Hu** | Shandong University, China |
| **Sebastian Kube** | University of Wisconsin–Madison, USA |
| **Golden Kumar** | The University of Texas at Dallas, USA |
| **Dongwoo Lee** | Sungkyunkwan University, Republic of Korea |
| **Maozhi Li** | Renmin University of China, China |
| **Mo Li** | Georgia Institute of Technology, USA |
| **Jörg Löffler** | ETH Zürich, Switzerland |
| **Robert Maaß** | Federal Institute of Materials Research and Testing, Germany |
| **Sundeep Mukherjee** | University of North Texas, USA |
| **Corey O'Hern** | Yale University, USA |
| **Eun Soo Park** | Seoul National University, Republic of Korea |
| **Birte Riechers** | Federal Institute of Materials Research and Testing, Germany |
| **Beatrice Ruta** | CNRS Institut Néel Grenoble, France |
| **Udo Schwarz** | Yale University, USA |
| **Frans Spaepen** | Harvard University, USA |
| **Paola Tiberto** | Istituto Nazionale di Ricerca Metrologica, Italy |
| **Paul Voyles** | University of Wisconsin–Madison, USA |
| **Wei-Hua Wang** | Institute of Physics, Chinese Academy of Sciences, China |
| **Shuai Wei** | Aarhus University, Denmark |
| **Chenchen Yuan** | Southeast University, China |

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## Symposium SF02: High Entropy Materials

High-entropy materials (HEMs) have become an exciting and vibrant field of materials science as a new generation of materials. The HEM design concept shifts the focus away from the corners of phase diagrams toward their centers, and allows compositions beyond the scope of traditional materials, offering unprecedented properties, challenges, and opportunities for a wide range of structural and functional applications. Although we understand HEMs much better today, there are still significant gaps in our knowledge that hinder the widespread use of HEMs. The goal of this symposium is to share the latest research advances in materials with high configurational entropy, including high-entropy and complex concentrated alloys, high-entropy oxides/ nitrides, high-entropy metallic glasses, etc., and discuss major materials issues for HEMs from property-targeted alloy design to process optimization, from structures to properties, and from the fundamental science to viable industrial applications. This symposium will cover fundamental theory and data-driven material design, fabrication, processing, and microstructure control, such as homogenization, precipitation, nanostructure, and grain-boundary engineering using conventional equipment, combinatorial fabrication, additive manufacturing, etc., phase stability and diffusivity under extreme environment, mechanical behavior under different deformation mechanisms, corrosion, physical, magnetic, electric, thermal, coating, and biomedical behavior, advanced characterization, such as synchrotron, three-dimensional atom probe, and 4-D STEM, computational modeling and simulations, and industrial applications, such as structural, mechanical, biomedical, energy applications. In this symposium, we hope to deepen our understanding of why HEMs attract such intensive interest, as well as highlight some challenging issues awaiting resolution to provide viable paths to widespread application and adoption of HEMs.

## Topics will include:

- Fundamental Theory and Data-driven Design of HEMs
- Process Development for Tailor-made Synthesis and Microstructure Control
- Phase Transformation (thermodynamics and kinetics) under Extreme Environments
- Structural/Mechanical Properties of HEMs, such as fatigue, creep, and fracture behavior
- Dynamic Mechanical Behavior under Different Deformation Mechanisms
- Physical, Chemical and Functional Properties of HEMs
- Intensive Structural Characterization using Cutting-edge Analysis Techniques
- Theoretical Modeling and Computational Simulations
- Innovative Industrial Applications, e.g. Structural Parts, Catalysis and Energy Storage Materials

## Invited speakers include:

| | |
|---|---|
| **Ben Breitung** | Karlsruhe Institute of Technology, Germany |
| **Brian Cantor** | University of Oxford, United Kingdom |
| **Cecilia Cao** | Shanghai University, China |
| **Jean-Philippe Couzinié** | Centre National de la Recherche Scientifique, France |
| **Andrew Detor** | Defense Advanced Research Projects Agency, USA |
| **Jurgen Eckert** | Montanuniversität Leoben, Austria |
| **Katharine Flores** | Washington University, USA |
| **Easo George** | The University of Tennessee, Knoxville, USA |
| **Olivia Graeve** | University of California, San Diego, USA |
| **Haruyuki Inui** | Kyoto University, Japan |
| **Veerle M. Keppens** | The University of Tennessee, Knoxville, USA |
| **Andrew M. Minor** | University of California, Berkeley, USA |
| **DANIEL B. MIRACLE** | Air Force Research Laboratory, USA |
| **Taheri Mitra** | Johns Hopkins University, USA |
| **B.S. Murty** | Indian Institute of Technology Hyderabad, India |
| **Noah Philips** | ATI Inc., USA |
| **Tresa Pollock** | University of California, Santa Barbara, USA |
| **Dierk Raabe** | Max-Planck-Institut für Eisenforschung GmbH, Germany |
| **Robert Ritchie** | Lawrence Berkeley National Laboratory, USA |
| **Chaewoo Ryu** | Hongik University, Republic of Korea |
| **John Sharon** | Raytheon Technologies, USA |
| **An-Chou Yeh** | National Tsing Hua University, Taiwan |

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## Symposium SF03: Materials for Robotics

Many advancements in robotics depend on the development of new materials and processing technologies. By focusing on innovative manufacturing approaches, researchers can unlock new possibilities for designing advanced robotic architectures and end-effectors. Additionally, by modeling material and actuation behaviors, researchers can develop more efficient and effective robotic systems. To this end, researchers are exploring a wide range of materials that can sense external stimuli and be reconfigured into manipulators and components at various scales for use in a variety of technological areas, including automotive, minimally invasive medicine, and food industry. Programmable matter and inter-communication between materials are also research areas of interest. The goal of this symposium is to bring together researchers interested in materials and processing techniques for robotics applications. The symposium covers the development of new materials and actuation mechanisms (i.e.: magnetic fields, electric fields, light, ultrasound, chemical fuels) using innovative manufacturing sequences and approaches, such as additive manufacturing. It also focuses on designing advanced robotic architectures and end-effectors, as well as modeling material and actuation behaviors, with applications in several fields such as biomedicine, bionics, minimally invasive medicine and automobiles. The symposium will also feature advanced manipulation and navigation systems, and the use of artificial intelligence to control the actuation of materials. The symposium also embraces materials with varying mechanical, magnetic, and electric properties or devices composed of building blocks that can communicate upon stimuli. Theoretical and experimental aspects of these materials are both welcomed. This symposium offers an excellent opportunity for researchers to exchange ideas and learn about the latest developments in materials and processing technologies for robotics applications.

## Topics will include:

- Soft matter and soft robotics
- Stimuli responsive and/or reconfigurable materials
- Magnetic materials
- Biocompatible Polymers
- Manufacturing, including micro- and nanofabrication
- Micro- and nanorobotics
- Programmable and/or multifunctional matter
- Manipulation and navigation systems
- Actuation and sensing approaches including magnetic, electric, ultrasound, light, chemistry
- Applications in minimally invasive medicine, assistive robotics, automobile

## Invited speakers include:

| | |
|---|---|
| **Buse Aktas** | ETH Zürich, Switzerland |
| **Sarah Berbreiter** | Carnegie Mellon University, USA |
| **Xiangzhong Chen** | Fudan University, China |
| **Hongsoo Choi** | Daegu Gyeongbuk Institute of Science and Technology, Republic of Korea |
| **Donglei Fan** | The University of Texas at Austin, USA |
| **Peer Fischer** | Heidelberg University, Germany |
| **Dario Floreano** | École Polytechnique Fédérale de Lausanne, Switzerland |
| **Ankita Hume** | MagnebotiX AG, Switzerland |
| **Cecilia Laschi** | National University of Singapore, Singapore |
| **Veronika Magdanz** | University of Waterloo, Canada |
| **Denys Makarov** | Helmholtz-Zentrum Dresden-Rossendorf, Germany |
| **Sylvain Martel** | Polytechnique Montréal, Canada |
| **Barbara Mazzolai** | Istituto Italiano di Tecnologia, Italy |
| **Berna Özkale Edelmann** | Technische Universität München, Germany |
| **Salvador Pané** | ETH Zürich, Switzerland |
| **Giovanni Pittiglio** | Harvard Medical School, USA |
| **Martin Pumera** | Central European Institute of Technology, Czech Republic |
| **Jerry Qi** | Georgia Institute of Technology, USA |
| **Carlos Sanchez Somolinos** | Universidad de Zaragoza, Spain |
| **Oliver Schmidt** | Technische Universität Chemnitz, Germany |
| **Simone Schuerle** | ETH Zürich, Switzerland |
| **Joseph Tracy** | North Carolina State University, USA |
| **Franziska Ullrich** | Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany |
| **Robert Wood** | Harvard University, USA |
| **Li Zhang** | Chinese University of Hong Kong, Hong Kong |
| **Xuanhe Zhao** | Massachusetts Institute of Technology, USA |

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## Symposium SF04: Advanced Functional Materials for Extreme Conditions

The ability to collect and transmit signals and control operations within harsh environments is essential for the emerging advanced technologies in energy production and conversion, efficient power transmission, space exploration, nuclear medicine, and other frontier technologies. Developing advanced functional materials for high power devices and novel sensors that can operate in extreme radiation, temperature, stress, and corrosion are at forefront of materials research to meet these growing technological demands. A thorough understanding of wide band gap semiconductor and photonic materials and developing novel approaches in their design, synthesis, and modulating their structures and properties are crucial to advance functional materials and develop new sensors and devices.

This symposium will bring researchers from the electronic and photonic hard materials spectrum working on broad areas including -but not limited to- developing new hard semiconductor materials and devices for high power applications, radiation tolerant hard semiconductor and photonic materials, inorganic material-based radiation detectors, and the next generation of hard material sensors for extreme conditions as these materials most likely share some common properties. The symposium topics will cover fundamental theory, data driven material design, novel synthesis, processing, microstructure and defect control, characterization, and novel device approaches. Artificial Intelligence (AI) and Machine Learning (ML) helps develop new functional materials for extreme conditions through a variety of perspectives. For example, the relationship between input features and target outputs are often unknown. AI and ML enables the implicit mapping the inputs and outputs, resulting in flexible models. In-situ characterization can monitor phase and structural stability, defect production and evolution, changes in electronic and optical properties during extreme irradiation, stress, and temperature conditions. The latest research from academia with the input on the frontier technologies from industry leaders during this symposium will help identifying the material fundamentals of universal radiation tolerance, transmitting high voltage, sustaining harsh structural, physical, and chemical attacks.

## Topics will include:

- 2D materials for extreme environments
- Defects in wide band gap materials and 2D materials
- Hard functional materials for extreme environments
- Hard material-based sensors for extreme environments
- Radiation tolerant hard semiconductors
- New materials for radiation detectors
- Multicomponent wide band gap materials for electronics and photonics
- Phonon and electron transport in wide band gap materials

Joint sessions are being considered with **SF05 - Structural and Functional Intermetallics**.

## Invited speakers include:

| | |
|---|---|
| **George Brandes** | Wolfspeed Inc, USA |
| **Eric Brosha** | Los Alamos National Laboratory, USA |
| **Sergio Brovelli** | Università degli Studi di Milano-Bicocca, Italy |
| **Ekaterine Chikoidze** | Université de Versailles Saint-Quentin-en-Yvelines, France |
| **Francesca Cova** | Università degli Studi Milano-Bicocca, Italy |
| **Vladimir Dobrosavljevic** | Florida State University, USA |
| **Cyrus Dreyer** | Stony Brook University, The State University of New York, USA |
| **Elzbieta Guziewicz** | Polish Academy of Sciences, Poland |
| **Aman Haque** | The Pennsylvania State University, USA |
| **Ray-Hua Horng** | National Yang Ming Chiao Tung University, Taiwan |
| **Anderson Janotti** | University of Delaware, USA |
| **Djamel Kaoumi** | North Carolina State University, USA |
| **Andrej Kuznetsov** | University of Oslo, Norway |
| **Robert Nemanich** | Arizona State University, USA |
| **Andrei Osinsky** | Agnitron Technology Inc., USA |
| **Stephen Pearton** | University of Florida, USA |
| **Siddharth Rajan** | The Ohio State University, USA |
| **Manijeh Razeghi** | Northwestern University, USA |
| **Farshchi Rouin** | First Solar, USA |
| **Kohei Sasaki** | Novel Crystal Technology, Japan |
| **Achim Strass** | Nexperia, Germany |
| **Anjana Talapatra** | Los Alamos National Laboratory, USA |
| **Seth Ariel Tongay** | Arizona State University, USA |
| **Blas Uberuaga** | Los Alamos National Laboratory, USA |
| **Joel Varley** | Lawrence Livermore National Laboratory, USA |
| **Yongqiang Wang** | Los Alamos National Laboratory, USA |
| **Grace Xing** | Cornell University, USA |
| **Qimin Yan** | Northeastern University, USA |
| **Andriy Zakutayev** | National Renewable Energy Laboratory, USA |
| **Mary Ellen Zvanut** | The University of Alabama at Birmingham, USA |

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## Symposium SF05: Structural and Functional Intermetallics

The goal of this symposium is to discuss recent progress in understanding, designing and developing intermetallic-based materials for structural and functional applications by bringing together multi-scale experimental and computational research activities on the composition-processing-structure-property relationships. The unique physical and mechanical properties of intermetallic compounds originate from their ordered structures and various crystallographic defects. This basic theory still remains incomplete, and holistic but deep understanding of intermetallics is necessary for their future advancement. Revisiting the definition of intermetallics, in contrast to high entropy alloys that are based on an opposite concept, can highlight the advantages and disadvantages of intermetallics. Intermetallic materials and phases of interest include aluminides, silicides, Laves phases, Heusler phases, and various other geometrically-, topologically- and close-packed compounds. From an applications perspective, presentations related to intermetallic compounds intended for structural and functional applications, including high temperature use in the aerospace and automotive industries, will be considered. This also includes applications for fossil fuel and nuclear industries, energy conversion and storage, ferromagnetic, catalysis, medical, and thermoelectric power.

## Topics will include:

- Phase equilibria and phase transformations
- Defect structures and their evolution
- Mechanical and physical properties
- Environmental effects including oxidation and hot corrosion
- Deformation, fracture and underlying mechanisms
- Processing-structure-property relationships
- Design of next-generation intermetallic-based materials
- Advanced processing techniques including additive manufacturing
- Advanced characterization techniques from an atomic level to a macroscopic level
- Computation and modeling studies and informatics approach
- Intermetallic composites and novel superalloys
- Shape memory, catalysis, magnetic, thermoelectric, energy storage and medical applications
- Recent applications in the aircraft, automotive and other industries

## Invited speakers include:

| | |
|---|---|
| **Melissa Allen** | GfE Metalle und Materialien GmbH, Germany |
| **Dipankar Banerjee** | Department of Materials Engineering, Indian Institute of Science, India |
| **Ken Cho** | Osaka University, Japan |
| **Alain Couret** | Centre d'Élaboration des Matériaux et d'Etudes Structurales, France |
| **Anders Engström** | ThermoCalc SA, Sweden |
| **Martin Friak** | Czech Academy of Sciences, Czech Republic |
| **Easo George** | The University of Tennessee, Knoxville, USA |
| **Bronislava Gorr** | Universität Siegen, Germany |
| **David Holec** | Montanuniversität Leoben, Austria |
| **Kyosuke Kishida** | Kyoto University, Japan |
| **Eric Lass** | The University of Tennessee, Knoxville, USA |
| **Yonghoon Lee** | KELK Ltd., Japan |
| **John Lewandowski** | Case Western Reserve University, USA |
| **Sadao Nishikiori** | IHI Corporation, Japan |
| **Toshihiro Omori** | Tohoku University, Japan |
| **Tresa Pollock** | University of California, Santa Barbara, USA |
| **Pierre Sallot** | Safran Aircraft Engines, France |
| **Frank Stein** | Max-Planck-Institut für Eisenforschung, Germany |
| **Howard Stone** | University of Cambridge, United Kingdom |
| **Naoki Takata** | Nagoya University, Japan |
| **Koichi Tsuchiya** | National Institute for Materials Science, Japan |
| **Hsin-Jay Wu** | National Yang Ming Chiao Tung University, Taiwan |
| **Ying Yang** | Oak Ridge National Laboratory, USA |
| **Christopher Zenk** | Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany |

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## Symposium SF06: From Robotic Towards Autonomous Materials

Soft robotics has made tremendous strides over recent years, with new forms of soft actuators, sensors, and control strategies paving the way for physical intelligence. However, the field still faces challenges in power, performance, and control due to limited materials availability. To overcome these limitations, researchers are turning to nature for inspiration. Multifunctionality is the key to building emergent autonomous behavior that can integrate distributed actuation, perception, control, and energy capabilities in robotic agents. This requires new materials design paradigms that can tightly integrate multiple robotic capabilities to create functional materials that can perform tasks without human intervention. The symposium aims to bring together experts from materials science, soft robotics, chemistry, and mechanics to achieve this interdisciplinary vision. By collaborating across these fields, researchers can build beyond the current visions of robotic materials and create truly autonomous ones. The potential applications of this technology are vast, from soft robots that can perform delicate surgical procedures to autonomous systems that can monitor and repair infrastructure. This innovative approach provides research opportunities where both theory and experiments can produce discoveries and potential applications in Material science and Engineering, such as self-cleaning and functionalized actuators for AR, VR XR applications, environmentally adaptive surfaces, energy systems, responsive surfaces to communicate biological markers, situation adaptive protective gear and more.

## Topics will include:

- Materials with distributed and/or embodied sensorimotor behaviors
- Soft material logic and neuromorphic computation
- Stimuli-responsive hydrogels, liquid crystalline materials, and composites
- Architected materials and Soft Robotic Materials
- Additive and digital fabrication of multifunctional and programmable materials
- Modeling, simulation, and control of autonomous materials
- Self-healing, self-regulatory, and homeostatic materials
- Autonomous soft, bioinspired, and/or microscale robots
- Embodied energy and materials for energy scavenging

## Invited speakers include:

| | |
|---|---|
| **Tommy Angelini** | University of Florida, USA |
| **Bilge Baytekin** | Bilkent University, Turkey |
| **Phil Buskohl** | Air Force Research Laboratory, USA |
| **Alfred J. Crosby** | University of Massachusetts Amherst, USA |
| **Michael Dickey** | North Carolina State University, USA |
| **Daniel I. Goldman** | Georgia Institute of Technology, USA |
| **Francesco Greco** | Scuola Superiore Sant'Anna, Italy |
| **Ryan Hayward** | University of Colorado Boulder, USA |
| **Alexandra Ion** | Carnegie Mellon University, USA |
| **Mirko Kovac** | Imperial College London, United Kingdom |
| **Shlomo Magdassi** | The Hebrew University of Jerusalem, Israel |
| **Shingo Meada** | Tokyo Institute of Technology, Japan |
| **Markus P. Nemitz** | Worcester Polytechnic Institute, USA |
| **Abdon Pena-Francesch** | University of Michigan, USA |
| **Kirstin Petersen** | Cornell University, USA |
| **James Pikul** | University of Wisconsin–Madison, USA |
| **Jordan Raney** | University of Pennsylvania, USA |
| **Sheila Russo** | Boston University, USA |
| **Francesco Giorgio Serchi** | University of Edinburgh, United Kingdom |
| **Herbert Shea** | École Polytechnique Fédérale de Lausanne, Switzerland |
| **Robert Shepherd** | Cornell University, USA |
| **David Swanson** | United States Air Force, USA |
| **Zeynep Temel** | Carnegie Mellon University, USA |
| **Ryan Truby** | Northwestern University, USA |
| **Thomas Wallin** | Massachusetts Institute of Technology, USA |
| **Timothy J. White** | University of Colorado Boulder, USA |
| **Emily Whitting** | Boston University, USA |
| **Xuanhe Zhao** | Massachusetts Institute of Technology, USA |

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