2025 MRS® SPRING MEETING & EXHIBIT

April 7-11, 2025 | Seattle, Washington

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Abstract Submission Opens
Tuesday, September 17, 2024

Abstract Submission Closes
Thursday, October 17, 2024 (11:59 PM ET)

Symposium BI01: Critical Raw Materials in Emerging Technology

This symposium delves into emerging sectors and technologies within the critical raw materials field. It encompasses a wide array of topics, ranging from newly evolving products to their associated processes – for example, in sodium-ion batteries, superconductors, semiconductors, magnets or green steel. Beyond these, the exploration extends to the application of CRMs in less visible sectors in the debate on CRMs, like pharmaceuticals, artificial intelligence, cyber security or agriculture.

Moreover, our focus extends to integrating CRMs in rapidly evolving domains, exemplified by fusion energy, the hydrogen economy, quantum computing, space technology, and water electrolysis. We invite contributions from diverse participants, including pioneering companies in emerging sectors, technology start-ups, researchers working in the intersection of CRMs and perspective technologies for the future sustainable economy, and all other stakeholders working in this advancing field.

In addition, the symposium addresses the geopolitical approaches of industrial and regulatory policies for critical raw materials and their supply chains to support strategic industries. Through interactive panels and talks, we will explore goals and deliverables for strategic perspectives on digital technologies, such as AI, and discuss the geopolitics of sustainable technologies with applied industrial policy for critical raw materials and supply chains, including lessons from current worldwide regulations.

Topics will include:

- Covers emerging sectors and technologies in the critical raw materials field.
- Encompasses a wide array of topics, ranging from lithium-ion batteries to semiconductors, pharmaceuticals, and cyber security.
- The focus extends to integrating CRMs in rapidly evolving domains, such as fusion energy, hydrogen economy, quantum computing, space technology, and water electrolysis.
- Addresses the geopolitics of sustainable technologies with applied industrial policy for critical raw materials and supply chains.

Joint sessions are being considered with **SU05 - Materials Innovation for Sustainability and Energy Applications of Critical Elements**.
Also, a **tutorial** complementing this symposium is tentatively planned. Further information will be included in the MRS Program that will be available online in January.

Invited speakers include:

Frank Brückner	Fraunhofer Institute for Material and Beam Technology, Germany
Hyeunseog Choi	Korea Institute of Industrial Technology, Republic of Korea
Yoshiko Fujita	Idaho National Laboratory, USA
Charlotte Griffiths	United Nations, Switzerland
Oliver Gutfleisch	Technische Universität Darmstadt, Germany
Subra Herle	Applied Materials, USA
Kyung-Tae Kim	Korea Institute of Materials Science, Republic of Korea
Tom Lograsso	Ames Laboratory, USA
Kyoung-Tae Park	Korea Institute of Industrial Technology, Republic of Korea
Mihai Stoica	ETH Zürich, Switzerland
Anja Waske	Bundesanstalt für Materialforschung und -prüfung, Germany

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Symposium CH01: Characterization of Dynamics and Heterogeneity in Energy Materials

Energy devices are often operated at far-from-equilibrium conditions. Their performance is dependent on the key kinetic processes such as mass conduction, charge transfer, interfacial nucleation and deposition, phase evolution, and degradation. In addition, energy devices are also hierarchical systems spanning multi-scales. For example, in commercial batteries, both the cathode and anode are composites of high heterogeneity at the nano- to microscale, consisting of active particles of different sizes and irregular shapes, a matrix composed of polymer binders and additives, and pores filled with the electrolyte. The active particles are further populated with grain boundaries, compositional variation, and microcracks. Such structural complexity inevitably induces heterogeneous electrochemical activities across a wide range of length scales. The dynamic nature and heterogeneous activities pose great challenges for basic understanding of the system performance and predicting the degradation pathway of energy devices. Several factors come into play in the material framework. While the local lattice and electronic structures at the atomic scale play the fundamental role, defects across different length scales are likely the determining factor in the reaction kinetics through nucleation and growth of undesired phases. The hierarchical structural and chemical complexity calls for a holistic investigation using advanced experimental probes with sufficient and complementary spatial/temporal resolution and chemical sensitivity and coupled with computational tools that could offer theoretical insights. This symposium aims to provide a platform to bring together experts in different disciplines and exchange state-of-the-art understanding on the dynamics and heterogeneity of energy storage and conversion systems. It will help formulate outstanding research needs and grand challenges in connecting the intricate local activities at small scale with the system performance at large scale. Recent developments on *in situ/operando* experiments and data-driven approach to interpret coupled mechanisms are highly welcome.

Topics will include:

- Energy storage materials such as batteries
- Energy conversion materials such as fuel cells, thermoelectrics, and electrochemical catalysis
- X-ray based analytics
- Electron microscopy analysis on charge-lattice coupling and tomography characteristics
- Optical microscopy-based analysis on particle assembly
- In-line inspection for manufacturing
- Cell defect detection and failure analysis
- High-throughput and/or autonomous experimentation
- Streamlined data curation and mining
- Data-driven analysis using machine learning and statistical analysis
- Physics-based computational modeling

Invited speakers include:

Veronica Augustyn	North Carolina State University, USA
Peng Bai	Washington University in St. Louis, USA
Anmin Cao	Institute of Chemistry, Chinese Academy of Sciences, China
Raphaële Clément	University of California, Santa Barbara, USA
Tomoya Kawaguchi	Tohoku University, Japan
Hansu Kim	Hanyang University, Republic of Korea
Yong Min Lee	Yonsei University, Republic of Korea
Linsen Li	Shanghai Jiao Tong University, China
Yuzhang Li	University of California, Los Angeles, USA
Feng Lin	Virginia Tech, USA
Pietro Papa Lopes	Argonne National Laboratory, USA

Marie-Ingrid Richard	European Synchrotron Radiation Facility, France
Mary Scott	University of California, Berkeley, USA
Xiaonan Shan	University of Houston, USA
Dong Su	Institute of Physics, Chinese Acadamy of Sciences, China
Ming Tang	Rice University, USA
Vaciliki Tileri	École Polytechnique Fédérale de Lausanne, Switzerland
Sarah Tolbert	University of California, Los Angeles, USA
Yan-Kai Tzeng	SLAC National Accelerator Laboratory, USA
Feng Wang	Lawrence Berkeley National Laboratory, USA
Jie Xiao	Pacific Northwest National Laboratory, USA
Qiang Zhang	Tsinghua University, China

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Symposium CH02: Emerging Optoelectronic and Quantum Materials—Advanced Multimodal Characterizations

Optoelectronic and quantum materials play pivotal roles in modern technologies, addressing the escalating demands of computing, data storage, and energy efficiency. As scrutiny intensifies, a profound understanding of these materials — from synthesis to device integration and operation — becomes imperative. This symposium serves as a convergence point for researchers across multiple domains, emphasizing the need for advanced characterization tools. Characterization techniques, capable of probing material properties under *in situ* and *operando* conditions with high spatial, temporal, energy, and momentum resolutions, are becoming essential. The symposium seeks to foster collaborations among diverse communities including material synthesis, device physics, optical spectroscopy, structural characterization, and materials theory. Our focus is to explore new frontiers in advanced characterizations of emerging optoelectronic and quantum materials, ranging from perovskite-inspired systems to quantum-confined materials and two-dimensional systems. The symposium underscores the synergy achieved through innovative combinations of various optical spectroscopies, scanning probe tools, synchrotron facilities, and machine learning techniques.

Topics will include:

- Optical techniques for photophysical investigations, including advanced spectroscopies, nonlinear approaches and pump-probe methods
- X-ray techniques, including X-ray diffraction, fluorescence, and scattering, coherent techniques and time-resolved approaches
- Electron techniques (ARPES and ultrafast electron microscopy)
- Advanced imaging techniques, including SNOM, STM, AFM
- Multimodal methodologies that combine multiple complementary probes
- Operando characterizations in device environments
- In-situ and high-throughput approaches for materials discovery and synthesis
- Novel methodologies for data analysis including machine learning
- Polaron, hot carrier and exciton dynamics
- Electron-lattice coupling
- Defects, lattice distortion, and symmetry breaking
- Light-induced phase changes in quantum materials
- Chiral properties and chirality-induced phenomena
- Electronic, magnetic, and magneto-optical properties
- Catalytic properties and activities

Invited speakers include:

Matthew Beard	National Renewable Energy Laboratory, USA
Annalisa Bruno	Nanyang Technological University, Singapore
Karena Chapman	Stony Brook University, The State University of New York, USA
Paul Evans	University of Wisconsin–Madison, USA
David Ginger	University of Washington, USA
Peijun Guo	Yale University, USA
Laura Herz	University of Oxford, United Kingdom
Bin Hu	The University of Tennessee, Knoxville, USA
Libai Huang	Purdue University, USA
Xinfeng Liu	National Center for Nanoscience and Technology, Chinese Academy of Sciences, China
Xinhui Lu	The Chinese University of Hong Kong, Hong Kong
David Mitzi	Duke University, USA
Fabian Mooshammer	Universität Regensburg, Germany
Wanyi Nie	University at Buffalo, The State University of New York, USA
Honglie Ning	Massachusetts Institute of Technology, USA
Akshay Rao	University of Cambridge, United Kingdom
Jian Shi	Rensselaer Polytechnic Institute, USA
Andrej Singer	Cornell University, USA
Joseph Spellberg	The University of Chicago, USA
Carolin Sutter-Fella	Lawrence Berkeley National Laboratory, USA
Z. Valy Vardeny	The University of Utah, USA
Kaifeng Wu	Dalian Institute of Chemical Physics, Chinese Academy of Sciences, China
Qing Zhang	Peking University, China
Xiaoyang Zhu	Columbia University, USA

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Symposium CH03: Advanced Scanning Probe Microscopy

Scanning probe microscopy (SPM), with notable examples including scanning tunneling microscopy (STM) and atomic force microscopy (AFM), plays a crucial role in offering high spatial resolution visualization of structures at the nanometer, molecular, and even atomic level. SPM offer distinct advantages over other imaging techniques, including high-resolution imaging, versatility applicable to a broad range of materials, *in situ/operando* imaging capabilities, non-destructive imaging, quantitative measurements and the ability to capture 3D structures. These ongoing advances in SPM technology and applications continue to broaden the impact of SPM-based methods across many research areas, encompassing surface and interfacial science, 2D and quantum materials, batteries, photovoltaics, and biomaterials.

This symposium focuses on covering a broad topic pertaining to recent technical advancements in SPM and their impact on materials discovery and optimization. Our aim is to bring together the scientists who are actively involved in the development and application of SPM techniques for characterizing diverse materials systems. In particular, we hope to stimulate the development and dissemination of SPM techniques include, for example, operando SPMs, correlative and multi-modal microscopies, and advancements in machine learning and instrumentation automation. We expect this symposium will serve as a platform for knowledge exchange and inspire collaborations that further propel the field of SPM and the applications in materials science.

Topics will include:

- High-speed AFM and force mapping studies of interfacial structure and dynamics in inorganic and biomolecular systems
- Time resolved electrostatic force microscopy/Kelvin probe force microscopy imaging of dynamic processes in electrical/optoelectronic materials
- Piezoresponse force microscopy development, with applications to ferroelectrics and mechanical energy harvesting devices
- SPM methods for probing energy materials, including photovoltaics, battery electrodes, battery interfaces, catalysts, and electrochemical processes in these materials
- SPMs for quantum materials and layered semiconductors, including STM-based methods and spectroscopy
- Development of advanced SPM probes and probe functionalization techniques
- Living cell imaging and mechanobiology
- Scanning microwave impedance microscopy, scanning capacitance microscopy, conductive and photoconductive AFM, scanning electrochemical microscopy
- Machine learning/AI assisted instrumentation automation.
- AFM-IR and related optical AFM methods for chemical contrast and materials mapping
- Combined multimodal techniques (such as AFM/SEM and AFM/confocal) and data analysis methods
- Signal processing and data-driven analysis of SPM images and spectra

Joint sessions are being considered with **CH04 - Advances in *In Situ/Operando* TEM Characterization of Dynamics and Functionalities in Materials**. Also, a **tutorial** complementing this symposium is tentatively planned. Further information will be included in the MRS Program that will be available online in January.

Invited speakers include:

Sarah Burke	The University of British Columbia, Canada	**Yunseok Kim**	Sungkyunkwan University, Republic of Korea
Mingyuan Chen	University of Michigan, USA	**Philippe Leclere**	Université de Mons, Belgium
Liam Collins	Oak Ridge National Laboratory, USA	**Marina Leite**	University of California, Davis, USA
James De Yoreo	Pacific Northwest National Laboratory, USA	**Rebecca Saive**	University of Twente, Netherlands
Shiyou Ding	Michigan State University, USA	**Laurene Tetard**	University of Central Florida, USA
Ricardo Garcia	Instituto de Ciencia de Materiales de Madrid, Spain	**Congzhou Wang**	South Dakota School of Mines and Technology, USA
David Ginger	University of Washington, USA	**Stefan Weber**	Universität Stuttgart, Germany
Peter Grutter	McGill University, Canada	**Alexander Weber-Bargioni**	Lawrence Berkeley National Laboratory, USA
Mark Hersam	Northwestern University, USA	**Xiaoji Xu**	Lehigh University, USA
Jennifer Hoffman	Harvard University, USA	**Xin Zhang**	Pacific Northwest National Laboratory, USA

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Symposium CH04: Advances in *In Situ/Operando* TEM Characterization of Dynamics and Functionalities in Materials

Recently, advanced *in situ/operando* electron microscopy techniques have extended the capability of investigating the structure, morphology, dynamics, and functionalities of materials across different length scales in their native environment with improved temporal and spatial resolution. For example, the motion of single Pt atoms in liquid could be visualized with a new design of liquid cell from 2D materials. Such real-time information also enriches statistics: Visualizing Brownian motion helps to map 3D lattice strain of a nanoparticle in liquid at single-atom resolution. Meanwhile, with new imaging modes and techniques integrated such as 4D-STEM and advanced detectors, emerging large data call for wise designs of data processing such as artificial intelligence algorithms, which in turn guides experiments and facilitates automatic *in situ* tools with “on-the-fly” data processing.

This symposium covers topics including crystallization and collective behaviors of nanomaterials, nanoscale heterogeneity and phase transformations, and processes with external stimuli. Additionally, works involving probing charge and heat transfer, lattice structure, and materials design based on insights from *in situ* strategies are welcomed. The symposium aims to pinpoint emerging directions in *in situ/operando* research in electron microscopy, X-ray techniques and spectroscopy, bridging mechanistic study, pragmatic synthesis, high output data processing, and above all, engineering of materials across various fields.

Topics will include:

- Self-assembly pathways with *in situ* techniques
- Nucleation and growth of crystals
- Interfacial processes and dynamics in gases and liquids
- Chemical and electrochemical reactions
- Electrically, magnetically, thermally, or mechanically driven processes
- Probing changes in structural, electronic and phononic properties
- *In situ* 4D-STEM, ptychography, differential phase contrast imaging, and correlative imaging
- Probing 3D information of complex systems
- Image processing/big data mining (machine learning and AI) for *in situ* techniques
- Material synthesis aided by *in situ* tools

Joint sessions are being considered with **CH03 - Advanced Scanning Probe Microscopy**, and **SF07 - Complexity Engineering of Materials Combining Order, Disorder and Hierarchical Organization**.
Also, a **tutorial** complementing this symposium is tentatively planned. Further information will be included in the MRS Program that will be available online in January.

Invited speakers include:

Judy Cha	Cornell University, USA	**Colin Ophus**	Lawrence Berkeley National Laboratory, USA
Miaofang Chi	Oak Ridge National Laboratory, USA	**Xiaoqing Pan**	University of California, Irvine, USA
James De Yoreo	Pacific Northwest National Laboratory, USA	**Jungwon Park**	Seoul National University, Republic of Korea
Jennifer Dionne	Stanford University, USA	**Kate Reidy**	Massachusetts Institute of Technology, USA
Madeline Dukes	Protochips Incorporated, USA	**Maria Sushko**	Pacific Northwest National Laboratory, USA
Nathan Gianneschi	Northwestern University, USA	**Katherine Sytwu**	Lawrence Berkeley National Laboratory, USA
Vida Jamali	Georgia Institute of Technology, USA	**Huan Wang**	Peking University, China
Yuki Kimura	Hokkaido University, Japan	**Taylor Woehl**	University of Maryland, USA
Robert Klie	University of Illinois at Chicago, USA	**Joeson Wong**	The University of Chicago, USA
Dongsheng Li	Pacific Northwest National Laboratory, USA	**Judith Yang**	University of Pittsbugh, USA
Yuzhang Li	University of California, Los Angeles, USA	**Yao Yang**	Cornell University, USA
Andrew Minor	University of California, Berkeley, USA	**Xingchen Ye**	Indiana University Bloomington, USA
Utkur Mirsaidov	National University of Singapore, Singapore	**Xin Zhang**	Pacific Northwest National Laboratory, USA
Ivan Moreno-Hernandez	Duke University, USA	**Haimei Zheng**	Lawrence Berkeley National Laboratory, USA

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Symposium CH05: Coherent Multidimensional Spectroscopies from the Visible to the Terahertz Range

Ultrafast spectroscopic techniques have evolved significantly, becoming essential tools for characterizing materials across the visible, infrared, and terahertz spectral regimes. Among these methods, *incoherent* nonlinear techniques, notably transient absorption/reflection spectroscopy, are widely utilized. These approaches involve observing population dynamics triggered by optical excitation using femtosecond pulses, enabling real-time measurement of material responses via transient absorption or reflection. However, *coherent* techniques, entail measuring the nonlinear material spectral response with precisely controlled phase relationships among multiple femtosecond excitation pulses. In contrast to traditional spectroscopic methods, coherent spectroscopy offers a more intricate understanding of materials by employing multiple precisely timed light pulses. This facilitates the measurement of both time-resolved *population* and *coherence* responses, allowing for the examination of spectral correlations, enhanced resolution of optically dense spectra, and the differentiation of contributions to spectral linewidths from homogeneous and inhomogeneous sources. This symposium aims to showcase materials research leveraging multidimensional coherent spectroscopies across the visible, infrared, and terahertz ranges. This research encompasses diverse materials, from organic and hybrid semiconductors to quantum materials.

Topics will include:

- Electronic coherent spectroscopy; Infrared coherent spectroscopy; Terahertz coherent spectroscopy
- Theoretical methods in coherent spectroscopy
- Organic semiconductors
- Metal-halide perovskites and related derivatives
- Quantum-confined semiconductors
- Quantum materials
- Exciton and exciton-polariton quantum dynamics
- Many-body quasi-particle correlations

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

Invited speakers include:

Tobias Brixner	Universität Würzburg, Germany
Irene Burghardt	Goethe-Universität Frankfurt, Germany
Giulio Cerullo	Politecnico di Milano, Italy
Minhaeng Cho	Institute for Basic Science, Republic of Korea
Elisabetta Collini	Università degli Studi di Padova, Italy
David Cooke	McGill University, Canada
Steven Cundiff	University of Michigan, USA
Jürgen Hauer	Technical University of Munich, Germany
David Jonas	University of Colorado Boulder, USA
Munira Khalil	University of Washington, USA
Pavel Maly	Charles University, Czech Republic
Dwayne Miller	University of Toronto, Canada
Henrike Müller-Werkmeister	University of Potsdam, Germany
Keith Nelson	Massachusetts Institute of Technology, USA
Jennifer Ogilvie	University of Michigan, USA
Tom Oliver	University of Bristol, United Kingdom
Tõnu Pullerits	Lund University, Sweden
Doran Raccah	The University of Texas at Austin, USA
Akshay Rao	University of Cambridge, United Kingdom
David Reichman	Columbia University, USA
Elisabet Romero	Institute of Chemical Research of Catalonia, Spain
Gabriela Schlau-Cohen	Massachusetts Institute of Technology, USA
Greg Scholes	Princeton University, USA
Lena Simine	McGill University, Canada
Ajay Ram Srimath Kandada	Wake Forest University, USA
Howe-Siang Tan	Nanyang Technological University, Singapore
Yoshitaka Tanimura	Kyoto University, Japan
Vivek Tiwari	Indian Institute of Science, Bengaluru, India
Martin Zanni	University of Wisconsin–Madison, USA
Xiaoyang Zhu	Columbia University, USA
Donatas Zigmantas	Lund University, Sweden

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Symposium EL01: Emerging Solution-Processable Nanomaterials for Optoelectronics and Photonics

Semiconductors are at the heart of various modern technologies that are extensively used in our daily lives. Classical bulk and epitaxial semiconductors are often produced by high-temperature, high-vacuum processes that consume significant energy and lack design freedom. Solution-processable semiconducting materials with nanoscale morphology, such as colloidal quantum dots, organics,and perovskites have received intense interest to address this problem. Their wide tunability in structure, dimensionality, optical and electronic properties allow for tailoring the materials' functionalities to fulfill different needs. Moreover, they can be deposited strain-free allowing large versatility to combine their functions with integrated platforms for mass production, such as silicon photonics. This booming class of materials also benefits from a vast spectral range covering from mid-IR to UV. As a consequence, massive effort has been put into integrating these materials into the latest generation of photonic devices, including solar cells, light-emitting diodes, photodetectors, single-photon sources, scintillators, lab-on-chips, and optical and quantum communication systems, achieving performances comparable to commercially available counterparts.
In spite of the many advantages, implementation of solution fabricated electronics still faces significant challenges that need to be addressed, such as operational stability of devices, optimization of interfaces between materials, and integration of such devices on chips. Given the intimate link between materials and photonics in all the application domains sketched above, this requires concerted efforts of different communities combining advanced synthetic approaches, interface engineering, device integration techniques, and in-depth studies on materials and devices using spectroscopy, microscopy and machine learning-based computational tools to provide insights on how to control light, heat, and carrier management.
This symposium will hence serve as a unique stimulating platform to promote multi-disciplinary discussions for addressing the current challenges. In order to achieve this, the symposium will bring together world-renowned leaders in the different fields, spanning from experimentalists to theorists and device engineers. To promote multifaceted debates, sessions will be dedicated to solution-based chemistry, nanomaterials characterization, theoretical modeling, device integration, and lab-to-industry process scalability, thus expecting to attract interest not only in academia but also in the industry.

Topics will include:

- Advanced syntheses of low-dimensional semiconducting nanostructures and organic molecules with tailored optical and charge transport properties.
- Materials and device characterization using advanced spectroscopy and microscopy techniques.
- Advances in on-chip integration of solution processed nanomaterials thin films and optimization of device interfaces.
- Design of hybrid photonic devices with innovative structures for optimized light, heat, and carrier management with record performances.
- Understanding and optimization of the devices' optoelectronic and photonic properties via theoretical modeling and spectroscopic analysis.
- Lab-to-industry scalability and sustainability of materials and devices production.

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

Invited speakers include:

Sergio Brovelli	Università degli Studi di Milano-Bicocca, Italy
Hilmi Volkan Demir	Bilkent University, Turkey
Sascha Feldmann	École Polytechnique Fédérale de Lausanne, Switzerland
Arjan Houtepen	Delft University of Technology, Netherlands
Bin Hu	The University of Tennessee, Knoxville, USA
Shinae Jun	Samsung Electronics, Republic of Korea
Oana Jurchescu	Wake Forest University, USA
Yu Kambe	NanoPattern Technologies, Inc., USA
Jongchan Kim	Yonsei University, Republic of Korea
Victor I. Klimov	Los Alamos National Laboratory, USA
Frédéric Laquai	King Abdullah University of Science and Technology, Saudi Arabia
Emmanuel Lhuillier	Sorbonne Université, France
Mengxia Liu	Yale University, USA
Maria Antonietta Loi	University of Groningen, Netherlands

Biwu Ma	Florida State University, USA
Hunter McDaniel	UbiQD, Inc., USA
Igor Nakonechnyi	QustomDot BV, Belgium
Thuc-Quyen Nguyen	University of California, Santa Barbara, USA
Isabel Pintor Monroy	imec, Belgium
Loredana Protesescu	University of Groningen, Netherlands
Ifor Samuel	University of St Andrews, United Kingdom
Henning Sirringhaus	University of Cambridge, United Kingdom
Graham Turnbull	University of St Andrews, United Kingdom
Dries van Thourhout	Universiteit Gent, Belgium
Koen Vandewal	Hasselt University, Belgium
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Mikhail Zamkov	Bowling Green State University, USA
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Symposium EL02: Innovations in Directed Self-Assembly for Next-Generation Nanomanufacturing

Directed Self-Assembly (DSA) of polymers or non-polymer materials represents a paradigm shift in materials patterning, offering a pathway to the scalable and cost-effective creation of nanoscale features essential for the next-generation semiconductor and various non-semiconductor applications. This session is designed to explore the recent advancement of DSA technology, from its fundamental principles to its practical applications, seeking to integrate fundamental scientific principles and insights with real-world implementation across various industrial domains. The symposium also aims to foster interdisciplinary collaborations and inspire new directions in the DSA field by combining the expertise of DSA from various research backgrounds.

In this session, discussions will span a wide range of topics in DSA, including the fundamental principles and significant advancements in DSA methodologies, the directed assembly of both polymer and non-polymeric materials, and the cutting-edge materials design, synthesis, and eco-friendly approaches tailored for DSA. The wide-ranging applications of DSA in enhancing electronic devices, energy, and photonic systems will be highlighted, as well as its potential as a complementary technique to Extreme Ultraviolet Lithography (EUVL). The session also focuses on the computational modeling, machine learning, and simulations integral to optimizing DSA processes alongside advanced characterization techniques and pattern transfer strategies. This session highly focuses on the current state-of-the-art technologies, significant challenges, and the perspective for future developments in DSA research, which is highly relevant to materials science and nanotechnology.

Topics will include:

- Fundamental principles and advances in directed self-assembly (DSA) methodologies
- Advances in materials for DSA: design, synthesis, and eco-friendly approaches
- DSA applications in electronic, energy, and photonic devices, sensors, membranes and beyond
- DSA as a complementary approach for EUVL and industrial scale-up of DSA
- Computational modeling, machine learning and simulations for DSA processes
- Characterization techniques for DSA structures
- Directed assembly of polymer and non-polymeric materials
- Equilibrium & non-equilibrium processes for directed self-assembly
- Advanced pattern transfer strategies

Invited speakers include:

Volker Abetz	Universität Hamburg, Germany	**Michael A. Morris**	Trinity College Dublin, Ireland
Teruaki Hayakawa	Tokyo Institute of Technology, Japan	**Cheolmin Park**	Yonsei University, Republic of Korea
Rong-Ming Ho	National Tsing Hua University, Taiwan	**Michele Perego**	Consiglio Nazionale delle Ricerche, Italy
Sang Ouk Kim	Korea Advanced Institute of Science and Technology, Republic of Korea	**Chandra Sarma**	Wolfspeed, USA
R. Joseph Kline	National Institute of Standards and Technology, USA	**Ulrich Wiesner**	Cornell University, USA
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Symposium EL03: Progress in van der Waals Heterostructures for Sustainable Electronics

The symposium will broadly cover current research on emerging heterostructures consisting of different layers interacting via van der Waals forces that can be employed in sustainable electronics. Examples of these architectures are two-dimensional (2D) materials deposited on non- or weakly-interacting substrates, molecular layers deposited on a 2D material, film of inorganic nanotubes deposited on a 2D material or heterostructures made solely of 2D materials. The symposium is divided into three parts. The first one will focus on the application of heterostructures in the field of neuromorphic computing, energy-efficient transistors and low-power memory devices. The second one will be dedicated to their use in the field of energy harvesting, with special attention to photovoltaic devices based on heterostructures comprising perovskites. Finally, the third one will cover the aspects of growth as well as properties, modelling and advanced characterization of various heterostructures between 2D materials. Therefore, the symposium will provide state-of-the-art research on various aspects of van der Waals layered heterostructures for sustainable electronics bringing together physicists, chemists, computer scientists and engineers from both academia and industry with the goal of bridging the gap between them. Symposium contributions should address fundamental science issues, including material properties and device configuration, or address challenges towards the development of practical applications from these emerging materials. Furthermore, a tutorial will be given by the company Synopsis regarding modelling of electronics based on stacked 2D devices.

Topics will include:

- van der Waals heterostructures
- Neuromorphic hardware
- Energy harvesting
- DFT calculations
- Device modelling
- Bottom-up growth of heterostructures
- Vertical, lateral, wrap-around heterostructures
- Advanced and in situ characterization techniques
- Twist effects in heterostructures
- Mixed dimensional heterostructures
- Energy-efficient transistors
- Photovoltaic solar cells
- Photoelectrocatalysis
- Monolayer, few-layer and many layer heterostructures

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

Invited speakers include:

Luis Hueso Arroyo	CIC nanoGUNE, Spain
Matthias Batzill	University of South Florida, USA
Camilla Coletti	Istituto Italiano di Tecnologia, Italy
María del Mar García Hernández	Instituto de Ciencia dei Materiales de Madrid, Spain
Antonija Grubisic-Cabo	University of Groningen, Netherlands
Humberto Rodriguez Gutierrez	University of South Florida, USA
Marc Hersam	Northwestern University, USA
Song Jin	University of Wisconsin–Madison, USA
Moon-Ho Jo	Pohang University of Science and Technology, Republic of Korea
Andras Kis	École Polytechnique Fédérale de Lausanne, Switzerland
Mario Lanza	King Abdullah University of Science and Technology, Saudi Arabia
Andrea Li Bassi	Politecnico di Milano, Italy
Adina Luican-Mayer	Ottawa University, Canada
Troels Markussen	Synopsys, Inc., Denmark
Cecilia Mattevi	Imperial College London, United Kingdom
Kirby Maxei	Intel Corporation, USA
Feng Miao	Nanjing University, China
Maurizia Palummo	INFN Sezione di Roma Tor Vergata, Italy
Eric Pop	Stanford University, USA
Iuliana Radu	Taiwan Semiconductor Manufacturing Company, Taiwan
Peter Sutter	University of Nebraska–Lincoln, USA
Boris Yakobson	Rice University, USA
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Symposium EL04: Radiation Effects in Semiconductors for Extreme Environments

Research on radiation effects in semiconductors for applications in extreme environments remains an active and crucial area of study. Radiation-hardening techniques are being actively explored to enhance the resilience of semiconductor devices against ionizing radiation, especially for applications in space, nuclear power plants, medical devices, and high-altitude aviation. Extensive efforts are concentrated on gaining a deeper understanding of the mechanisms by which ionizing radiation impacts semiconductor materials, encompassing studies on the effects of various radiation types, such as gamma rays, neutrons, and ions, on both the electronic and structural properties of semiconductors. In parallel, identifying or engineering semiconductor materials that inherently possess greater resistance to radiation-induced damage remains a focal point to address the need for radiation tolerance to ensure reliability. Device-level studies are also being conducted to assess the impact of radiation on the performance and reliability of specific semiconductor devices. The success of implementing radiation-hard semiconductor technologies relies on key breakthroughs and fundamental discoveries in semiconductor materials and device designs. This symposium hopes to bring together prominent efforts in this field. Particular emphasis will be laid on novel experimental and modeling approaches that approach radiation responses of (ultra)wide bandgap materials and devices.

Topics will include:

- Advanced experimental, modeling, and data-driven approaches to predict the effects of ionizing radiation
- Behavior and properties of radiation-induced defects
- Radiation-induced single-event effects
- Radiation-induced degradation of electronic performance
- Innovative strategies for enhancing the radiation hardness of semiconductor devices
- Novel semiconductor materials or modifications to existing materials to improve their inherent resistance to radiation-induced damage

Invited speakers include:

Ruben Alia Garcia	Conseil européen pour la Recherche nucléaire, Switzerland	**Ani Khachatrian**	U.S. Naval Research Laboratory, USA
Aaron Arehart	The Ohio State University, USA	**Andrew O'Hara**	Western Michigan University, USA
Scooter Ball	Vanderbilt University, USA	**Stephen Pearton**	University of Florida, USA
Stefano Bonaldo	Università degli Studi di Padova, Italy	**Miguel Sequeira**	Instituto Superior Técnico, University of Lisbon, Portugal
Rongming Chu	The Pennsylvania State University, USA	**Blair Tuttle**	The Pennsylvania State University, USA
Rosine Coq Germanicus	Université de Caen Normandie, France	**Chris Van de Walle**	University of California, Santa Barbara, USA
Esmat Farzana	Iowa State University, USA	**Grace Xing**	Cornell University, USA
Max Fischetti	The University of Texas at Dallas, USA	**Enxia Zhang**	University of Central Florida, USA

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Symposium EL05: 2D and 3D Printed Optoelectronics and Sensors—Advanced Materials, Device Functionality and Systems

Advanced functional materials whose optical, electronic, and mechanical characteristics can be customized through chemical design offer unprecedented opportunities to generate new solutions for societal challenges, advancing the potential applications of emerging technologies in environmental monitoring, energy technology, robotics, communication, smart agriculture, healthcare, wearable, and Internet of Things devices. Processing such materials by the large palette of state-of-the-art additive 2D and 3D printing techniques represents an opportunity to develop integrated (opto)electronic or sensor systems that can be personalized to the application needs in a cost- and material-efficient manner. Developing high-performance printed optical, chemical, biological and physical sensors, thermoelectric, light-emitting, or photovoltaic devices, all the way to supercapacitors and actuators, requires a holistic multidisciplinary approach. This involves the design of novel materials, the fabrication of multi-material/multifunction device architectures with high-quality interfaces, and integrating systems onto flexible, stretchable, and soft substrates. Furthermore, the current advances in 3D printing technology open new pathways for fabricating devices with unprecedented form factors while carrying exciting material science challenges. This symposium aims to bring together scientists and engineers across different disciplines to discuss the challenges and the recent advances in the design of advanced materials, their processing through additive manufacturing techniques and the fabrication of next-generation devices and integrated systems. The contributions should discuss the fundamental understanding of the devices and their engineering challenges without forgetting the role of circular materials, green solvents, and sustainable applications.

Topics will include:

- Synthesis and characterization of novel printable optoelectronic and sensing materials
- Printed chemical, biological, and physical sensors and applications
- Printed optical sensors
- Printable energy harvesting and energy storage devices
- Printeable light emitting devices (OLEDs, LECs, LEFETs)
- Organic electrochemical devices and lasers
- Green solvents and circular materials in printed electronics
- Solution-processable electronics
- Optical, electronic, magnetic, structural and morphological characterization of printed functional films
- Material-property-performance relationships in printed devices
- Investigation of device physics in printed devices.
- Methods for processing of printed multilayers.
- Rational and machine learning-driven design of ink formulations and printing processes
- Applications of printed elements in integrated electronic systems

Joint sessions are being considered with **EL14 - Flexible and Stretchable Optoelectronics and Circuits for Emerging Wearable Electronics**.

Invited speakers include:

Chihaya Adachi	Kyushu University, Japan
Thomas Anthopoulos	The University of Manchester, United Kingdom
Jason Azoulay	Georgia Institute of Technology, USA
Derya Baran	King Abdullah University of Science and Technology, Saudi Arabia
Mario Caironi	Istituto Italiano di Tecnologia, Italy
Fabio Cicoira	Polytechnique Montréal, Canada
Ravinder Dahiya	Northeastern University, USA
Wei Gao	California Institute of Technology, USA
Sungjune Jung	Pohang University of Science and Technology, Republic of Korea
Do-Hwan Kim	Hanyang University, Republic of Korea

Hyunhyub Ko	Ulsan National Institute of Science and Technology, Republic of Korea
Jodie Lutkenhaus	Texas A&M University, USA
Roderick MacKenzie	Durham University, United Kingdom
Vincenzo Pecunia	Simon Fraser University, Canada
Barbara Stadlober	JOANNEUM RESEARCH Forschungsgesellschaft mbh, Austria
Stefano Toffanin	Consiglio Nazionale delle Ricerche, Italy
Graham Turnbull	University of St Andrews, United Kingdom
Gregory Whiting	University of Colorado Boulder, USA
Wenzhou Wu	Purdue University, USA
Cunjiang Yu	The Pennsylvania State University, USA

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Symposium EL06: Novel Perovskite Semiconductors and Optoelectronics

In the last decade, the rise of organic-inorganic lead metal halide perovskite has led to significant change in research direction of the whole photovoltaic community. What makes perovskite particularly promising as light-harvesting semiconductor due to its facile synthesis using simple deposition techniques and low manufacturing cost. Additionally, there are a large variety of organic-inorganic combinations available and therefore, suitable dimensionalities (3D to 0D) and bandgaps. This symposium aims to bring together leading experts from around the world to discuss fundamental advantages of perovskite, including the influence of organic A-cations, optimization of manufacturing processes, versatility of thin film deposition (solution and evaporation films), lead-free perovskite, advances in stability. Perovskite offers remarkable properties suitable for numerous applications in thin-film technology. Particularly, this symposium includes, solar cells, light-emitting diodes, memristors, and other emerging applications. Furthermore, the development of multi-junction solar cells, as well as advancements in scale-up preparation for in-door and out-door applications, are bringing this promising technology one step closer to commercialization. Finally, to achieve climate-neutrality and sustainability, it is imperative to prioritize circular technology. This entails reducing the consumption of raw materials, promoting recycling processes, and ultimately, cutting production costs.

Topics will include:

- Low-dimensional perovskites
- Lead-free perovskite
- Photophysics
- Optimal manufacturing processes
- Durability
- Tandem
- Sustainability and bankability

Invited speakers include:

Pablo P. Boix	Valencia Polytechnic University, Spain
Bin Chen	Northwestern University, USA
Juan-Pablo Correa-Baena	Georgia Institute of Technology, USA
Francesca de Rossi	Università degli Studi di Roma Tor Vergata, Italy
Steffan De Wolfe	King Abdullah University of Science and Technology, Saudi Arabia
Felix Deschler	Universität Heidelberg, Germany
Xiwen Gong	University of Michigan, USA
Yi Hou	National University of Singapore, Singapore
Tae-Woo Lee	Seoul National University, Republic of Korea
Maria Antonietta Loi	University of Groningen, Netherlands
Jovana Milic	Université de Fribourg, Switzerland
Andrew Musser	Cornell University, USA
Ana Flavia Nogueira	University of Campinas, Brazil
Selina Olthof	University of Cologne, Germany
Senol Oz	Solaveni, Germany
Barry Rand	Princeton University, USA
Ted Sargent	Northwestern University, USA
Brett M. Savoie	Purdue University, USA
Laura Schelhas	National Renewable Energy Laboratory, USA
Hiroshi Segawa	Tokyo University, Japan
Martin Stolterfoht	The Chinese University of Hong Kong, Hong Kong
Samuel Stranks	University of Cambridge, United Kingdom
Wouter Van Gompel	Hasselt University, Belgium
Atushi Wakamiya	Kyoto University, Japan
Gang Xiong	First Solar, USA
Jingjing Xue	Zhejiang University, China
Peidong Yang	University of California, Berkeley, USA
Yang Yang	University of California, Los Angeles, USA
Qiuming Yu	Cornell University, USA
Kai Zhu	National Renewable Energy Laboratory, USA

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Symposium EL07: Superconducting Materials

The symposium will broadly cover recent progress in superconducting materials from both fundamental and applications perspectives. The emphasis will be placed on several research areas: 1) recent emerging superconductors that include kagome superconductors, nickelates, twisted bilayer graphene, topological superconductors, and high-T_c hydride superconductors; 2) medium- and high-temperature superconductors that include cuprates, iron-based compounds, and MgB_2; 3) applications of superconducting materials in quantum computation and sensors, and large-scale superconducting applications, such as superconducting power devices, high field magnets for accelerators, and compact fusion reactors.

The symposium contributors are encouraged to address the development of superconducting quantum limited sensors and superconducting qubit with related technologies and the discussion on performance of superconducting wires, such as homogeneity through length, cost-effectiveness, high throughput, and scalability. In this symposium, we will discuss the future perspectives of superconducting materials and create a strong network of researchers.

Topics will include:

- Topological superconductors and unconventional superconductivity
- Quantum materials and computing
- Nonreciprocal superconductivity and superconducting diode effect
- Kagome superconductors, nickelate, and other novel superconductors
- Superconducting qubit: materials issues, gates and error corrections
- Josephson junction technology and interface
- Flux pinning and critical currents: intrinsic pinning behavior, anisotropy, irradiation effect
- REBCO wires and coated conductors: processing and applications
- Fe-based superconductors and potential applications
- Bi-based, Nb-based, MgB(2) tapes and round wires: processing and applications
- Tuning superconductivity by high pressure, ion gating, and light
- Superconducting devices and their implementations

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

Invited speakers include:

Ariando Ariando	National University of Singapore, Singapore
Valla Fatemi	Cornell University, USA
Hong-Jun Gao	Institute of Physics, Chinese Acadamy of Sciences, China
Yasuhiro Iijima	Fujikura Ltd., Japan
Francesco Laviano	Politecnico di Torino, Italy
Qiang Li	Stony Brook University, The State University of New York, USA
Kathryn Moler	Stanford University, USA
Jagadeesh Moodera	Massachusetts Institute of Technology, USA
Teruo Ono	Kyoto University, Japan

Stuart Parkin	Max Planck Institute of Microstructure Physics, Germany
Ivan Schuller	University of California, San Diego, USA
Javad Shabani	New York University, USA
Takasada Shibauchi	The University of Tokyo, Japan
Tsuyoshi Tamegai	The University of Tokyo, Japan
Yayu Wang	Tsinghua University, China
Peng Wei	University of California, Riverside, USA
Judy Wu	University of Kansas, USA
Hideki Yamamoto	NTT Group, Japan

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Symposium EL08: Ferroic Materials and Heterostructures

Recent progress in the synthesis of (anti-)ferroic materials and heterostructures has led to the discovery of new physical properties and conceptually new application paradigms for beyond-CMOS computing schemes. In this class of materials, the interplay between charge, spin, lattice, and orbital degrees of freedom leads to a wide range of fascinating quantum phenomena not observed in conventional semiconducting compounds. These include chirality, magnetoelectricity, and systems with multiple order parameters (e.g., multiferroics). Furthermore, recent advances in synthesis have enabled the tailoring of symmetry and competing interactions to yield topologically non-trivial polar and magnetic textures. The beauty and connections of the unifying scientific concepts in materials with electric and/ magnetic order are mutually beneficial and have become a strong motivation for interdisciplinary activities, propelled by the recent developments in theory, synthesis, and characterization.

This symposium focuses on (anti-)ferroics, related boundaries/interfaces and textures rather than excitations. Albeit abstracts that investigate switching kinetics and dynamics in these systems are encouraged. This symposium aims to bring together experts and young scientists with an interest in synthesis and multiscale characterization of controlled (anti-)ferroic materials and interfaces, heterostructures, and nanostructures. The organizers encourage the submission from academic, national lab, and industry researchers who seek to advance the state-of-the-art in bulk and thin film synthesis, engineering of (anti-)ferroic order with strain, interfaces, defects, disorder and scaling/dimension, spectroscopic and time-domain measurements of ferroic behavior.

Topics will include:

- Ferroelectrics and antiferroelectrics
- Magnetic, multiferroic, and magnetoelectric materials
- Heterostructures of, and interfaces in, thin films and superlattices
- Non-collinear, incommensurate, and chiral textures in magnetic and polar materials
- Topological order in magnetic and polar materials
- Two-dimensional and freestanding functional materials and thin films
- Functional domain walls in ferroics and anti-ferroics
- Advanced atomic resolution and operando probes of (anti-)ferroic orders, scale bridging and correlated characterizations
- Theory of ferroic systems, non-collinear magnetic and electric dipole textures and their switching dynamics

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

Invited speakers include:

Nazanin Bassiri-Gharb	Georgia Institute of Technology, USA
Laura Begon-Lours	ETH Zürich, Switzerland
Lucas Caretta	Brown University, USA
Gustau Catalan	Catalan Institute of Nanoscience and Nanotechnology, Spain
Neus Domingo Marimon	Oak Ridge National Laboratory, USA
Catherine Dubourdieu	Helmholtz-Zentrum Berlin, Germany
Ismail El Baggari	Harvard University, USA
Vincent Garcia	Centre National de la Recherche Scientifique, France
Marty Gregg	Queen's University Belfast, United Kingdom
Sinead Griffin	Lawrence Berkeley National Laboratory, USA
Alexei Gruverman	University of Nebraska–Lincoln, USA
Jorge Iniguez	Luxembourg Institute of Science and Technology, Belgium
Lynette Keeney	Tyndall National Institute, Ireland

Lane Martin	Rice University, USA
Sophie Morley	Lawrence Berkeley National Laboratory, USA
Julia Mundy	Harvard University, USA
Beatriz Noheda	University of Groningen, Netherlands
Patrycja Paruch	University of Geneva, Switzerland
Roger Proksch	Oxford Instruments, USA
Ramamoorthy Ramesh	Rice University, USA
YuTsun Shao	University of Southern California, USA
Nicola Spaldin	ETH Zürich, Switzerland
Nives Strkalji	Institute of Physics of the University of Zagreb, Croatia
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Symposium EL09: Stability of Metal Halide Perovskites—From Materials to Devices

Organic-inorganic hybrid perovskites have emerged as highly promising materials for various optoelectronic devices, including solar cells, LEDs, lasers, photodetectors, and transistors. Despite significant progress, there are still major challenges, particularly regarding stability. Stability issues involve design, materials processing, defects, and interfaces, all of which need to be understood and optimized for different environmental conditions.

This symposium aims to promote collaboration and knowledge exchange by bringing together researchers from chemistry, materials science, physics, and engineering. By providing a platform for discussion, the symposium will address stability challenges in hybrid perovskite materials and devices and highlight recent advances. Through in-depth discussions, it will enhance understanding using advanced experimental and theoretical approaches. Ultimately, the symposium strives to foster the development of stable halide perovskite materials and devices.

Topics will include:

- Materials development: synthesis and processing of active layers and transport layers
- Reliability testing: accelerated testing protocols and degradation model
- Materials and device failure modes
- Machine learning-assisted stability prediction
- Compositional engineering of halide perovskites
- Defect characterization and the passivation of defects in perovskites
- Interfacial engineering in device applications
- Phase transitions in halide perovskites
- Charge carrier dynamics at interfaces and, defects for device applications
- Mechanistic understanding of degradation in perovskite materials and devices

Joint sessions are being considered with **EL06 - Exploring Frontiers in Perovskite Semiconductors and Optoelectronics—Emerging Materials and Scaling Strategies**, and **EL10 - Advances in the Fundamental Understanding of Halide Perovskites**.

Invited speakers include:

Aram Amassian	North Carolina State University, USA
Henk Bolink	Universitat de València, Spain
Ana Flavia Nogueira	University of Campinas, Brazil
Feng Gao	Linköping University, Sweden
David Ginger	University of Washington, USA
Laura Herz	University of Oxford, United Kingdom
Robert Hoye	University of Oxford, United Kingdom
Alex Jen	City University of Hong Kong, Hong Kong
Jin-Wook Lee	Sungkyunkwan University, Republic of Korea
Monica Lira-Cantu	Catalan Institute of Nanoscience and Nanotechnology, Spain
Maria Antonietta Loi	University of Groningen, Netherlands
Joey Luther	National Renewable Energy Laboratory, USA
Luana Mazzarella	Delft University of Technology, Netherlands
Michael McGehee	University of Colorado Boulder, USA
David Mitzi	Duke University, USA
Aditya Mohite	Rice University, USA
Nitin Padture	Brown University, USA
Nam-Gyu Park	Sungkyunkwan University, Republic of Korea
Annamaria Petrozza	Istituto Italiano di Tecnologia, Italy
Lina Quan	Virginia Tech, USA
Barry Rand	Princeton University, USA
Nicholas Rolston	Arizona State University, USA
Michael Saliba	Universität Stuttgart, Germany
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Hyunjung Shin	Sungkyunkwan University, Republic of Korea
Shijing Sun	University of Washington, USA
Prashant V. Kamat	University of Notre Dame, USA
Sjoerd Veenstra	TNO, Netherlands
Rui Wang	Westlake University, China
Zonglong Zhu	City University of Hong Kong, Hong Kong

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Symposium EL10: Advances in the Fundamental Understanding of Halide Perovskites

Halide perovskites have emerged as a new class of semiconductors with exceptional material properties, making them promising candidates for a plethora of 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, bright-dark exciton level inversion, high ion mobility, as well as chiroptical and chiral-induced electronic behaviours have not been fully understood. To date, a lack of deep insight into the interplay between structure, morphology, and optical and electronic properties impedes the further advancement of halide perovskites. This symposium will be a platform for researchers whose work addresses underlying fundamental material aspects. Research topics covered in the symposium will include, among others, the latest advances in photophysics, charge carrier transport, ultrafast spectroscopy, band-structures, and phonon-carrier interaction, role of defects, 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:

- Experimental & computational characterization of dynamic properties and charge transport in halide perovskites
- Ultrafast processes in perovskite materials (e.g., hot carriers and localization, electron-phonon interactions, polaron formation, structural dynamics, phase transitions)
- Micro- and nano-scale imaging of perovskites using optical probes (pump-probe, photoluminescence) and non-optical probes (electron, x-ray, neutron, and scanning probe microscopy)
- Role of defects, impurity doping, and mobile ions on fundamental material properties and device performances
- Excitons, phonons, polarons, spins, and magnons realized in 3D and 2D perovskites
- Interplay of chirality and spin in halide perovskites
- Fundamental insights into low-dimensional perovskites including nanocrystals, layered perovskites, 2D heterostructures, and nanoplatelets
- Understanding the interfacial processes of perovskite materials
- Band structure calculations and theoretical modelling of optoelectronic properties
- Emerging properties of perovskites, including ferroelectricity, spintronics, bulk photovoltaics, memristor and ionic conductivity
- Perovskite-derived materials, including metal halide hybrids, and non-lead-halide based hybrid organic-inorganic perovskites

Joint sessions are being considered with **EL06 - Exploring Frontiers in Perovskite Semiconductors and Optoelectronics—Emerging Materials and Scaling Strategies**, and **EL09 - Stability of Metal Halide Perovskites—From Materials to Devices**.

Invited speakers include:

Mahshid Ahmadi	The University of Tennessee, Knoxville, USA	**Linn Leppert**	University of Twente, Netherlands
Wei Bao	Rensselaer Polytechnic Institute, USA	**Annamaria Petrozza**	Istituto Italiano di Tecnologia, Italy
Matthew Beard	National Renewable Energy Laboratory, USA	**Diana Qiu**	Yale University, USA
Volker Blum	Duke University, USA	**Tze Chien Sum**	Nanyang Technological University, Singapore
Juan-Pablo Correa-Baena	Georgia Institute of Technology, USA	**Michael Toney**	University of Colorado Boulder, USA
Letian Dou	Purdue University, USA	**Yiying Wu**	The Ohio State University, USA
Jinsong Huang	University of North Carolina at Chapel Hill, USA	**Omer Yaffe**	Weizmann Institute of Science, Israel
Song Jin	University of Wisconsin–Madison, USA	**Yanfa Yan**	The University of Toledo, USA
Mercouri Kanatzidis	Northwestern University, USA	**Qiuming Yu**	Cornell University, USA
Maksym Kovalenko	ETH Zürich, Switzerland	**Yuanyuan Zhou**	The Hong Kong University of Science and Technology, Hong Kong

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Symposium EL11: Wide and Ultrawide Bandgap Materials, Devices and Applications

Research in wide and ultra-wide-bandgap (WBG/UWBG) semiconductor materials (bandgap over 3 eV) and devices continues to progress rapidly. Materials beyond silicon carbide and gallium nitride, such as gallium oxide, diamond, cubic boron nitride, aluminum nitride, and others, are at the frontier of semiconductor materials and device physics research. While such materials hold great promise for applications such as ultraviolet optoelectronic emitters and detectors, more compact and efficient energy converters, higher power high-frequency amplifiers, and quantum information science, many materials and processing challenges must still be addressed before UWBG semiconductors mature and can have significant impact. For example, many of the fundamental properties of these emerging materials are still poorly understood, including the physics of high-energy carrier scattering and transport responsible for electrical breakdown. Practical challenges such as efficient and controllable n- and p-type doping, synthesis of large area, low-defect-density substrates, the formation of reliable, low-resistance electrical contacts, and the integration of dielectric films with high quality interfaces are also areas that need to be further advanced before delivery of mature, viable, and cost competitive UWBG technologies can occur. This symposium will address a comprehensive set of topics related to the materials science, device physics, and processing of ultra-wide-bandgap materials, with a view towards the applications that are driving research in the field. The concept of co-design, whereby research topics such as those described above as well as their potential impact on applications are considered concurrently, is anticipated to be a theme of the symposium. Topics of current interest in the more traditional wide-bandgap materials is also encouraged for this symposium. Additionally, the symposium organizers highly encourage graduate student presentations and posters, and expect to recognize multiple student contributions with best presentation and poster awards.

Topics will include:

- Defects and Doping
- First-principles theory
- Electronic transport and carrier dynamics
- Advanced materials characterization and techniques
- Heterointergration approaches
- WBG/UWBG electronic and optoelectronic devices
- Materials and device processing
- Ultraviolet emitters and detectors
- Thermal properties and electro-thermal co-design
- Color centers for quantum technologies
- Advanced SiC and III-Nitride materials and devices

Invited speakers include:

Andrew Allerman	Sandia National Laboratories, USA
Oliver Bierwagen	Paul Drude Institute for Solid State Electronics, Germany
Michael Dudley	Stony Brook University, The State University of New York, USA
Hiroshi Fujioka	The University of Tokyo, Japan
Bernard Gil	Université de Montpellier, France
Andrew Green	Air Force Research Laboratory, USA
Timothy Grotjohn	Michigan State University, USA
Masataka Higashiwaki	Osaka Metropolitan University, Japan
Ryota Ishii	Kyoto University, Japan
Jong Kyu Kim	Pohang University of Science and Technology, Republic of Korea
Yoshinao Kumagai	Tokyo University of Agriculture and Technology, Japan
Jacob Leach	Kyma Technologies, USA

Ilja Makkonen	University of Helsinki, Finland
Hideto Miyake	Mie University, Japan
John Muth	North Carolina State University, USA
Hari Nair	Cornell University, USA
Georges Pavlidis	University of Connecticut, USA
Siddharth Rajan	The Ohio State University, USA
Julita Smalc-Koziorowska	Institute of High Pressure Physics of the Polish Academy of Sciences, Poland
Takashi Taniguchi	National Institute for Materials Science, Japan
Lasse Vines	University of Oslo, Norway
Grace Xing	Cornell University, USA
Jiandong Ye	Nanjing University, China

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Symposium EL12: Emerging Material Platforms and Fundamental Approaches for Plasmonics, Nanophotonics and Metasurfaces

This symposium will address emerging topics of plasmonics, nanophotonics, metamaterials, and metasurfaces to overcome existing limitations that prevent the development of practical photonic devices. The symposium seeks to provide a general overview of recent advances in new design concepts and material platforms, including fabrication techniques and promising applications enabled by the new developments. Novel approaches in plasmonics and metasurfaces promise the generation, processing, sensing, and detection of signals at the nanometer scale with great potential in a wide range of fields, including photovoltaics, optical communications, quantum information processing, bioimaging, lighting, sensing, chemistry, and medicine.
The recent discovery of new plasmonic materials as well as layered and two-dimensional materials with low loss, tunable optical properties, and CMOS compatibility can enable a breakthrough in the field of nanophotonics, optical metamaterials, and their applications. Novel nonlinear and quantum phenomena and advanced design based on machine learning strategies and new simulation methods for metasurface, metamaterial, and plasmonic materials/devices are also of interest to this symposium.

Topics will include:

- Plasmonics and Metasurfaces
- Tunable and alternative plasmonic and metasurface materials
- Photonics with two-dimensional materials
- Materials with epsilon-near-zero and hyperbolic dispersion properties
- Topological photonic and parity-time symmetric materials
- Biological and chemical sensing with plasmonics and metasurfaces
- Quantum and thermal properties in plasmonic, metasurface, and nannophotonic structures
- Ultrafast and nonlinear effects in metamaterials and plasmonics
- Photovoltaic applications and efficient light harvesting
- Waveguides, devices and systems from plasmonics and metamaterials
- Novel fabrication techniques for improving plasmonic/metasurface properties
- Advanced nanophotonic design strategies, including machine learning, as well as new simulation methods

Invited speakers include:

Harry Atwater	California Institute of Technology, USA
Alexandra Boltasseva	Purdue University, USA
Hou-Tong Chen	Los Alamos National Laboratory, USA
Sangyeon Cho	Massachusetts General Hospital and Harvard Medical School, USA
Nader Engheta	University of Pennsylvania, USA
Jonathan Fan	Stanford University, USA
Eyal Feigenbaum	Lawrence Livermore National Laboratory, USA
Erez Hasman	Technion–Israel Institute of Technology, Israel
Deep Jariwala	University of Pennsylvania, USA
Sejeong Kim	The University of Melbourne, Australia
Wei Li	Changchun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Sciences, China
Zhaowei Liu	University of California, San Diego, USA
Yuan Luo	National Taiwan University, Taiwan
Ren-Min Ma	Peking University, China

Stefan Maier	Monash University, Australia
Arka Majumdar	University of Washington, USA
Jeremy Munday	University of California, Davis, USA
Ragip Pala	Meta Materials Inc., Canada
Albert Polman	AMOLF, Netherlands
Lisa Poulikakos	University of California, San Diego, USA
Vladimir Shalaev	Purdue University, USA
Qinghua Song	Tsinghua University, China
Takuo Tanaka	RIKEN, Japan
Feng Wang	University of California, Berkeley, USA
Yuanmu Yang	Tsinghua University, China
Ta-Jen Yen	National Tsing Hua University, Taiwan
Nanfang Yu	Columbia University, USA
Yang Zhao	University of Illinois at Urbana-Champaign, USA

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Symposium EL13: Frontiers in Electrochromic Materials and Devices

Electrochromic devices (ECDs) are innovative components that can change their optical transmittance or reflectance when an electric potential is applied. They're especially useful in smart windows for automobiles and buildings, where they shift between dark (colored) and clear (bleached) states. This switching ability enhances energy efficiency and provides visual comfort. ECDs are also becoming increasingly important in the virtual and augmented reality sectors of the future meta-world. They offer low power consumption and can operate in both transmissive and reflective modes, making them a unique alternative to emissive displays for various applications.

To maximize the potential of ECDs, advancements in material design, processing methods, device architecture, and a deeper understanding of how ions and electrons move within these devices are crucial. Identifying and addressing failure modes is also vital. This symposium aims to gather leading researchers and industry experts to discuss recent technical progress, tackle challenges in mass production, and explore commercial opportunities.

The symposium invites abstract submissions on all facets of electrochromic technology, including material design, patterning, coating, device fabrication, and large-scale manufacturing processes. It will also focus on discussions related to business development in this field.

Topics will include:

- Small molecule-based electrochromic materials and devices
- Polymer-based electrochromic materials and devices
- Metal-oxide based electrochromic materials and devices
- Plasmonic electrochromics
- Reversible metal deposition
- Mixed organic conductors
- Ion and electron transport
- Optical and electronic modeling of electrochromic thin films

Invited speakers include:

Chris Barile	University of Nevada, Reno, USA	**Pooi See Lee**	Nanyang Technological University, Singapore
Liisa Hakola	VTT Technical Research Centre of Finland Ltd., Finland	**Delia Milliron**	The University of Texas at Austin, USA
Eunkyoung Kim	Yonsei University, Republic of Korea	**Macro Schott**	Fraunhofer Institute for Silicate Research, Germany
Jongwook Kim	Ecole Polytechnique, France	**Eric Shen**	Georgia Institute of Technology, USA
Caroline Lee	Hanyang University, Republic of Korea		

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Symposium EL14: Flexible and Stretchable Optoelectronics and Circuits for Emerging Wearable Electronics

Wearable electronics have emerged as a paramount platform for monitoring human health. These devices must establish a close and comfortable connection with the human skin while exhibiting mechanical flexibility and stretchability to endure the mechanical stress experienced during everyday use. In this context, the development of flexible and stretchable optoelectronics is imperative, encompassing components like stretchable light-emitting devices, photovoltaics, and photodetectors, all designed to maintain functionality under mechanical strain. However, overcoming the trade-off between stretchability and device efficiency remains a significant challenge for all electronic devices. This symposium aims to delve into the cutting-edge realm of flexible and stretchable optoelectronics, with the overarching goal of advancing wearable electronics. The proposed symposium will cover a broad spectrum of topics, from the fundamental mechanisms underpinning the design of stretchable materials to their real-world applications. Our discussions will encompass, flexible displays, emerging materials for wearable optoelectronics, three-dimensional microfabrication, printed optoelectronics, stretchable integrated circuits, bio-integrated optoelectronics, user-interactive displays. Through this comprehensive exploration, we aim to foster a dynamic exchange of ideas and insights, ultimately propelling the field of flexible and stretchable optoelectronics forward and promising transformative contributions to wearable electronics.

Topics will include:

- Flexible, foldable, rollable and stretchable display
- Emerging materials for wearable optoelectornics
- Three-dimensional microfabrication
- Printed optoelectronics
- Stretchable integrated circuits
- Bio-integrated optotelectornics
- Sensors and actuators for integrated display
- User interactive display
- Encapsulations for flexible and stretchable electronics

Joint sessions are being considered with **SB02 - Flexible, Stretchable Biointegrated Materials, Devices and Related Mechanics**.

Invited speakers include:

Jong-Huyn Ahn	Yonsei University, Republic of Korea	**Jin-Woo Park**	Yonsei University, Republic of Korea
Ana Claudia Arias	University of California, Berkeley, USA	**Qibing Pei**	University of California, Los Angeles, USA
Zhenan Bao	Stanford University, USA	**Seung Yoon Ryu**	Dongguk University, Republic of Korea
Canan Dagdeviren	MIT Media Lab, USA	**Franky So**	North Carolina State University, USA
Antonio Facchetti	Georgia Institute of Technology, USA	**Benjamin Tee**	National University of Singapore, Singapore
Po-Chun Hsu	The University of Chicago, USA	**Limei Tian**	Texas A&M University, USA
Ali Javey	University of California, Berkeley, USA	**Sihong Wang**	The University of Chicago, USA
Bumjoon Kim	Korea Advanced Institute of Science and Technology, Republic of Korea	**Jie Xu**	Argonne National Laboratory, USA
Dae-Hyeong Kim	Seoul National University, Republic of Korea	**Jinwoong Yang**	Daegu Gyeongbuk Institute of Science and Technology, Republic of Korea
Pooi See Lee	Nanyang Technological University, Singapore	**Tomoyuki Yokota**	The University of Tokyo, Japan
Tae-Woo Lee	Seoul National University, Republic of Korea	**Seunghyup Yoo**	Korea Advanced Institute of Science and Technology, Republic of Korea
Yeongjun Lee	Korea Advanced Institute of Science and Technology, Republic of Korea	**Cunjiang Yu**	The Pennsylvania State University, USA
Jin Young Oh	Kyung Hee University, Republic of Korea	**Zhibin Yu**	Florida State University, USA
Cheolmin Park	Yonsei University, Republic of Korea		

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Symposium EL15: Fundamentals of Mixed Ionic-Electronic Conductors

Mixed ionic-electronic conductors, also known as mixed conductors, are an increasingly important category of materials with applications in energy storage, electrochromic displays, bioelectronics, sensors, electrocatalysis, neuromorphic devices, thermoelectrics, and actuators. Mixed conductors exhibit both ion and electron/hole conductivity, and ionic-electronic coupling (i.e., capacitance), allowing them to effectively transduce ionic signals to electronic ones, and vice versa. In recent years, new mixed conductors have been developed beyond the traditional metals oxides and phosphates to include (semi)conducting polymers, radical polymers, perovskites, and hybrid organic-inorganic materials, enabling improved performance and new functionalities. Despite these advances, challenges remain in characterizing and modeling the dynamic relationship among electronic transport, ionic transport, and material structure during device operation. This symposium will focus on the synthesis, characterization, and modeling of these emerging materials, with an emphasis on their fundamental understanding, existing challenges, and future directions. In particular, new material designs and synthetic approaches, structure-property relationships, mechanical properties, device physics and engineering, electrochemical transistors, in-situ and in-operando characterization, materials and device stability, theory, modeling, and molecular dynamics simulations will be covered. This symposium will provide a unique opportunity to bring together experts in organic, inorganic, and hybrid materials to discuss the fundamentals of mixed ionic-electronic conductors.

Topics will include:

- Fundamentals of ion and electron/hole transport
- *In situ/operando* characterization
- Design and synthesis of new materials
- Organic (semi)conductors
- Radical polymers
- Perovskites and hybrid materials
- Metal Oxides
- Mixed conductor thermoelectrics
- Device engineering and optimization
- Mechanical and electronic stability
- Theory, modeling, and molecular dynamics simulations

Invited speakers include:

Natalie Banerji	University of Bern, Germany	**Iain McCulloch**	Princeton University, USA
Michael Chabinyc	University of California, Santa Barbara, USA	**Jianguo Mei**	Purdue University, USA
Alex Giovannitti	Chalmers University of Technology, Sweden	**Davide Moia**	Max Planck Institute for Solid State Research, Switzerland
Fei Huang	South China University of Technology, China	**Erin Ratcliff**	Georgia Institute of Technology, USA
Laure Kayser	University of Deleware, USA	**Alberto Salleo**	Stanford University, USA
Jongwoo Lim	Seoul National University, Republic of Korea	**Brett M. Savoie**	Purdue University, USA
Sabine Ludwigs	Universität Stuttgart, Germany	**Hitoshi Takamura**	Tohoku University, Japan
Christine Luscombe	Okinawa Institute of Science and Technology, Japan	**Alessandro Troisi**	University of Liverpool, United Kingdom
Björn Lüssem	Universität Bremen, Germany	**Choongho Yu**	Texas A&M University, USA
Micaela Matta	King's College London, United Kingdom		

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Symposium EL16: Nanogenerators and Piezotronics

Recent advancements in nanogenerator research have demonstrated significant potential in capturing mechanical energy from the environment and the human body, offering practical and sustainable power sources in diverse conditions. Over the past two decades, nanogenerator technologies leveraging piezoelectric, triboelectric, and other effects have rapidly evolved. Integrating nanogenerators with energy storage and functional devices has led to various micro/nano-systems for portable, wearable, implantable electronics, remote sensors, nanorobotics, intelligent MEMS/NEMS, and blue energy technology. The coupling between piezoelectric polarization and semiconductor properties, wherein strain manipulates electrons and photons (piezotronics and piezo-phototronics), presents unique opportunities to enhance semiconductor performance. Advances in piezotronics and piezo-phototronics have driven significant progress from fundamental studies of piezoelectricity and semiconductor properties in functional nanomaterials to developing smart electronics and optoelectronics applications, including sensing, human-machine interfacing, robotics, catalysis, energy, and healthcare. This symposium aims to encourage in-depth discussion and advancement of nanogenerators and piezotronics. Theoretical and experimental research into triboelectric, piezoelectric, and ferroelectric materials and devices and nanogenerators in self-powered devices and piezotronics are particularly welcome.

Topics will include:

- Novel piezoelectric, ferroelectric, and triboelectric nanomaterials
- Theoretical analysis of nanoscale mechanical-to-electric energy conversion
- Bio-inspired materials and device innovations in mechanical energy harvesting
- Technological advances in the integration and manufacturing of nanogenerators and piezotronics
- Hybridization of nanogenerators with energy storage units
- Mechanisms of triboelectric charge generation and transportation
- Mechanisms of triboelectric charge generation and transportation
- Tribotronics for electronics and sensors
- Piezotronics and Piezophototronics in 1D/2D nanomaterials
- Theoretical and experimental study of piezotronic and piezophototronic effects
- Materials and heterostructure developments for piezotronics and piezophototronics
- Fundamental and technological issues in piezocatalysis and piezo-electrocatalysis

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

Invited speakers include:

Ana Borras	Instituto de Ciencia de Materiales de Madrid, Spain
Geoff Brennecka	Colorado School of Mines, USA
Joe Briscoe	Queen Mary University of London, United Kingdom
Jun Chen	University of California, Los Angeles, USA
Ravinder Dahiya	Northeastern University, USA
Serena Danti	University of Pisa, Italy
Ishara Dharmasena	Loughborough University, United Kingdom
Yong Ding	ETH Zürich, Switzerland
Matthew Eichenfield	The University of Arizona, USA
Alper Erturk	Georgia Institute of Technology, USA
Kourosh Kalantar-Zadeh	The University of Sydney, Australia
Sohini Kar-Narayan	University of Cambridge, United Kingdom
Sang-Woo Kim	Yonsei University, Republic of Korea
Sangtae Kim	Hanyang University, Republic of Korea
Lijie Li	Swansea University, United Kingdom

Zong-Hong Lin	National Taiwan University, Taiwan
Judith MacManus-Driscoll	University of Cambridge, United Kingdom
Yogendra Kumar Mishra	Syddansk Universitet, Denmark
Simiao Niu	Rutgers University, USA
Giuseppina Pace	Consiglio Nazionale delle Ricerche, Italy
Jose Pedro Silva	University of Minho, Portugal
Hyun-Cheol Song	Korea Institute of Science and Technology, Republic of Korea
Urszula Stachewicz	AGH University of Science and Technology, Poland
Barbara Stadlober	JOANNEUM RESEARCH Forschungsgesellschaft mbh, Austria
Susan Trolier-McKinstry	The Pennsylvania State University, USA
João Ventura	Universidade do Porto, Portugal
Roseanne Warren	The University of Utah, USA
Changsheng Wu	National University of Singapore, Singapore
Jyh-Ming Wu	National Tsing Hua University, Taiwan
Daniil Yurchenko	University of Southampton, United Kingdom

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Symposium EN01: Lithium-Ion Batteries and Beyond

Lithium-ion batteries (LIBs) have been the primary power source for portable electronics and electric vehicles, and their demand continues to surge, driven by their potential applications in grid-scale energy storage. They remain a crucial component of society in the foreseeable future, with no imminent technology poised to fully replace them. Nonetheless, the increasing demand for LIBs leads to the mounting concern about the future availability of crucial raw materials, notably lithium and cobalt. To illustrate, lithium constitutes an exceedingly small fraction of the Earth's crust (0.0017%) and is heavily concentrated in a few regions with unstable political and economic conditions. Even relatively abundant graphite necessitates export permits from certain production countries. Hence, there is an urgent need to advance current LIBs technologies to achieve higher energy density without compromising lifespan and safety. The imperative to further reduce costs and address raw material challenges for large-scale applications, such as the grid, propels the exploration beyond lithium-ion batteries. Other monovalent secondary batteries (i.e., Na^+, K^+) and multivalent batteries (e.g., Mg^{2+}, Ca^{2+}, Zn^{2+}) can leverage abundant and inexpensive species, providing the option to employ Co- and Ni-free cathodes. Consequently, this symposium is also dedicated to the pursuit of alternative battery technologies. This first part of the symposium delves into the advancements in LIBs and monovalent batteries, such as Na-ion and K-ion batteries. The focus on LIBs centers on enhancing their performance through materials and chemistry innovations, including cathode degradation mitigation, high-energy-density anodes innovation, thick electrode fabrication, and operando analytical methods to study battery materials in practical or closely simulated environments. Within the realm of Na-ion/K-ion batteries, topics of interest include the synthesis of hard-carbon, alloying-type anodes, low-voltage intercalation anodes, and high-capacity cathodes, with a specific emphasis on earth-abundant materials like Fe- and Mn-based cathodes. The symposium's second segment focuses on multivalent batteries, which offer significant advantages in volumetric energy density and are less prone to dendrite formation compared to LIBs. These batteries promote the use of metal anodes to fully realize their potential energy density. However, challenges persist, including metal anode dendrite formation, the absence of stable and wide-voltage window electrolytes, sluggish interface kinetics, the development of ionically insulating layers on metal anode surfaces due to electrolyte decomposition, limited mobility of multivalent ions in solids, and the absence of high-voltage cathodes. We are interested in topics addressing these challenges, such as cathode materials development, electrolyte innovation, and anode-electrolyte interphase engineering. Contributions from both experimental and computational research are welcome and encouraged.

Topics will include:

- Material advancement and thick electrode design in lithium-ion batteries
- Novel anode and cathode development for lithium-ion and beyond batteries
- Liquid electrolyte innovations
- Solid-state electrolyte material advancements for beyond lithium-ion batteries
- Metal dendrites formation mechanism and control
- Interface phenomena study and interphase engineering
- Insights into reaction kinetics and mechanisms in new energy storage materials
- New characterization methods for materials and interfaces
- Simulations in understanding the material structure and interface reaction between electrode and electrolyte

Invited speakers include:

Veronica Augustyn	North Carolina State University, USA	**Arumugam Manthiram**	The University of Texas at Austin, USA
Majid Beidaghi	The University of Arizona, USA	**Erik Spoerke**	Sandia National Laboratories, USA
Zheng Chen	University of California, San Diego, USA	**Gabriel Veith**	Oak Ridge National Laboratory, USA
Miaofang Chi	Oak Ridge National Laboratory, USA	**Chongmin Wang**	Pacific Northwest National Laboratory, USA
Yury Gogotsi	Drexel University, USA	**Yiying Wu**	The Ohio State University, USA
Juchen Guo	University of California, Riverside, USA	**Jie Xiao**	Pacific Northwest National Laboratory, USA
De-en Jiang	Vanderbilt University, USA	**Kang Xu**	SES AI Corporation, USA
Vibha Kalra	Cornell University, USA	**Wu Xu**	Pacific Northwest National Laboratory, USA
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Symposium EN02: Sodium-Based Energy Storage

As the quest for sustainable and cost-effective energy storage solutions intensifies, sodium-based batteries stand at the forefront as highly promising alternatives to lithium technologies. Sodium, being the sixth most abundant element in Earth's crust compared to the ranking of lithium at thirty-first, presents a particularly compelling option for applications in grid-scale energy storage and electric vehicles. Particularly, beyond the well-explored sodium-ion batteries, other battery designs such as all-solid-state sodium batteries and molten sodium batteries have also demonstrated promising capabilities to fulfill our energy storage demand. Despite their potential, sodium battery technologies are still at an early stage of development – challenges such as limited energy density, stability issues, or slow rate capabilities have hindered their large-scale deployment.

This symposium is dedicated to showcasing the latest advancements, identifying key barriers, and exploring the future directions of sodium batteries. We will focus on the development of new chemistries, innovative battery designs, advanced characterization, the implementation of modeling and artificial intelligence to speed up sodium battery research, and the routes toward scaling up manufacturing. We invite researchers and industry professionals to participate in this symposium to foster a collaborative environment to address the challenges and unlock the potential of sodium batteries with enhanced energy density, faster charging capabilities, and prolonged lifecycle, paving the way for a more sustainable energy future.

Topics will include:

- Exploration of new chemistries for cathodes, anodes, electrolytes, and separators of sodium-ion and sodium batteries.
- Characterization and modeling methods to gain deeper insights into the electrochemical behavior.
- Solid electrolytes with high sodium ionic conductivity and robust interfacial stability.
- Solid-state sodium batteries.
- Molten sodium batteries such as sodium-sulfur and sodium metal halide.
- Low-cost and scalable synthesis and processing of sodium battery materials.
- Innovative battery design for high-energy, fast-charging, and long-lasting sodium batteries.
- Strategies for scaling up the production of sodium batteries while maintaining quality and performance.
- The role of artificial intelligence, robotics, and automation in battery development.
- Recycling of sodium batteries and development of easy-to-recycle batteries.

Invited speakers include:

Khalil Amine	Argonne National Laboratory, USA
Chunmei Ban	University of Colorado Boulder, USA
Pieremanuele Canepa	University of Houston, USA
Gerbrand Ceder	University of California, Berkeley, USA
William Chueh	Stanford University, USA
Ryan DeBlock	U.S. Naval Research Laboratory, USA
Claude Delmas	Institut de Chimie de la Matière Condensée de Bordeaux, CNRS, France
Bruce Dunn	University of California, Los Angeles, USA
Kent Griffith	University of California, San Diego, USA
Kelsey Hatzell	Princeton University, USA
Enyuan Hu	Brookhaven National Laboratory, USA
Ju Li	Massachusetts Institute of Technology, USA
Hao Liu	Binghamton University, The State University of New York, USA
Chao Luo	University of Miami, USA
Matthew McDowell	Georgia Institute of Technology, USA
David Mitlin	The University of Texas at Austin, USA
Yifei Mo	University of Maryland, USA
Partha P. Mukherjee	Purdue University, USA
Linda Nazar	University of Waterloo, Canada
Shyue Ping Ong	University of California, San Diego, USA
Bin Ouyang	Florida State University, USA
Andrej Singer	Cornell University, USA
Venkat Srinivasan	Argonne National Laboratory, USA
Esther Takeuchi	Stony Brook University, The State University of New York, USA
Anton Van der Ven	University of California, Santa Barbara, USA
Hui Wang	University of Louisville, USA
Huolin Xin	University of California, Irvine, USA
Claire Xiong	Boise State University, USA
Naoaki Yabuuchi	Yokohama National University, Japan
Hongli Zhu	Northeastern University, USA

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Symposium EN03: Scientific Advances in Nuclear Fuels Through Experiment and Modeling

The development of new nuclear reactors and the operation of existing reactors beyond their standard operating envelopes are critical to solving a variety of challenges, including the provision of large quantities of clean energy and the reliable generation of electricity or heat in remote terrestrial or extra-terrestrial environments. Understanding the response of nuclear materials under extreme conditions will support the qualification of Zircaloy-UO_2 fuel beyond current burnup limits and the development of advanced fuels, including high thermal conductivity ceramics, fuels containing Pu and/or minor actinides, molten salts, liquid metals and cladding materials, such as SiC-SiC and novel alloys. The response of these materials under extreme temperature, irradiation and chemical conditions is controlled by complex phenomena that span a large range of phase space, length scales and time scales. The combination of mechanistic models (implemented at the engineering, meso-, and atomic scales) with a wide variety of advanced experimental techniques is poised to provide the tools necessary to accelerate the deployment of new and innovative nuclear fuel technology. Modeling and experimental integration through uncertainty quantification and validation, as well as scale bridging and machine learning, are expected to play a crucial role.

Topics will include:

- Traditional fuel and cladding materials beyond standard operating conditions, e.g., high burnup or temperatures
- Advanced fuel materials: doped and mixed oxides, UN, UC, metal fuel, TRISO kernels, molten salts
- Advanced cladding materials: Fe-based alloys, SiC and SiC-SiC composites, TRISO particles
- Fuel fragmentation, pulverization, relocation and dispersal
- Fuel-cladding mechanical and chemical interactions
- Advanced PIE and characterization of irradiated nuclear fuel
- Accelerated burnup tests and ion-beam irradiations
- Fuel and cladding performance simulations at the engineering, meso-, and atomic scales
- Machine learning, surrogate models, physics-based fuel performance codes and scale bridging
- Separate-effects tests and characterization of fuel properties
- Uncertainty quantification and experimental-modeling validation

Invited speakers include:

Larry Aagesen	Idaho National Laboratory, USA
Denise Adorno-Lopez	Oak Ridge National Laboratory, USA
Assel Aitkaliyeva	University of Florida, USA
Johann Bouchet	Commissariat à l'énergie atomique et aux énergies alternatives Cadarache, France
Laurent Capolungo	Los Alamos National Laboratory, USA
Kevin Field	University of Michigan, USA
Mirco Große	Karlsruhe Institute of Technology, Germany
Christopher Matthews	Los Alamos National Laboratory, USA
Simon Middleburgh	Bangor University, United Kingdom
Hiroki Nakamura	Japan Atomic Energy Agency, Japan
Andrew Nelson	Oak Ridge National Laboratory, USA
Par Olsson	KTH Royal Institute of Technology, Sweden
Markus Piro	Ontario Tech University, Canada
Davide Pizzocri	Politecnico di Milano, Italy
Catherine Sabathier	Commissariat à l'énergie atomique et aux énergies alternatives Cadarache, France
Martin Sevecek	Czech Technical University in Prague, Czech Republic
Anna Smith	Delft University of Technology, Netherlands

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Marjorie Bertolus

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Symposium EN04: Concentrating Solar Thermal Materials for Industrial Decarbonization and Heat Storage

Renewable energy production and industrial decarbonization are receiving increased attention as global warming races towards the threshold identified UN Intergovernmental Panel on Climate Change. Concentrating solar thermal (CST) is a well-established renewable power generation technology that can be coupled with a thermal energy storage system for off-sun electricity generation, potentially at greater scales and lower costs than traditional electrochemical storage methods. Recently, the application of CST for electricity generation has expanded beyond steam turbines, to supercritical CO_2 power blocks and solar thermoelectric generators (STEG)--inexpensive solid-state devices that can convert heat directly into electricity without the need for sun tracking. CST has the potential to drive high-temperature chemical processes for production of commodity chemicals and low-carbon fuels, e.g., hydrogen and ammonia, and for decarbonisation of energy-intensive thermally-driven industrial processes such as water desalination, mineral purification, ore refining, calcination, and biorefining. CST energy can be directly stored as chemical energy, enabling photo-thermal catalytic reactions such as water splitting to produce hydrogen, CO_2 methanation, photocatalytic organic synthesis, and selective catalysis of volatile organic pollutants, to be fully solar-driven without secondary energy inputs.

Materials development is key for next generation CST technologies targeting high-temperature processes (ranging from 500°C up to > 1200°C) for electricity generation and solar thermochemical processes. This symposium aims to advance the discussion on materials for CST and to bring together researchers of diverse backgrounds to address the multidisciplinary challenges of this growing field. Graduate students, post-docs, and early-career researchers are encouraged to submit abstracts. The symposium is expected to attract support from academia, national laboratories, and the commercial sector due to its potential for renewable energy generation and decarbonisation of industrial processes.

Topics will include:

- High-temperature materials discovery and development through computational models and AI/machine learning
- Thermal and thermochemical energy storage materials (e.g., molten salts, particles, metal hydrides/hydroxides, and metal oxides)
- Materials for solar thermochemical production of hydrogen, fuels, and fine chemicals
- Materials for solar thermal decarbonisation of industrial processes, including process heat, cement, ore processing, pyrolysis, gasification, and desalination
- Design and manufacture of materials for operation under extreme conditions (heat, pressure, corrosion) for thermal energy storage, heat transfer, and power blocks (steam and supercritical CO_2)
- Advances in coating materials and application methods for receivers, heliostats, and inner tube surfaces for heat transfer/storage transport
- Theory, simulation, and modelling of thermomechanical, thermochemical, thermoelectric, and thermo-optical properties of emerging materials
- Advanced (e.g., high spatiotemporal resolution, high throughput, multimodal) *in situ* and *ex situ* materials characterisation and screening
- Investigation of performance, durability, reliability, and degradation of CST materials

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

Invited speakers include:

Gözde Alkan	Deutsches Zentrum für Luft- und Raumfahrt e.V., Germany
Renkun Chen	University of California, San Diego, USA
Andrej Lenert	University of Michigan, USA
Takahiro Nomura	Hokkaido University, Japan
Todd Otanicar	Boise State University, USA
Victor H Ramos Sanchez	Northern Arizona University, USA
Kai Schickedanz	Wacker Chemie AG, Germany
Kaoru Tsuda	Nano Frontier Technology, Japan
Matthew Witman	Sandia National Laboratories, USA

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Symposium EN05: Thin-Film Compound Semiconductor Photovoltaics

The global climate crisis is accelerating the need for high-performance photovoltaic (PV) materials, both well-known and novel. Thin-film compound semiconductor PV materials are well suited to help meet growing demand as they continue to demonstrate their potential for generating sustainable and cost-efficient electrical energy. Both module and lab scale performance remain lower than other PV technologies, thus more cutting-edge materials research is required to enable these technologies to flourish. The symposium will focus on the science and technology of polycrystalline films, single crystal model systems, defects, interfaces, the interplay of materials and band structure, characterization methods, modeling, scaling and advanced manufacturing in thin-film compound semiconductor PV. Relevant materials include those based on chalcogenide semiconductors such as copper indium gallium (di)selenide (CIGS), cadmium telluride (CdTe), and copper zinc tin sulfide (CZTS), as well as the associated alloys, heterojunction partner materials, buffer layers and contacts. Novel absorber materials such as van der Waals compounds, oxides, and chalcogenides in general are also of high interest. Active areas of research include synthesis/fabrication process development to enable controlled doping, alloying, and passivation all while managing compensation and inhomogeneity at nano-, micro-, and macro- scales as well as advanced architectures such as tandem, bifacial, semitransparent, and dual-function devices. Topics related to stability, reliability, and sustainability are of great interest also.

Topics will include:

- Novel, earth abundant, and/or non-toxic materials
- Absorber Inhomogeneities
- High bandgap absorbers
- Carrier selective, passivating, and/or transparent contacts
- Bifacial, semitransparent, and dual-function devices
- Tandem and multijunction devices
- Thin-film modules and industry
- Deposition, growth, and fabrication
- Surfaces, interfaces, and extended defects
- Characterization theory and modeling
- Degradation and reliability
- Critical Materials, Reuse, and Recycling

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

Invited speakers include:

Peter Borowski	AVANCIS GmbH, Germany
Stela Canulescu	Technical University of Denmark, Denmark
Mirjana Dimitrievska	Empa–Swiss Federal Laboratories for Materials Science and Technology, Switzerland
Sean Garner	Corning, Inc., USA
Xiaojing Hao	University of New South Wales, Australia
Anderson Janotti	University of Delaware, USA
Jeung-hyun Jeong	Korea Institute of Science and Technology, Republic of Korea
Dan Lamb	Swansea University, United Kingdom

Jianmin Li	Wuhan University, China
Qingbo Meng	Institute of Physics, Chinese Acadamy of Sciences, China
Craig Perkins	National Renewable Energy Laboratory, USA
Shahaboddin Resalati	Oxford Brookes University, United Kingdom
Byungha Shin	Korea Advanced Institute of Science and Technology, Republic of Korea
Nicolae Spalatu	Tallinn University of Technology, Estonia
Gang Xiong	First Solar, USA
Chunlei Yang	Shenzheng Institute of Advanced Technology, Chinese Academy of Sciences, China

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Symposium EN06: Materials for Energy-Storage Systems in Extreme Environments

The ongoing shift from reliance on traditional fossil fuels to the embrace of renewable and sustainable energy sources critically depends on the development of advanced energy storage technologies. Energy storage systems are sometimes required to operate in extreme environments such as high temperatures, high pressures, the presence of extreme fluxes of energetic particles, and chemically reactive conditions. Applications of these systems include outer space exploration, liquefied gas storage, medical imaging equipment, nuclear reactors, aircraft engines, high-latitude vessels etc. For example, batteries in cell phones may shut down in extremely cold areas or catch fire in harshly hot climates. Such batteries would not be suitable for space exploration on Mercury, where temperatures vary between 430°C (during the day) and –180°C (at night). As another example, the thermal energy produced in concentrating solar-thermal power plants is usually stored using molten salt, which can be highly corrosive to containment materials such as tanks and pipelines. Key to expanding the applicability of energy storage systems from ambient conditions to extreme environments is the development of advanced materials that can retain their structural and functional properties in the latter. This symposium provides a platform for scientists and engineers to present their latest research in addressing materials challenges for energy storage systems in extreme environments.

Topics will include:

- Energy storage materials in extreme thermal environments, e.g., elevated temperatures and cryogenic temperatures
- Materials subject to high fluxes of energetic particles and photons in energy storage systems
- Radiation-resistant materials for nuclear energy storage
- Hydrogen embrittlement-resistant materials for hydrogen storage and transport
- Materials in energy storage systems that are subject to shock loading or high hydrostatic pressures
- Energy storage materials in chemically reactive environments, e.g., in the presence of corrosion, oxidation, or acidic conditions that may lead to accelerated material degradation and failure

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

Invited speakers include:

Sarbajit Banerjee	Texas A&M University, USA
Wurigumula Bao	The University of Chicago, USA
Ben Breitung	Karlsruhe Institute of Technology, Germany
Manish Chhowalla	University of Cambridge, United Kingdom
Jang Wook Choi	Seoul National University, Republic of Korea
Hongjie Dai	The University of Hong Kong, Hong Kong
Yury Gogotsi	Drexel University, USA
Russell Hemley	University of Illinois at Chicago, USA
Maren Lepple	Justus-Liebig-Universität Giessen, Germany
Jun Liu	Pacific Northwest National Laboratory, USA
Kai Liu	Georgetown University, USA
Nian Liu	Georgia Institute of Technology, USA
Yifei Mo	University of Maryland, USA
Bin Ouyang	Florida State University, USA
Soojin Park	Pohang University of Science and Technology, Republic of Korea
Marshall Schroeder	U.S. Army Research Laboratory, USA
Esther Takeuchi	Stony Brook University, The State University of New York, USA
Huolin Xin	University of California, Irvine, USA
Guiliang Xu	Argonne National Laboratory, USA
Guihua Yu	The University of Texas at Austin, USA
Zhiyuan Zeng	City University of Hong Kong, Hong Kong

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Symposium EN07: Solid-State Alkali-Metal Batteries

Solid state batteries (SSBs) based on alkali-metal (Li, Na, Mg, etc) chemistry have attracted much attention from both academia and industry in last decade. They are considered as a promising alternative for conventional Li-ion batteries in a number of important applications (e.g. electrified transportation and grid storage), owing to the enhanced safety properties and potentially much higher energy density. For instance, SSBs with Li metal anodes have the potential for specific energy >500 Wh/kg, energy density >1500 Wh/L; SSBs with Na metal anode have the potential for specific capacity> 1100 mAh/g, energy density ~ 400-500 Wh/kg, and potential lower cost due to abundant raw material reserves on earth. After a decade of extensive research efforts, many novel high-performance solid electrolyte materials have been discovered and reported. So far, there are significant challenges in structure/interface design, device fabrication, and materials processing and manufacturing of SSBs. The anodes and cathodes in solid-state could impart significant stresses at interfaces; and the interplay between stresses, electrochemistry, interfacial and layer structures could lead to morphological evolution of the layers to form interphases and chemo-mechanical degradation during cycling. In addition, fast charging such as in automotive applications could drive the SSBs towards early performance degradation with reduced reliability and safety margins. Moreover, manufacturing challenges also impede the practical application of SSBs towards to commercialization.

This symposium aims to provide an interdisciplinary forum for colleagues from both academia and industry, to address the fundamental and technological aspects and the challenges involved in the development of SSB devices and characterizations. Key focus areas of the symposium include: development of new solid electrode materials, new device fabrication methodologies, fast charging of SSBs, in-operando and in-situ characterization of interfaces and layer morphologies, and multiscale electrochemical modeling to analyze the performance and safety aspects of SSBs, manufacture methods and life cycle analysis, etc.

Topics will include:

- Alkali-metal anode (Li, Na, Mg, etc) for SSBs;
- New cathodes and cathode-electrolyte composites for SSBs;
- Electrode/electrolyte interface design and studies;
- Interfacial stability, stresses, defect formation and failure mechanism
- Theoretical understanding of SSBs (simulation and modeling for materials and battery system, e.g. DFT, MD, multi-physics modeling)
- System safety and regulatory requirement for large-scale implementation;
- Advanced processing and manufacturing towards to scale-up mass production;
- Advanced characterizations (in situ and inoperando techniques) for SSBs;
- Impact of fast charging on electrochemical degradation and failure;

Invited speakers include:

Peter Bruce	University of Oxford, United Kingdom	**David Mitlin**	The University of Texas at Austin, USA
William Chueh	Stanford University, USA	**Kyung-Wan Nam**	Dongguk University, Republic of Korea
Neil Dasgupta	University of Michigan, USA	**Jagjit Nanda**	Stanford University, USA
Vibha Kalra	Cornell University, USA	**Linda Nazar**	University of Waterloo, Canada
Xin Li	Harvard University, USA	**Yue Qi**	Brown University, USA
Jongwoo Lim	Seoul National University, Republic of Korea	**Sanja Tepavcevic**	Argonne National Laboratory, USA
Ping Liu	University of California, San Deigo, USA	**Donghai Wang**	The Pennsylvania State University, USA
Dongping Lu	Pacific Northwest National Laboratory, USA	**Andrew Westover**	Oak Ridge National Laboratory, USA
Matthew McDowell	Georgia Institute of Technology, USA	**Yan Yao**	University of Houston, USA

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Symposium MT01: Integrating AI-Assisted Computation and Experimentation for Autonomous Laboratories

Computational materials science and the use of artificial intelligence (AI) and machine learning (ML) methods to mine existing databases have significantly accelerated materials design and discovery in the past few years. In addition, high throughput experiments which involve the use of automated systems and technologies to perform laboratory experiments and data collection without direct human intervention have increased the speed, reproducibility, and cost efficiency for materials synthesis and characterization. With these advances, an emerging challenge concerns the close integration of AI-assisted computation and automated experimentation in a closed loop manner, and how this data might be analyzed and interpreted for subsequent experiment planning. This symposium will provide a platform to discuss the specific opportunities and challenges in building autonomous laboratories and their underlying computational frameworks to make fully autonomous materials discovery a reality. Topics will include the development of novel AI/ML methods, experimental automation for both hardware and software, and high-throughput experimental and computational frameworks. Materials for energy-related applications such as batteries, catalysts, optoelectronics, solar cells, and fuel cells will be highlighted. This symposium intends to inform the broad materials community of the current status and future directions of developing the very promising AI-driven autonomous laboratory.

Topics will include:

- Integration of simulations with experiments in a closed loop using AI/ML
- AI-accelerated simulations of materials under operating conditions
- AI/ML driven advanced characterization of materials
- Development of digital twins for experiments
- Advanced AI/ML techniques for materials development and manufacturing
- Autonomous systems for experimental synthesis and characterization with humans out of the loop

Joint sessions are being considered with **MT02 - Accelerated Material Discovery: Data-Driven Discovery, High-throughput Experimentation and Automated Process**.

Invited speakers include:

Milad Abolhasani	North Carolina State University, USA	**Marina Leite**	University of California, Davis, USA
Gerbrand Ceder	University of California, Berkeley, USA	**Eric McCalla**	McGill University, Canada
Maria Chan	Argonne National Laboratory, USA	**Kristin Persson**	Lawrence Berkeley National Laboratory, USA
Ekin Dogus Cubuk	Google DeepMind, USA	**Lilo Pozzo**	University of Washington, USA
John Gregoire	California Institute of Technology, USA	**James Rondinelli**	Northwestern University, USA
Jason Hattrick-Simpers	University of Toronto, Canada	**Dong-Hwa Seo**	Korea Advanced Institute of Science and Technology, Republic of Korea
Jens Hauch	Forschungszentrum Jülich GmbH, Germany	**Wei Wang**	Pacific Northwest National Laboratory, USA
Christoph Kreisbeck	Aixelo, USA	**Yan (Eric) Wang**	Samsung Semiconductor US, USA
Heather Kulik	Massachusetts Institute of Technology, USA	**Olga Wodo**	University at Buffalo, The State University of New York, USA
Aaron Gilad Kusne	National Institute of Standards and Technology, USA		

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Symposium MT02: Accelerated Material Discovery—Data-Driven Discovery, High-Throughput Experimentation and Autonomous Laboratories

The exploration and creation of materials have ushered in a new era dominated by big data. Achieving accelerated material discovery necessitates urgent contributions from experiments, theory, simulation, and data science. This symposium is dedicated to integrating these emerging efforts to pave the way for accelerated, or eventually autonomous material discovery. Its particular focus is to foster dialogue on recent advancements in areas such as high-throughput experimentation, database development both from simulation and experiments, and the acceleration of material design through artificial intelligence (AI) and machine learning (ML), in addition to exploring closed-loop experimental architectures and more. The event will feature a diverse array of world-leading experts at the forefront of material discovery. These specialists range from those in lab automation and high-throughput material synthesis to experts in automated characterization and materials testing, as well as in AI/ML, and theory-driven computational methods.

This symposium is designed to present a varied array of perspectives that will guide the future milestones of material discovery. Topics will include, but are not limited to, 1) Progresses of automation in materials synthesis, characterization, and testing; 2) Innovative methods for integrating AI/ML with various experimental approaches; 3) Strategies for utilizing big data to enhance our understanding of different material design spaces; 4) Approaches for closing the feedback loop or enabling rapid iteration across theory, computation, AI/ML, synthesis, and characterization; 5) Opportunities and approaches to incorporate generative AI and large langrage models in materials discovery. We welcome submissions that align with any of the themes or other novel research within the realm of accelerating material discovery.

Topics will include:

- Progresses of automation in materials synthesis, characterization, and testing
- Innovative methods for improving the throughput of various experimental approaches
- Strategies for utilizing big data to enhance our understanding of different material design spaces
- New approaches for data harvesting, data fusion and data interpretation across experiment and theory
- Opportunities and approaches to incorporate generative AI in materials discovery.
- Application of large language models in materials design and discovery
- Protocols and platform development for promoting the share of data
- Integrating theory driving approaches with AI/ML algorithm

Joint sessions are being considered with **MT01 - Integrating AI-Assisted Computation and Experimentation for Autonomous Laboratories**.

Invited speakers include:

Chibueze Amanchukwu	The University of Chicago, USA
Ryoji Asahi	Nagoya University, Japan
Tonio Buonassisi	Massachusetts Institute of Technology, USA
Gerbrand Ceder	University of California, Berkeley, USA
Emory Chan	Lawrence Berkeley National Laboratory, USA
Maria Chan	Argonne National Laboratory, USA
Ekin Dogus Cubuk	Google DeepMind, USA
Elif Ertekin	University of Illinois at Urbana-Champaign, USA
Sheng Gong	ByteDance Inc, USA
Jason Hattrick-Simpers	University of Toronto, USA
Sergei Kalinin	University of Tennessee, Knoxville, USA
Miao Liu	Institute of Physics, Chinese Academy of Science, China
Shyue Ping Ong	University of California, San Diego, USA
Kristin Persson	University of California, Berkeley, USA
Dong-Hwa Seo	Korea Advanced Institute of Science and Technology, Republic of Korea
Shijing Sun	University of Washington, USA
Carolin Sutter-Fella	Lawrence Berkeley National Laboratory, USA
Kazuo Tanaka	Kyoto University, Japan
Jiayu Wan	Shanghai Jiao Tong University, China
Yan (Eric) Wang	Samsung Semiconductor US, USA
Chris Wolverton	Northwestern University, USA
Tian Xie	Microsoft Research, USA
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Symposium MT03: Harnessing Data-Centric Strategies for Materials by Design

This symposium will cover the challenges in physics-driven intelligent materials discovery and design. This symposium will provide a forum for the community to evaluate and discuss the future of materials by design in an ever-evolving field driven by artificial intelligence and physics-informed computations/experiments. Topics of discussion will include challenges for which existing methods fail or remain inadequate, and up-and-coming areas of materials by design. These challenges will be considered both from the perspective of methodological/algorithmic developments and applications that leverage informatics/AI strategies as a primary component. Core topics will include physics-informed machine learning, data-centric strategies for AI in materials science, procedures for handling multi-model data/uncertainty, explainable and autonomous feature selection, interpretable machine learning and generalized explainable AI strategies, data pre-processing/augmentation strategies (particularly those related to generative modeling), and large language models. Emphasis will be placed on methods that bridge both length and time scales as well as methods that combine experiments and computations/simulations.

Topics will include:

- Autonomous/explainable feature selection
- Data preprocessing/augmentation
- Physics aware/informed ML
- Data-centric AI for materials
- Uncertainty in both data and models
- Procedures for combining data across datasets
- Model interpretability
- Large language models for materials discovery
- Data strategies for generative models

Invited speakers include:

Brian Barnes	U.S. Department of the Army, USA
Ramin Bostanabad	University of California, Irvine, USA
Markus J. Buehler	Massachusetts Institute of Technology, USA
Kamal Choudhary	National Institute of Standards and Technology, USA
Payel Das	IBM T.J. Watson Research Center, USA
Adji Bousso Dieng	Princeton University, USA
Claudia Draxl	Humboldt-Universität Berlin, Germany
Leora Dresselhaus-Marais	Stanford University, USA
Saryu Fensin	Los Alamos National Laboratory, USA
Luca Ghiringhelli	Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany
Johannes Hachmann	University at Buffalo, The State University of New York, USA
Anoop Krishnan	Indian Institute of Technology Delhi, India
Santiago Miret	Intel Labs, USA
Gian-Marco Rignanese	Université catholique de Louvain, Belgium
Ellad Tadmor	University of Minnesota Twin Cities, USA
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Symposium MT04: Rational Design of Electrocatalysts—Insights into Structure-Function Relationships for Next-Generation Materials

Unlocking the potential of electrocatalysis hinges on our ability to design materials with precise structural attributes that drive targeted functionalities. This symposium serves as a platform for the latest advancements in the design, characterization, and performance assessment of electrocatalysts with well-defined structures. By marrying theory with practice, the agenda is to provide insight into the structure and function of electrocatalysts, laying the groundwork for the informed design of next-generation materials. Reactions of interest will include CO2 reduction, water splitting, small molecule upgrade, ammonia synthesis, etc.

Key topics to be addressed, including 1) Advanced synthesis techniques yielding electrocatalysts with tailored architectures 2) Comprehensive strategies, including *operando*/*in situ* methods, for characterizing the surface and bulk properties of electrocatalysts, and 3)Theoretical models and computational tools for understanding electrocatalyst behavior.

The symposium will spotlight interdisciplinary contributions from academia, national labs, and industry, promoting a synergetic environment conducive to breakthroughs in material science. A curated roster of experts from varied backgrounds will be invited to present their pioneering work, ensuring a rich tapestry of perspectives on the nuances of electrocatalyst design. This gathering will not only shine a light on current research but will also chart a course for the future of electrocatalysis. Emphasizing the importance of structural precision, we aim to foster a narrative that will embolden researchers to conceive and realize electrocatalysts that are as effective as they are innovative. This symposium is positioned to be a cornerstone for those who stand on the frontier of materials research, advocating for the pivotal role of structure-informed design in the next era of electrochemical catalysts.

Topics will include:

- Advanced synthesis methods for electrocatalysts
- Operando and in-situ characterization of electrocatalytic systems
- Theoretical and computational models in electrocatalysis (including machine learning and artificial intelligence)
- Electrocatalysts for sustainable energy applications
- Surface and interface science
- Effects of electrode micro-environment in tuning catalyst performance
- Well-defined catalyst materials

Invited speakers include:

Emily Carter	Princeton University, USA	**Marcel Schreier**	University of Wisconsin–Madison, USA
Yimo Han	Rice University, USA	**Francesca Toma**	Helmholtz-Zentrum Hereon, Germany
Adam Holewinski	University of Colorado Boulder, USA	**Jesus Velazquez**	University of California, Davis, USA
Tianquan Lian	Emory University, USA	**Haimei Zheng**	Lawrence Berkeley National Laboratory, USA
Hang Ren	The University of Texas at Austin, USA		

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Symposium MT05: The Materials Science of Synthesis Across Scales Through Data Science Integration

The symposium will delve into recent breakthroughs at the intersection of data science and materials science, focusing on material structure design, autonomous synthesis, advanced characterization tools, computational simulations, and data analysis facilitated by machine learning approaches. This symposium will unfold across four distinct segments. 1) Materials Design and Synthesis: This first segment delves into the realm of materials design, with a specific focus on macromolecular structures and functions. Contributions exploring the design of functional materials and autonomous synthesis, high-throughput synthesis are particularly encouraged. 2) Characterization Tools at the Solid-Liquid Interface: The second part is dedicated to the utilization of characterization tools, especially those performed at the solid-liquid interface. This includes *in situ/operando* microscopy, spectroscopy, and diffraction/scattering techniques. 3) Simulation and Theory Exploration: The third segment introduces recent advances in the simulation and theory side of materials science, with a special emphasis on data science-transformed modeling techniques and computation-guided material discovery. 4) Nanomaterials and Nanodevices: The fourth part explores the realm of nanodevices, encompassing memristors, artificial synapses, sensors, and batteries. Contributions in all parts are encouraged to present new results in materials design, functionalization, synthesis, characterization, and simulation. The symposium places a particular spotlight on functional materials design and innovative data analysis methods. Fundamental studies based on simulation and other approaches are also welcomed. Additionally, research on nanodevices is highly welcomed.

Topics will include:

- Functional materials design
- *In situ/operando* spectroscopy, diffraction, and scattering methods
- Atomistic and coarse-grained simulations
- Autonomous synthesis
- Advanced scanning probe methods
- Simulations of interfacial crystal growth or assembly pathways
- High-throughput synthesis
- New data processing, analysis, and mining methods for large in-situ datasets
- Big data and machine learning
- Nanoscale materials and Nanodevices

Invited speakers include:

Paul Ashby	Lawrence Berkeley National Laboratory, USA
François Baneyx	University of Washington, USA
Carlos Bassani	Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany
Guilherme de Vilhena	Instituto de Ciencia de Materiales de Madrid, Spain
Mingdong Dong	Aarhus University, Denmark
Julia Dshemuchadse	Cornell University, USA
Kristen Fichthorn	The Pennsylvania State University, USA
Oleg Gang	Columbia University, USA
Ricardo Garcia	Instituto de Ciencia de Materiales de Madrid, Spain
Michael Gruenwald	The University of Utah, USA
Michael Howard	Auburn University, USA
Yu Huang	University of California, Los Angeles, USA
Fang Jiao	Institute of Physics, Chinese Acadamy of Sciences, China

Xuan Mu	The University of Iowa, USA
Alex Noy	Lawrence Livermore National Laboratory, USA
Wengen Ouyang	Wuhan University, China
Kelly Powderly	Washington University in St. Louis, USA
Lilo Pozzo	University of Washington, USA
Miquel Salmeron	Lawrence Berkeley National Laboratory, USA
Mitra Taheri	Johns Hopkins University, USA
Tom Truskett	The University of Texas at Austin, USA
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Symposium QT01: Development of 2D Quantum Materials Pipelines (2D-QMaPs)

A unique range of properties emerge at the atomically thin limit across the ever-expanding universe of 2D materials, including graphene, hexagonal boron nitride, transition metal dichalcogenides, magnetic layered semiconductors (e.g., CrX_3, X = Cl, Br, I; or MPS_3 , M = Cr, Fe, Ni), and other layered and ultra-thin materials. These materials can be stacked together to form heterostructures which profoundly modify their electronic and optical properties. By varying the interlayer twist angle, new phenomena can be induced between two layers of identical or different compositions. These phenomena arise from modified interlayer symmetry, Brillouin zone folding, and the detailed structure produced within the moiré superlattice, leading to strongly correlated states, superconductivity, topological band structures, quantum confinement, ferroelectricity, emergent magnetic order, and other novel phenomena derived from engineered Hamiltonians through modified strain, symmetry, and screening. This opens numerous possibilities for basic research and potential applications in 2D quantum materials and devices. However, fabricating heterostructure devices based on layered materials involves many manual processes, making it time-consuming, unpredictable, and prone to variations based on individual skills. There is often substantial variation in properties from device to device – and even within individual devices – due to moiré disorder. Consequently, there is growing interest within the 2D materials community to reduce sources of unintentional variability or heterogeneity, often by automating each step of the fabrication process to minimize human intervention and maximize material quality and throughput.

This symposium aims to bring researchers together who are interested in applying new techniques to overcome these bottlenecks and produce layered materials and heterostructures at a large scale with higher material quality, properties control, speed, and area, among other improvements. This can encompass various approaches, such as large-area thin-film growth, improved bulk crystal synthesis, high-yield or enhanced-quality exfoliation methods, automated flake characterization and cataloguing, automated or large-area assembly of layered heterostructures, high-throughput characterization of defects, and *in situ* process monitoring during assembly. Additionally, the symposium will cover the use of robotics and machine learning to automate each step of the device fabrication process, including sample preparation and placement in the cleanest possible environment, to accelerate the development of 2D quantum materials and devices. We welcome contributions on the latest developments in 2D materials and heterostructures, including novel and efficient layer isolation/identification, stacking techniques with greater control using new hardware or robotics, applications of AI and machine learning to improve processing, and new routes towards enhanced quality in device fabrication. The goal of this symposium is to exchange ideas and advancements towards the autonomous fabrication of 2D quantum materials-based devices, fostering the development of novel techniques and accelerating progress in the field.

Topics will include:

- High-Throughput Synthesis, Growth, and Exfoliation Techniques for 2D Materials
- Novel Methods for Layer Isolation, Identification, and Stacking
- Advanced Characterization and Cataloging of 2D Materials
- AI and Machine Learning for Two-Dimensional Material Identification and Selection
- Autonomous and Robotic Methods for Flake Exfoliation, van der Waals Assembly, Nanofabrication, and Device Characterization
- Parallel and Batch Fabrication of van der Waals Heterostructures and Devices
- Heterostructure Assembly under Vacuum Conditions

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

Invited speakers include:

Yee Sin Ang	Singapore University of Technology and Design, Singapore
Thomas Beechem	Purdue University, USA
Sanjaya Beharu	San Diego State University, USA
Kenneth Burch	Boston College, USA
Manish Chhowalla	University of Cambridge, United Kingdom
Hyunyong Choi	Seoul National University, Republic of Korea
Loc Duong	Montana State University, USA
Louis Gaudreau	National Research Council Canada, Canada
David Goldhaber-Gordon	Stanford University, USA
Roman Gorbachev	The University of Manchester, United Kingdom
Josh Goss	University of Arkansas, USA

Byung Hee Hong	Seoul National University, Republic of Korea
Kibum Kang	Korea Advanced Institute of Science and Technology, Republic of Korea
Fang Liu	Stanford University, USA
Tomoki Machida	The University of Tokyo, Japan
Farnaz Niroui	Massachusetts Institute of Technology, USA
Daniel Rhodes	University of Wisconsin–Madison, USA
Matthew Rosenberger	University of Notre Dame, USA
Hyeon-Jin Shin	Gwangju Institute of Science and Technology, Republic of Korea
Christoph Stamper	Aachen University, Germany
Patrick Vora	George Mason University, USA

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Symposium QT02: Advanced Quantum Magnets and Related Technologies Toward Energy-Efficient Computing

Quantum magnetism has recently seen numerous advances including both the discovery of new material platforms as well as magnetic phases controllable through external stimuli, holding promise for enabling potential quantum technologies (QTs). We aim to convene a diverse range of leading scientists in the field with broad perspectives offering a platform for disseminating and discussing the latest developments in the area of quantum magnetism, energy-efficient computing, and novel applications in QTs. The symposium aims to bring together an interdisciplinary group of experts in several aspects of quantum materials, device implementations, and novel computing approaches. These will include high-caliber experimentalists, device engineers, material scientists, theoreticians, and material informatics specialists. With a mix of invited and joint keynote speakers including junior and emerging scientists, the symposium will capture recent and exciting developments, exposing the audience to the frontiers of advanced quantum materials and technologies.

Topics will include:

- Linking quantum technologies (QTs) to low-dimensional magnets
- Energy efficient quantum magnets and their applications
- Quantum magnetism, floquet engineering, and twisted platforms (e.g., moiré superlattices)
- Spin-based quantum sensing (e.g., NV microscopy), topology and correlation in strongly interacting compounds
- Recent frontiers in magnetometry, Lorentz TEM, MOKE, NV-Center microscopy, nano-SQUID
- Ultrafast magnetization dynamics via optical and current excitations

Joint sessions are being considered with **QT03 - Recent Advances and New Opportunities in van der Waals Heterostructures**.
Also, a **tutorial** complementing this symposium is tentatively planned. Further information will be included in the MRS Program that will be available online in January.

Invited speakers include:

TeYu Chien	University of Wyoming, USA
Sugata Chowdhury	Howard University, USA
Riccardo Comin	Massachusetts Institute of Technology, USA
Aron Cumings	Catalan Institute of Nanoscience and Nanotechnology, Spain
Pintu Das	Indian Institute of Technology Delhi, India
Geoffrey Diederich	The University of Washington, USA
Ole Erikison	Uppsala University, Sweden
Thorsten Hesjedal	University of Oxford, United Kingdom
Axel Hoffman	University of Illinois at Urbana-Champaign, USA
Phil King	University of St Andrews, United Kingdom
Yue Li	Argonne National Laboratory, USA
Matteo Mitrano	Harvard University, USA
Atindra Pal	S. N. Bose National Centre for Basic Sciences, India
Shriram Ramanathan	Rutgers University, USA
Ramamoorthy Ramesh	Rice University, USA
Theo Rasing	Radboud University, Netherlands
Priscila Rosa	Los Alamos National Laboratory, USA
Jairo Sinova	Johannes Gutenberg Universität Mainz, Germany
Ronald Walsworth	University of Maryland, USA
Weigang Wang	The University of Arizona, USA
Yishu Wang	The University of Tennessee, Knoxville, USA
Haidan Wen	Argonne National Laboratory, USA
Joerg Wrachtrup	Universität Stuttgart, Germany
Yingying Wu	University of Florida, USA
Changsong Xu	Fudan University, China
Hao Zeng	University at Buffalo, The State University of New York, USA
Liuyan Zhao	University of Michigan, USA

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Symposium QT03: Recent Advances and New Opportunities in van der Waals Heterostructures

Over the past two decades, two-dimensional (2D) van der Waals (vdW) materials have emerged as an exciting platform for materials science research owing to their wide array of fascinating properties and naturally vertical integrability. Beyond the many unique properties found within the growing families of 2D materials in isolation, exciting new opportunities have arisen upon integrating two or more of these layered materials into heterostructures. Because layers are coupled by van der Waals interactions rather than chemical bonding, these manually-assembled heterostructures can feature rich chemical compositions, flexible stacking orders, designable layer numbers, and gate-controlled physical properties. In the past few years, the discovery of flat electronic bands with hidden quantum geometry has sparked a new era for this field. Moiré superlattice engineering provides one means of generating such flat bands, giving rise to a broad spectrum of interesting electronic phases such as those featuring strong electron correlations and nontrivial band topology. Prime examples are gate-tunable magnetism, superconductivity, Wigner crystallization, nematicity, and (integer and fractional) quantum anomalous Hall effects. Similar phases can also be found in rare crystalline forms of 2D materials even in the absence of any moiré effect. Additional opportunities enabled by combining 2D materials with 3D materials are also starting to be explored. This rapid progress underscores the rich potential for future scientific discoveries and the development of innovative engineering applications by integrating advances in material synthesis, device fabrication, property characterization, and theoretical modeling. Our symposium will highlight the recent developments in 2D material heterostructures of all types, including their synthesis, fabrication, characterization, modeling, and novel devices. Specific focus areas will be on the forefronts of 2D materials discovery, the fabrication of novel vdW heterostructures, understanding intrinsic and extrinsic properties of these materials, and advancing device applications. The symposium will attract a worldwide group of researchers from a variety of scientific backgrounds, all working at the frontiers of these fields. We aim to broadly cover the exciting recent progress in these areas and identify promising future directions for the field.

Topics will include:

- Discovery and synthesis of new 2D van der Waals materials
- Growth and integration of vdW heterostructures
- Electronic, optical, and optoelectronic properties of vdW heterostructures
- Strongly correlated phases and superconductivity in vdW heterostructures
- Geometric and topological phenomena in vdW heterostructures
- Ground- and excited-state properties and charge dynamics of vdW heterostructures
- Theoretical modeling of vdW heterostructures
- Development of novel experimental techniques to characterize 2D vdW materials and heterostructures
- Devices based on vdW heterostructures for quantum information science and engineering

Invited speakers include:

Raymond Ashoori	Massachusetts Institute of Technology, USA
Leni Bascones	Instituto de Ciencia de Materiales de Madrid, Spain
Jennifer Cano	Stony Brook University, The State University of New York, USA
Ting Cao	University of Washington, USA
Michael Crommie	University of California, Berkeley, USA
Cory Dean	Columbia University, USA
Kalus Ensslin	ETH Zürich, Switzerland
Philip Kim	Harvard University, USA
Bediako Kwabena	University of California, Berkeley, USA
Jeanie Lau	The Ohio State University, USA
Zhengguang Lu	Florida State University, USA
Qiong Ma	Boston College, USA
Allan MacDonald	The University of Texas at Austin, USA
Stevan Nadj-Perge	California Institute of Technology, USA
Rebeca Ribeiro-Palau	Université Paris-Saclay, France
Sufei Shi	Carnegie Mellon University, USA
Emanuel Tutuc	The University of Texas at Austin, USA
Oskar Vafek	Florida State University, USA
Ashvin Vishwanath	Harvard University, USA
Feng Wang	University of California, Berkeley, USA
Di Xiao	University of Washington, USA
Xiaodong Xu	University of Washington, USA
Aiming Yan	University of California, Santa Cruz, USA
Ali Yazdani	Princeton University, USA
Eli Zeldov	Weizmann Institute of Science, Israel
Fan Zhang	The University of Texas at Dallas, USA
Yahui Zhang	Johns Hopkins University, USA
Jun Zhu	The Pennsylvania State University, USA

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Symposium QT04: Transformative Oxide Heterostructures and Membranes for Microelectronics and Energy Technologies

The strong coupling between charge, spin, lattice, and orbital degrees of freedom in strongly correlated oxides leads to a wide range of emergent phenomena, including magnetism, superconductivity, ferroelectricity, etc. Recent advances in precision synthesis of thin films and heterostructures have further enabled the design of atomic-scale oxide heterostructures, providing an opportunity to discover novel artificial materials and architectures with unprecedented or remarkable physical, chemical, quantum mechanical properties that are absent in bulk materials. This symposium covers recent advances in the synthesis and characterization of complex oxide thin films, heterostructures, and membranes for versatile applications in quantum microelectronics and energy technologies. In addition, studies and advancements in autonomous processing, transformative manufacturing, automated experiments, in situ and operando characterizations, time-resolved techniques, and high-throughput calculations and AI/ML approaches will be encouraged. Abstracts will be solicited from (but not limited to) experimental or theoretical studies of complex oxide thin films and heterostructures as well as other forms of matter, including membranes and artificially stacked/twisted superlattices, and their phenomena that provide the fundamental scientific solutions to technological advancements in quantum science and technology, energy technology, and microelectronics.

Topics will include:

- Precision epitaxial synthesis of complex oxides thin films and heterostructures
- Remote epitaxy and sacrificial layer epitaxy of complex oxides and 2D materials
- Stacking and twisting of complex oxides, and integration with two dimensional materials
- Novel functionalities enabled from defect, strain, and interface engineering in complex oxide thin films
- In situ and operando characterization by synchrotron X-ray techniques, neutron scattering, electron and scanning microscopy
- Ultrafast probing of heterostructures by X-ray free-electron laser, pump-probe optic tools and ultrafast electron diffraction/microscopy.
- High throughput approaches
- Automation and machine learning methods for synthesis and characterization

Joint sessions are being considered with **SF02 - Complex Oxide Epitaxial Thin Films**.
Also, a **tutorial** complementing this symposium is tentatively planned. Further information will be included in the MRS Program that will be available online in January.

Invited speakers include:

Sang-Hoon Bae	Washington University in St. Louis, USA
Chang Beom Eom	University of Wisconsin–Madison, USA
Dillon Fong	Argonne National Laboratory, USA
Jun Fujioka	University of Tsukuba, Japan
Erjia Guo	Institute of Physics, Chinese Acadamy of Sciences, China
Jordan Hachtel	Oak Ridge National Laboratory, USA
Marios Hadjimichael	University of Warwick, United Kingdom
Varun Harbola	Max Planck Institute for Solid State Research, Germany
Megan Holtz	Colorado School of Mines, USA
Harold Y. Hwang	Stanford University, USA
Bharat Jalan	University of Minnesota Twin Cities, USA
Jeehwan Kim	Massachusetts Institute of Technology, USA
Thomas Maier	Oak Ridge National Laboratory, USA
Johanna Nordlander	Harvard University, USA
Nini Pryds	Technical University of Denmark, Denmark
Milan Radovic	Paul Scherrer Institute, Switzerland
Km Rubi	Los Alamos National Laboratory, USA
Ambrose Seo	University of Kentucky, USA
Changhee Sohn	Ulsan National Institute of Science and Technology, Republic of Korea
Sandhya Susarla	Arizona State University, USA
Y. Eren Suyolcu	Max Planck Institute for Solid State Research, Germany
Yuri Suzuki	Stanford University, USA
Sangmoon Yoon	Gachon University, Republic of Korea
Xiaofang Zhai	ShanghaiTech University, China

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Symposium QT05: Emergent Quantum Orderings and Properties in 2D Materials and Heterostructures

Two-dimensional (2D) materials offer a unique platform to explore and integrate novel physical properties, including spin-valley coupling, strong electron correlations, enhanced collective excitations, unconventional superconductivity, and tunable topological orders. Based on these emergent quantum properties, new device prototypes are made possible and can realize novel and high-performance device functionalities. This symposium will focus on progress in understanding and controlling quantum properties and phase transitions in 2D materials. Aiming to promote interdisciplinary discussions among researchers, this symposium will include the most recent developments in material synthesis, characterization, and theory and bring together a diverse pool of researchers in different career stages to identify emerging opportunities in 2D quantum materials.

Topics will include:

- Scalable synthesis and assembling of 2D material and heterostructures
- Disentangled characterization of electron, spin, and lattice degrees of freedom in 2D quantum materials, e.g., electrical transport, optical spectroscopies, scanning tunneling microscopy (STM), and angle-resolved photoemission spectroscopy(ARPES).
- Manipulation of quantum phases and novel device design using chemical methods, electrical field, high-pressure, and ultrafast optical responses.
- Theoretical predictions on novel 2D material properties and material discovery
- New electronic, spintronic, optoelectronic, and photonic device development based on 2D quantum materials

Invited speakers include:

Youn Jue Bae	Cornell University, USA	**Kayla Nguyen**	University of Oregon, USA
Ting Cao	University of Washington, USA	**Diana Qiu**	Yale University, USA
Yulin Chen	Oxford University, United Kingdom	**Daniel Rhodes**	University of Wisconsin–Madison, USA
Zhehao Ge	University of California, Berkeley, USA	**Sandhya Susarla**	Arizona State University, USA
Tony Heinz	Stanford University, USA	**Peter Wahl**	University of St Andrews, United Kingdom
Pinshane Huang	University of Illinois at Urbana-Champaign, USA	**Ying Wang**	University of Wisconsin–Madison, USA
Maciej Koperski	National University of Singapore, Singapore	**Matthew Yankowitz**	University of Washington, USA
Qiong Ma	Boston College, USA	**Liuyan Zhao**	University of Michigan, USA
Vinod Menon	The City College of New York, USA	**Jun Zhu**	The Pennsylvania State University, USA
Stevan Nadj-Perge	California Institute of Technology, USA	**Xiaoyang Zhu**	Columbia Unviersity, USA

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Symposium QT06: Defects in Solid-State Materials for Quantum Technologies

Point defects in solid-state materials are recognized as one of the most promising platforms for quantum sensing and quantum network technologies. Understanding and controlling these optically-addressable spins associated with atom-like systems in solids enables revolutionary quantum technologies. In this symposium, we will focus on several important aspects of solid-state defects as qubits for quantum technologies. *First,* we will focus on state of the art host materials for spin defects including wide bandgap semiconductors such as diamond and silicon carbide, intermediate band gap semiconductors such as silicon, as well as oxides and two-dimensional materials. Each system has its unique opportunities and challenges. Control of crystalline quality and residual impurity concentrations remain to be a challenge of all host materials. *Second,* we will discuss both intrinsic defects and extrinsic dopants, including s-p defects, transition metals, and rare-earth quantum emitters. Rare-earth ions (REI) exhibit characteristic sharp emission lines and long coherence. Detection and control of single REI can be coupled with photonic crystal resonators for emission rate enhancement. The rapid materials discovery can be facilitated by accurate ab-initio theory which predicts critical physical parameters. Recent advancement of electronic structure theory shows promise in tackling strong electron correlation, complex excited-state potential energy surfaces, excited-state kinetics, and spin relaxation and decoherences of defect systems. *Third*, controlling spin defects' properties through surface sciences and enhancement of spin qubits' coherence and use for entanglement distribution will be discussed. Long relaxation and coherence time is needed for stable manipulation of qubits at room temperature. How to control the decoherence pathway has been an active key topic for decades. Meanwhile qubit entanglement via light and interfacing with superconducting qubits are viable approaches for information transduction and quantum networking.

Topics will include:

- Spin defects in silicon, silicon carbide, diamond, oxides, and 2D materials
- Rare earth ions quantum emitters
- Molecular qubits
- Growth, fabrication, and optimization of solid-state materials as hosts
- Computational approaches to understanding optically-active defects
- Surface science and quantum sensing with defects
- Materials for superconducting qubits and interfaces with spin qubits
- Solid-state qubits entanglement and networks
- Identification and control of decoherence

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

Invited speakers include:

Mete Atatüre	University of Cambridge, United Kingdom
David Awschalom	The University of Chicago, USA
Mihir Bhaskar	AWS Center for Quantum Networking, USA
Songtao Chen	Rice University, USA
Kyeongjae Cho	The University of Texas at Dallas, USA
Jennifer Choy	University of Wisconsin–Madison, USA
Cyrus Dreyer	Stony Brook University, The State University of New York, USA
Danna Freedman	Massachusetts Institute of Technology, USA
Adam Gali	Budapest University of Technology and Economics, Hungary
Giulia Galli	The University of Chicago, USA
Elizabeth Goldschmidt	University of Illinois at Urbana-Champaign, USA
Supratik Guha	The University of Chicago, USA
Joseph Heremans	Argonne National Laboratory, USA
Alex High	The University of Chicago, USA
Evelyn Hu	Harvard University, USA
Viktor Ivády	Linköping University, Sweden
Zeeshawn Kazi	Princeton University, USA
Shimon Kolkowitz	University of California, Berkeley, USA
Tongcang Li	Purdue University, USA
Peter Maurer	The University of Chicago, USA
Hosung Seo	Ajou University, Republic of Korea
David Strubbe	University of California, Merced, USA
Susumu Takahashi	University of Southern California, USA
Jelena Vuckovic	Stanford University, USA
Chris Van de Walle	University of California, Santa Barbara, USA
Qimin Yan	Northeastern University, USA

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Symposium SB01: Soft Materials in Human–Machine Interfaces—Design, Integration and Performance

In the era of ever-evolving technology, this symposium serves as a critical exploration of the transformative role soft materials play in shaping the future of human-machine interactions. Soft materials, including but not limited to elastomers, polymers, textiles, and hydrogels, have emerged as pivotal elements in the design of interfaces that are responsive, adaptive, and comfortable for users. This symposium is dedicated to comprehensively investigating the design aspects, integration challenges, and performance evaluation of soft materials in human-machine interfaces (HMIs). Through a multidisciplinary approach, it aims to unravel the full potential of soft materials in enhancing the user experience and expanding the horizons of technological integration. The symposium will provide a platform for leading researchers, engineers, and innovators to exchange insights on the design principles underpinning soft material-based HMIs. Presentations and discussions will revolve around the latest advances in soft materials and applications. These topics will shed light on the innovative ways in which soft materials can be manipulated to create interfaces that are not only highly functional but also adaptable and intuitive. Moreover, the symposium will delve into the intricacies of how soft materials can be seamlessly incorporated into a wide range of applications, from wearable technology to medical devices. In addition to design and integration, the symposium also places a strong emphasis on the performance evaluation of soft material-based HMIs. Experts can share research findings and methodologies for assessing the efficacy and user satisfaction of such interfaces. Attendees will gain insights into measuring and enhancing the reliability, safety, and user experience of these soft material interfaces. By bringing together diverse perspectives and fostering collaboration, this symposium aims to accelerate the development of soft material solutions that enable more natural, intuitive, and comfortable interactions between humans and machines. Participants will leave with a deeper understanding of the potential of soft materials in revolutionizing the landscape of human-machine interfaces.

Topics will include:

- Wearable electronics based on soft materials
- Soft materials for neural electrodes
- Soft materials for biointegration
- Soft materials for robotics
- Soft bioadhesives
- Soft materials for energy harvesting
- Hydrogels for implants
- Soft Stimuli-responsive materials
- Minimally-invasive implants based on soft materials
- Ingestible devices based on soft materials

Invited speakers include:

Zhenan Bao	Stanford University, USA
Wei Gao	California Institute of Technology, USA
Debkalpa Goswami	Case Western Reserve University, USA
Dae-Hyeong Kim	Seoul National University, Republic of Korea
Stéphanie Lacour	École Polytechnique Fédérale de Lausanne, Switzerland
Jianyu Li	McGill University, Canada
Nanshu Lu	The University of Texas at Austin, USA
George Malliaras	University of Cambridge, United Kingdom
Naoji Matsuhisa	The University of Tokyo, Japan
Ivan Minev	Technische Universität Dresden, Germany
Seongjun Park	Korea Advanced Institute of Science and Technology, Republic of Korea
John Rogers	Northwestern University, USA
Takao Someya	The University of Tokyo, Japan
Jeong-Yun Sun	Seoul National University, Republic of Korea
Bozhi Tian	The University of Chicago, USA
Sihong Wang	The University of Chicago, USA
Xuanhe Zhao	Massachusetts Institute of Technology, USA

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Symposium SB02: Flexible, Stretchable Biointegrated Materials, Devices and Related Mechanics

Recent advances in materials science and mechanical engineering have enabled high-performance bio-integrated systems in soft, flexible formats. The rise in personalized medical diagnostics and treatments stems from the demand for quick, reliable, and cost-effective healthcare solutions. Wearable and implantable bioelectronic materials and devices have driven innovation, enhancing reliability, reducing infection risks, and broadening applications, revolutionizing conventional clinical procedures. Personalized healthcare has highlighted wearable and implantable devices that meticulously monitor physiological parameters, allowing comprehensive analysis from bodily movements to targeted clinical treatments. The integration of individualized bio-parameters from various organs has transformed healthcare diagnostics. Progress in materials science and device engineering, along with predictive biological models, propels bioelectronics forward. Materials facilitating seamless communication with biological entities have led to new device configurations, enabling the transduction and amplification of biological signals. This synergy between biology and electronics underpins reliable high-content studies and predictive models. This symposium will showcase ultrathin inorganic and hybrid materials for flexible, stretchable, bio-integrated devices, emphasizing their design, materials, mechanical structures, and bioelectronics applications. It will highlight the latest advancements in bioelectronic materials and devices, focusing on controlling bioelectronic interfaces to create durable and functional systems. Sessions will explore strategies for biomedical applications and multifunctional electronic materials interfacing with biology. The symposium aims to provide an overview of cutting-edge bioelectronics developments, particularly their integration into personalized healthcare, fostering interdisciplinary collaboration for transformative healthcare technology and innovation.

Topics will include:

- Flexible/stretchable electronics
- Ultrathin inorganic hybrid materials with related mechanics & modeling
- Biodegradable, transient electronic devices
- Bioelectronics, optoelectronics, and energy devices
- Wearable electronics for personalized medicine
- On-chip integration of electronics with biological components

Joint sessions are being considered with **EL14 - Flexible and Stretchable Optoelectronics and Circuits for Emerging Wearable Electronics**, and **SB01 - Soft Materials in Human–Machine Interfaces—Design, Integration and Performance**.
Also, a **tutorial** complementing this symposium is tentatively planned. Further information will be included in the MRS Program that will be available online in January.

Invited speakers include:

Jong-Huyn Ahn	Yonsei University, Republic of Korea
Ana Claudia Arias	University of California, Berkeley, USA
Zhenan Bao	Stanford University, USA
Yang Chai	The Hong Kong Polytechnic University, Hong Kong
Canan Dagdeviren	Massachusetts Institute of Technology, USA
Muhammad M. Hussain	Purdue University, USA
Martin Kaltenbrunner	Johannes Kepler Universität Linz, Austria
Sohini Kar-Narayan	University of Cambridge, United Kingdom
Dae Hyeong Kim	Seoul National University, Republic of Korea
Seok Kim	Pohang University of Science and Technology, Republic of Korea
Tae-il Kim	Sungkyunkwan University, Republic of Korea
Chiwan Lee	Purdue Unviersity, USA
Pooi See Lee	Nanyang Technological University, Singapore
Sunghoon Lee	RIKEN, Japan
Tae-Woo Lee	Seoul National University, Republic of Korea
Carmel Majidi	Carnegie Mellon University, USA
George Malliaras	University of Cambridge, United Kingdom
Tse Nga Ng	University of California, San Diego, USA
Thuc-Quyen Nguyen	University of California, Santa Barbara, USA
Jang Ung Park	Yonsei University, Republic of Korea
Qibing Pei	University of California, Los Angeles, USA
Jonathan Rivnay	Northwestern University, USA
Ravi Silva	University of Surrey, United Kingdom
Luisa Torsi	Università degli Studi di Bari, Italy
Joseph Wang	University of California, San Diego, USA
Sheng Xu	University of California, San Diego, USA
W. Hong Yeo	Georgia Institute of Technology, USA
Xuanhe Zhao	Massachusetts Institute of Technology, USA

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Symposium SB03: Biopolymers for Electronics and Robotics

Electronics and robotics are ubiquitous and among the fastest-growing sectors. They enabled striking benefits to mankind such as increased efficiency and automation, enhanced safety and security and advancements in medicine, energy, agriculture, education and many other fields. However, there is a mounting problem related to plastics in the electronics and robotics industries, especially considering the thousands of tons of electronic and robotic waste (*e*-/*bot*-waste) generated at the device's end of life. Traditional plastics are petroleum-based, they display a prolonged environmental lifespan, and are commonly incinerated upon disposal. One solution to this pressing issue lies in the adoption of polymers that are biobased and/or biodegradable. Many biopolymers are notable for being compostable and recyclable, offering multiple options to avoid landfilling at the conclusion of their life cycle. The significance of biopolymers has become paramount in addressing the issue of *e*-/*bot*-waste, which needs a collaborative effort among the realms of materials science, electronics, robotics, and sensors. This synergy highlights the potential for the creation of environmentally friendly components for electronics and robotics. Promising examples can be found in established research fields such as soft robotics and flexible electronics but also include emerging areas such as biodegradable sensors for environmental monitoring, edible electronics and robotics, and underwater robots. The symposium will be a focal point for the in-depth exploration of these research fields. The focus of this symposium will be on both fundamental and applied research in the realm of biopolymers, with potential applications in the fields of electronics and robotics. It will span a broad spectrum of research areas, encompassing advances in green chemistry, polymer science, composite development, sensors design and engineering, sustainable manufacturing, green electronics, and the seamless integration of these innovative solutions into robots. The symposium's topic of interest comprises a wide variety of topics, including but not limited to biopolymer-based basic electronic materials like dielectrics, conductors, and semiconductors, devices crafted from biobased and biodegradable materials such as sensors and actuators, and structural components for electronics and robotics such as printed circuit boards and encasements. Biopolymer-based energy sources, supercapacitors, and energy harvesting systems such as triboelectric generators and solar cells, as well as biomass-based devices and edible electronic and robotic systems will also be of interest. This symposium offers a unique platform for researchers from diverse backgrounds in materials synthesis, electronics, robotics, and device and sensor fabrication to converge and collectively work toward reducing reliance on petroleum-derived materials. This collective effort aims to establish the groundwork for a more sustainable future in the realms of electronics and robotics.

Topics will include:

- Innovative use of biopolymers as building blocks for dielectrics, electrical conductors, and semiconductors.
- Biopolymer-based composites for electronics and robotics.
- Degradable robotic components: towards zero waste electronics and robotics.
- Biopolymers engineering for transient electronics.
- Biopolymer-based actuators for soft robotics.
- Haptic feedback systems from biopolymers.
- Biopolymer-based additive manufacturing for electronics.
- Biopolymer-based hydrogels used for electronics, sensors, and robotics.
- Recyclable electronics and robotics.
- Sustainable and green manufacturing.

Invited speakers include:

Ana Claudia Arias	University of California, Berkeley, USA
Emiliano Bilotti	Imperial College London, United Kingdom
Mario Caironi	Istituto Italiano di Tecnologia, Italy
Kenjiro Fukuda	RIKEN, Japan
Francesco Greco	Scuola Superiore Sant'Anna, Italy
Suk-Won Hwang	Korea University, Republic of Korea
Martin Kaltenbrunner	Johannes Kepler Universität Linz, Austria
Nicholas Kotov	University of Michigan, USA
Danielle Mai	Stanford University, USA
Denys Makarov	Helmholtz-Zentrum Dresden-Rossendorf, Germany
George Malliaras	University of Cambridge, United Kingdom
Abdon Pena-Francesch	University of Michigan, USA
Luisa Petti	Libera Università di Bolzano, Italy
Ritu Raman	Massachusetts Institute of Technology, USA
Eleni Stavrinidou	Linköping University, Sweden
Yu Jun Tan	National University of Singapore, Singapore
Helen Tran	University of Toronto, USA

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Symposium SB04: Bioinspired Macromolecular Assembly and Inorganic Crystallization—From Fundamental Science to Applications

Living organisms produce a wide variety of hierarchical materials in an energy-efficient and highly reproducible manner, all under rather mild aqueous synthetic conditions. Throughout these processes, specialized biomacromolecules, such as proteins and peptides, enable 1) hierarchical organization to assemble biomaterials and execute high-level functions; and 2) precise control over mineral crystal nucleation, growth kinetics, phase transformation, and particle attachment and assembly, ultimately giving rise to biominerals with versatile functions. Inspired by nature, numerous approaches have been developed for the design and synthesis of bioinspired materials by using engineered proteins, peptides, DNA, PNA and other sequence-defined synthetic polymers (e.g., peptoids). These efforts address one of the grand challenges of materials science: to design and synthesize functional materials that rival those found in biology.

This symposium will highlight recent developments in the areas of 1) bioinspired macromolecular assembly to exploit (bio)macromolecules as building blocks to create hierarchical bionanomaterials, and 2) biomimetic control over crystallization including a) bioinspired control over inorganic (nano)crystal nucleation and growth, and b) nanoparticle self-assembly and attachment. This symposium will also address 3) the most recent insights obtained in the principles underlying (bio)macromolecular assembly and bio-controlled crystal formation (including using *in situ* molecular imaging and computational tools).

Topics will include:

- Hierarchical assembly of proteins, peptides, peptoids, or other biomimetic polymers into nanostructured materials and their applications.
- Biomineralization.
- Bioinspired crystal growth.
- Chiral nanomaterials.
- Bioinspired nanoparticle assembly
- Advanced characterization tools, including *in situ* TEM and AFM, for bioinspired macromolecular assembly and bio-controlled inorganic crystal formation.
- Theory driven design of (bio)macromolecules for assembly and for controlling inorganic crystal formation.
- Applications of bioinspired macromolecule assemblies and organic-inorganic hybrid hierarchical materials.

Invited speakers include:

David Baker	University of Washington, USA
Michael Davis	Wallace H. Coulter Department of Biomedical Engineering at Emory University and Georgia Tech, USA
James De Yoreo	Pacific Northwest National Laboratory, USA
Patricia Dove	Virginia Tech, USA
Ehud Gazit	Tel Aviv University, Israel
Yu Huang	University of California, Los Angeles, USA
David Kisailus	University of California, Irvine, USA
Marc Knecht	University of Miami, USA
Nicholas Kotov	University of Michigan, USA
Dongsheng Li	Pacific Northwest National Laboratory, USA
Chuanbin Mao	The Chinese University of Hong Kong, Hong Kong
Fiona Meldrum	University of Leeds, United Kingdom
Andrea Merg	University of California, Merced, USA
Jwa-Min Nam	Seoul National University, Republic of Korea
Ki Tae Nam	Seoul National University, Republic of Korea
So-Jung Park	Ewha Womans University, Republic of Korea
Darrin Pochan	University of Delaware, USA
Marika Rioult	3-D Matrix Medical Technology, Japan
Nico Sommerdijk	Radboud University Medical Center, Netherlands
Nicholas Stephanopoulos	Arizona State University, USA
Molly Stevens	Imperial College London, United Kingdom
Samuel Stupp	Northwestern University, USA
Jing Sun	Jilin University, China
Rein Ulijn	The City University of New York, USA
Larry Unsworth	University of Alberta, Canada
Shuguang Zhang	Massachusetts Institute of Technology, USA
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Symposium SB05: Emerging Bioresponsive Nanomaterials for Theranostics

This symposium aims to bring together scientists engaged in interdisciplinary research focused on disease diagnostics and therapy. It leverages nanomaterials designed to respond to specific pathologic microenvironment, such as reactive oxygen species, pH, temperature, enzymatic activity, etc., or certain stimuli, such as light, magnetic fields, ultrasound, radiation, and microwaves. Nanomaterials, characterized by variations in sizes, shapes, chemical compositions, and surface chemistry, are increasingly pertinent for imaging and therapy. Bioresponsive nanomaterials, capable of reacting to specific stimuli and environments, offer heightened sensitivity, improved efficiency, and minimized side effects. The design and synthesis of materials for imaging and therapy, particularly for complex diseases like cancer, pose significant research challenges. Nevertheless, multifunctional nanomaterials hold the potential to address these challenges. Additionally, immunotherapy has shown exceptional promise in cancer therapy. Bioresponsive nanomaterials could augment the effectiveness of immunotherapy and broaden its application to a wider range of diseases. Furthermore, the integration of artificial intelligence (AI) or machine learning (ML) technology has the potential to expedite the development of emerging bioresponsive nanomaterials for disease theranostics.

This symposium has been designed to provide an opportunity to discuss the most recent advances in bioresponsive nanomaterials, including current challenges and future directions. The topics will include the synthesis, characterization, and application of emerging and new nanomaterials in imaging, therapy, and biomedical engineering. Additionally, discussions will encompass immunotherapy and the design of nanomaterials assisted by artificial intelligence.

Topics will include:

- Responsive Nanomaterials for Targeted Drug Delivery and Therapy
- Multifunctional Nanocarriers for Imaging, Diagnostics, and Therapy
- Smart Nanomaterials for Real-Time Biosensing and Therapeutic Interventions
- Emerging Nanotechnologies in Cancer Immunotherapy
- Magnetic Nanomaterials in Imaging and Hyperthermia Treatment
- Responsive Biomaterials and Tissue Engineering
- Emerging Nanotechnologies for Metabolic Therapy
- AI-Driven Nanomaterial Design for Precision Medicine
- Case Studies: Nanomaterial Applications in Imaging and Therapy

Invited speakers include:

Stacy Copp	University of California, Irvine, USA
Tram Dang	Nanyang Technological University, Singapore
Geme-Louise Davies	University of Birmingham, United Kingdom
Clare Hoskins	University of Strathclyde, United Kingdom
Taeghwan Hyeon	Seoul National University, Republic of Korea
Gavin Jell	University College London, United Kingdom
Nazila Kamaly	Imperial College London, United Kingdom
Jessica Larsen	Clemson University, USA
Fangyuan Li	Shanghai Jiaotong University School of Medicine, China
Fuyou Li	Fudan University, China
Yuanpei Li	University of California, Davis, USA
Alessandro Poma	University College London, United Kingdom
Carlos Rinaldi-Ramos	University of Florida, USA
Zeev Rosenzweig	University of Maryland, Baltimore County, USA
Graeme Stasiuk	King's College London, United Kingdom
Xiaodi Su	National University of Singapore, Singapore
Nguyen T. K. Thanh	University College London, United Kingdom
Jun Wang	South China University of Technology, China
Gareth Williams	University College London, United Kingdom
Qian Yin	Stanford University, USA
Lanry Yung	National University of Singapore, Singapore

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Symposium SB06: Biopolymer Solutions for Climate Change

Biopolymers are naturally occurring substances or polymeric biomolecules that are synthesized by living organisms throughout their entire life cycle. Biopolymers can also be degradable, recyclable, and diverse, making them a promising material for replacing petrochemical polymers in a variety of disciplines including, energy storage and generation, nanocomposites, soil remediation, agriculture, electronics, and water purification. Furthermore, biopolymers are also non-toxic and making them suitable for a wide range of food, pharmaceutical, and biomedical applications. Current interest in this area has grown dramatically due to the development of advanced synthesis techniques which are at once sustainable, and economically competitive with the petrochemical industry. These techniques, are carbon neutral, and in some cases able to sequester carbon dioxide, operate on renewable energy sources, and produce industrial quantities of polymers. For example, enzymatic biosynthesis in combination with genetic engineering has enabled in controlled in vitro synthesis and design of polymers with unique functionalities, while increased understanding of bacterial metabolic pathways has enabled the design of bioreactors with higher capacities and efficiency. This symposium would like to explore the developments in this area, with emphasis on synthesis, application, and modeling and their broader implications on addressing climate change and environmental conservation. In addition the symposium aims to foster dialogue between industry and academia in furthering research and innovation in these areas, as well as introducing students to emerging career opportunities.

Topics will include:

- Biopolymers for Soil remediation, stabilization, and erosion control
- Biopolymers for environmentally sustainable flame retardants
- Biopolymers impact on plant biology: germination, root, foliage, and fruit development,
- Biopolymers in Sustainable Cosmetic Formulations and Design
- Challenges in sustainable biopolymer additive manufacturing
- Modeling biopolymer molecular structure and design
- Incorporating biopolymers in medical and pharmaceutical applications
- Academia/Industry panel: advancing opportunities for recent graduates
- Biopolymer-Based Materials for Energy Applications

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

Invited speakers include:

Sherif Abdelaziz	Virginia Tech, USA
Ali Dhinojwala	The University of Akron, USA
Fengxiang Han	Jackson State University, USA
Eugenia Kumacheva	University of Toronto, USA
Samantha Lucker	U.S. Army Engineer Research and Development Center, USA
Marta Miletic	San Diego State University, USA
Eyal Zussman	Technion–Israel Institute of Technology, Israel

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Symposium SB07: Stimuli-Responsive Smart Materials for Intelligent Systems

Intelligent systems have the ability to sense their environments, analyze surrounding signals, and provide logical responses. While intelligence is common in complex biological systems such as humans and animals, traditional materials like bricks or polymers are considered static and passive, lacking intelligence. For several decades, researchers have been developing stimuli-responsive smart materials that can sense their environments and exhibit basic changes in their properties. However, in recent years, significant advancements have been made in designing stimuli-responsive materials with highly advanced smart functions, involving the creative design of their structures, the combination of different materials, and the exploitation of specific physical-chemical phenomena. The focus of this symposium is on the research of these stimuli-responsive smart functions, which contribute to the development of intelligent, autonomous, and self-powered systems. Stimuli-responsive functions can be classified into three categories: analytical, regulatory, and practical functions. Analytical functions include memory, information storage, logic gates, and computing. Regulatory functions encompass self-oscillation, rectification, amplification, and self-organization. Practical functions involve motion, controlled release, shape change, targeting, pattern formation, and communication. These functions are constructed using various materials, such as stimuli-responsive hydrogels, polymers, inorganic materials, 2D materials, and biomaterials. By combining these different stimuli-responsive functions, truly intelligent systems capable of sensing, analyzing, and providing practical responses can be achieved. These smart autonomous systems with advanced operations have a wide range of potential applications, from medical devices to environmental sensing and response systems to advanced manufacturing technologies.

Topics will include:

- Responsive soft matter with programmable functions
- Responsive soft actuators and soft robotics
- Responsive actions of stimuli-responsive biointerfaces and biomaterials
- Stretchable electronic, electrochemical, and photonic systems
- Smart functions of shape memory materials
- Stimuli-responsive memory systems with analytical functions
- Advanced functions of stimuli-responsive nanoparticles
- Advanced functions of 3D printed stimuli-responsive materials
- Advanced functions of stimuli-responsive 2D materials
- Advanced functions of dynamic and self-healing polymeric materials
- Bioinspired and biomimetic robotic materials
- Machine learning and data-driven design of functional soft matter

Invited speakers include:

Joanna Aizenberg	Harvard University, USA
Kyle Bishop	Columbia University, USA
Michael Dickey	North Carolina State University, USA
Noémie-Manuelle Dorval Courchesne	McGill University, Canada
Yoel Fink	Massachusetts Institute of Technology, USA
David Gracis	Johns Hopkins University, USA
Bartosz Grzybowski	Ulsan National Institute of Science and Technology, Republic of Korea
Ryan Hayward	University of Colorado Boulder, USA
Ximin He	University of California, Los Angeles, USA
Thomas Hermans	IMDEA Nanoscience, Spain
Ghim Wei Ho	National University of Singapore, Singapore
Gong Jianping	Hokkaido University, Japan
Eugenia Kumacheva	University of Toronto, Canada
Joerg Lahann	University of Michigan, USA
Jennifer Lewis	Harvard University, USA
Katherine A. Mirica	Dartmouth College, USA
Xu Rong	Nanyang Technological University, Singapore
Ayusman Sen	The Pennsylvania State University, USA
Robert F. Shepherd	Cornell University, USA
Chih-Jen Shih	ETH Zürich, Switzerland
Atsushi Shishido	Tokyo Institute of Technology, Japan
Metin Sitti	Max Planck Institute for Intelligent Systems, Germany
Joseph Wang	University of California, San Diego, USA
Tao Xie	Zhejiang University, China
Hyo Jae Yoon	Korea University, Republic of Korea
Ryo Yoshida	The University of Tokyo, Japan
Xuanhe Zhao	Massachusetts Institute of Technology, USA

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Symposium SB08: Polymer Nanofibers for Bio/Medical Applications

Nanofibers, prepared by electrospinning and other techniques, have been undergoing growing investigation for biomedical applications, becoming increasingly significant in the landscape of healthcare technologies. Their exceptional biofriendly properties and carefully designed multi-functional properties propel nanofiber membranes into a unique role within the biomedical sphere. The previous MRS symposium on polymer nanofibers was held in Fall 2009, ~ 15 years ago. Considering the increasing demand for versatile and efficient biomedical solutions and corresponding important advances in electrospinning technologies, equipment and bio/medical applications, in-depth exploration and related exchange of communication regarding nanofiber capabilities are very timely.

Two main aspects of the symposium are (a) incorporation of advanced functional materials/additives, including novel drugs, micelles, cells, and nanoparticles, to nanofiber platforms and (b) novel nanofiber platforms for diverse biomedical applications including, but not limited, to drug delivery, tissue engineering, wound healing, cancer therapy, diabetes therapy, contraception, cosmetics, personal protection and biosensing. Technologies for nanofiber fabrication and nanofiber membranes approach will be covered in both fundamental and practical aspects, including the electrospinning technique. Overall, the symposium will be dedicated to sharing recent developments and discussing the current and future trends to pave the way for innovative therapeutic approaches and diagnostic tools.

Topics will include:

- Nanofiber Membranes - Fundamental and Practical Aspects of Electrospinning
- Other Advanced Technologies for Nanofiber Formation
- Drug Incorporation & Delivery
- Interaction with Cells (cells in fibers, fibers on cells)
- Functionalization with Nanoparticles
- Hydrogel Formation & Related Applications
- Transplant for Cancer Therapy
- Transplant for Diabetes Therapy
- Wound Care & Tissue Regeneration
- Contraception & Prevention of STDs
- Biomedical Sensors
- Electromechanical Stimulation
- Cosmetic Applications
- Personal Protection
- Other biomedical applications of Polymer Nanofibers

Invited speakers include:

Blair Bettmann	Georgia Institute of Technology, USA	**Jessica Schiffman**	University of Massachusetts Amherst, USA
Il-Doo Kim	Korea Advanced Institute of Science and Technology, Republic of Korea	**Urszula Stachewicz**	AGH University of Science and Technology, Poland
Minglin Ma	Cornell University, USA	**Gareth Williams**	University College London, United Kingdom
Fillipo Pierini	Instytut Podstawowych Problemów Techniki PAN, Poland	**Gary Wnek**	Case Western Reserve University, USA
Dario Pisignano	University of Pisa, Italy	**Younan Xia**	Georgia Institute of Technology, USA
Norbert Radacsi	University of Edinburgh, United Kingdom		

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Symposium SB09: Bio/Solid Soft Molecular Interfaces—Biology Meets Materials and Technology

Understanding biomolecule interactions at solid interfaces is crucial for designing soft interfaces in technology and medicine. Peptides, with their 10-20 amino acid sequences, are much smaller than proteins and thus more manageable and efficient for materials scientists and engineers. Recent advancements in high throughput screening, directed evolution, computational modeling, and machine intelligence have greatly enhanced the ability to design peptides with predictable, exclusive functions. This symposium will bring together three scientific communities: materials scientists, condensed- and soft-matter physicists, and chemists on the one hand, and molecular biologists, geneticists, and biotechnologists on the other. Computational and machine intelligence scientists will also be present, creating a truly convergent science and technology platform. The symposium aims to review the recent accelerated evolution of fundamental insights learned at the bio/solid hybrid interfaces and explore the molecular approaches in practical implementations, from mainstream applications in tissue engineering and biomedical materials coatings to peptide-functionalized drugs and delivery systems to genetically enabled bio-electronic, -magnetic, and -photonic materials, sensors, logic devices, and quantum biological systems.

Topics will include:

- Molecular Biomimetics – Lessons from Biology at the Molecular Dimensions
- Deep Directed Evolution & Deep Mutational Scanning, Solid Binding peptides
- The role of structured water at bio/solid interfaces- from theory to applications
- Chimeric peptides as multifunctional molecular constructs
- Molecular self-assembly at bio/solid interfaces
- Engineered peptides in bioelectronics, biophotonics, and biomagnetics
- Predictive design of peptides, peptidoglycans, and peptidolipids
- High-throughput experimentation and data acquisition at bio/nano interfaces
- Computational modeling of bio/solid interfaces
- Biomineralization and Remineralization of Bone and Dental Tissues

Invited speakers include:

Maisoon Al-Jawad	University of Leeds, United Kingdom
Frances Arnold	California Institute of Technology, USA
Nurit Ashkenasy	Ben-Gurion University, Israel
David Baker	University of Washington, USA
Francois Baneyx	University of Washington, USA
Annelise E. Barron	Stanford University, USA
Magnus Berggren	Linköping University, Sweden
Andrew Care	University of Technology Sydney, Australia
Douglas Fowler	University of Washington, USA
Peter Fratzl	Max Planck Institute of Colloids and Interfaces, Germany
Aren E Gerdon	Emmanuel College, USA
Nick Jakubovics	Newcastle University, United Kingdom
David Kaplan	Tufts University, USA
Kalpana Katti	North Dakota State University, USA
Roya Maboudian	University of California, Berkeley, USA
Ann Magnuson	Uppsala University, Sweden
Henry C Margolis	University of Pittsburgh, USA
Phillip Messersmith	University of California, Berkeley, USA
Janet Moradian-Oldak	University of Southern California, USA
Darrin Pochan	University of Delaware, USA
Ram Samudrala	University at Buffalo, The State University of New York, USA
Serdar Sariciftci	Johannes Kepler Universität Linz, Austria
Mehmet Sarikaya	University of Washington, USA
Malcolm Snead	University of Southern California, USA
Molly Stevens	Imperial College London, United Kingdom
Candan Tamerler	University of Kansas, USA
Silvia Vignolini	Max Planck Institute of Colloids and Interfaces, Germany
Tiffany Walsh	Deakin University, Australia
Steve Weiner	Weizmann Institute of Science, Israel
Domenick Zero	Indiana University, USA

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Thursday, October 17, 2024 (11:59 PM ET)

Symposium SB10: Neuromorphic Biohybrids—Materials, Devices, Interfaces and Computing Principles

The symposium focuses on advancing the development of materials, devices, and systems that can intelligently interface with biology, crucial for designing biosensors and neuromorphic electronics. It seeks to explore the common ground among various topics, some of which are already addressed in separate sections at MRS. Recognizing the limitations of traditional computing systems in replicating the brain's efficiency in information processing, the symposium emphasizes the importance of computational approaches inspired by biological neural networks on the device and circuit levels. These examples constitute the initial steps toward creating efficient bio-morphic systems capable of analyzing, interpreting, perceiving, and responding to dynamic real-world environments.

As a result, a new era of smart sensor and actuation applications is emerging, where systems efficiently interact with biological environments. However, achieving this intelligence also necessitates novel algorithmic support within a co-design framework. A longer-term approach involves allowing actual biological substrates to perform computations, directly tapping into the high level of computational efficiency inherent in biological processes.

The symposium will delve into the latest advancements in both inorganic and organic materials for bio-inspired information processing, bio-computation, and biosensing. It will showcase emerging applications in neuromorphic computing, sensing, actuation, and nano-scale bio-interfacing, along with recent progress in algorithmic development. By bringing together global experts in neuromorphic computing, bioelectronics, and neuroscience, the symposium aims to foster transdisciplinary interactions. Ultimately, it seeks to bridge the gaps between materials science, computing, and neuroscience by initiating a dialogue on this emerging and interdisciplinary topic.

Topics will include:

- Information Processing Inspired by Biology
- Mimicking Neural Processes
- Algorithms and hardware for Neuro-Inspired Computing and Intelligent Sensing
- Materials Innovation in Neuromorphic Devices: Inorganic and Organic Perspectives
- Sensing and Acting Like the Brain
- Flexible Bio-Interfaces: Adaptive Bio-Interfacing and materials
- Bridging Biology and Technology: Neural Interface Devices and materials
- Living Electrodes
- Integrating Nano-Scale Technologies with Biology: Bioelectronics with 2D Materials

Invited speakers include:

Chiara Bartolozzi	Istituto Italiano di Tecnologia, Italy
Saptarshi Das	The Pennsylvania State University, USA
Simone Fabiano	Linköping University, Sweden
Jennifer Gelinas	Columbia University, USA
Paschalis Gkoupidenis	Max Planck Institute for Polymer Research, Germany
Sahika Inal	King Abdullah University of Science and Technology, Saudi Arabia
Jean-Anne Incorvia	The University of Texas at Austin, USA
Deep Jariwala	University of Pennsylvania, USA
Scott Keene	Cambridge University, United Kingdom
Mario Lanza	King Abdullah University of Science and Technology, Saudi Arabia
Jia Liu	Harvard University, USA
Iain McCulloch	University of Oxford, United Kingdom
Jonathan Rivnay	Northwestern University, USA
Alexandra Rutz	Washington University in St. Louis, USA
Alberto Salleo	Stanford University, USA
Xenofon Strakosas	Linköping University, Sweden

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Symposium SB11: SynBioelectronics

Both Synthetic biology (encompassing engineered cellular and cell-free systems) and Bioelectronics aim to augment biological function for applications in therapeutics, diagnostics, or robotics, among others. Recent research at the intersection of synthetic biology and bioelectronics reveals a promising synergy, involving the integration of bioelectronic devices with synthetic biological circuits for precise control of function like metabolic reactions, signaling, sensing, and gene expression. This convergence combines the biological specificity of synthetic biology with the precision and communication capabilities of bioelectronic systems, facilitated by advances in microfabrication and novel materials. These advancements have minimized the size of the interface, allowing for direct communication with individual cells and membrane proteins. While synthetic biology can regulate their behavior through chemical feedback, their functional connectivity is inherently limited, lacking the advanced computational abilities found in organisms with a nervous system. The integration of synthetic biology with bioelectronics provides access to complex computations, allowing for both real-time and long-term adaptations. The enhanced capabilities emerging from this convergence have the potential to expand and deepen the impact of both synthetic biology and bioelectronics, leading to the development of user-programmable living organisms. These organisms could perform specific functions such as the synthesis of desired substances, directed motion, synthesis and modification of specific genes, cell reproduction and proliferation, thereby opening opportunities in regulated, personalized therapeutics. This symposium will bring together a diverse set of researchers from academia to industry, forefronting advancements in understanding and engineering biohybrid devices capable of producing and modulating cells, controlling therapeutic doses, and enabling precise diagnostics and interventions for mitigating disorders.

Topics will include:

- Cell-based biohybrids systems for biomedical applications
- Soft electronic materials and biological systems interface
- Electronic/optical/electrochemical coupling with cells and microorganisms
- 3D-4D engineered living materials and devices
- Cell-type specific neuromodulation
- Drug/gene delivery materials for neural interfacing
- Biohybrid Robotics
- Novel biological signal transduction approaches
- Microorganisms and cells engineering for biosensing
- Single-molecule measurements on peptides, proteins, and biomolecular interactions
- Integrated devices with multiple neural interfacing modality
- Biosensing/stimulation devices, and closed loop sensing/stimulation
- Fundamentals of engineered microbial fuel cells
- Cell-laden or biohybrid electronics and/or living hydrogels and their applications
- Conducting hydrogels & proteins: synthesis, characterization and application
- Brain-machine interfacing and health monitoring

Invited speakers include:

Alex Abramson	Georgia Institute of Technology, USA
Rashid Bashir	University of Illinois at Urbana-Champaign, USA
Guillermo Bazan	National University of Singapore, Singapore
Alexander Boys	Dartmouth College, USA
Tzahi Cohen-Karni	Carnegie Mellon University, USA
Susan Daniel	Cornell University, USA
Sahika Inal	King Abdullah University of Science and Technology, Saudi Arabia
Duygu Kuzum	University of California, San Diego, USA
Anna-Maria Pappa	Khalifa University, United Arab Emirates
Tyler Ray	University of Hawaii, USA
Jacob Robinson	Rice University, USA
Marco Rolandi	University of California, Santa Cruz, USA

Alexandra Rutz	Washington University in St. Louis, USA
Achilleas Savva	Delft University of Technology, Netherlands
Paul Sheehan	Advanced Research Projects Agency for Health, USA
Samuel Sia	Columbia University, USA
Hyongsok Tom Soh	Stanford University, USA
James Stafford	The University of Vermont, USA
Xenofon Strakosas	Linköping University, Sweden
Luisa Torsi	Università degli studi di Bari Aldo Moro, Italy
Christina Tringides	Rice University, USA
Omid Veiseh	Rice University, USA
Rabia Yazicigil	Boston University, USA

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Symposium SB12: Soft, Healable Conducting Polymers and Hydrogels for Bioelectronic Interfaces and Wearables

This symposium will cover current trends, advances, and perspectives on the synthesis and use of soft and healable conducting (and/or mixed-conducting) polymers and hydrogels for various emerging applications, including, but not limited to, medical wearables, biomimetic devices, tissue engineering, and biological interfacing. Soft and healable conducting polymers and hydrogels are heavily researched at the forefront to explore their ultimate potential in impacting multiple research fields, ranging from materials science, device engineering, microelectronics, tissue engineering, flexible & stretchable electronics, to iontronics. However, despite recent advances, their synthesis, fabrication, and integration remain challenging due to the difficulty of combining inherently and mutually exclusive properties, such as ionic conductivity, electronic conductivity, stretchability, healability, diffusive property, toughness, and fatigue properties. Additionally, their use in different application scenarios requires these materials to survive in complicated, humid, and electrolytic environments, imposing additional requirements on basic material properties such as viscoelasticity, adhesion, breathability, diffusion dynamics, and stability, etc. This symposium will cover efforts to advance soft and healable conducting polymers and hydrogels, as well as other similiar materials applied to and designed for broad applications. We will stimulate a debate on using different approaches to overcome the challenges in obtaining soft and healable properties while maintaining charge transport properties. This symposium will bring together investigators from multiple disciplines and address the synthesis, characterization, processing, fabrication, and manufacturing of soft and healable conducting polymers or hydrogels or other hydrated materials that either (1) possess advanced properties, including electronic, ionic, magnetic, optical, piezoelectric, rheological, breathability, and adhesive properties, or (2) are used in the construction of functional devices, such as soft and healable electrode arrays, sensors, medical wearables, biomimetic devices, soft robotics, actuators, and electrical stimulation of cell-laden tissue-engineered scaffolds.

Topics will include:

- Soft and healable conducting polymers and hydrogels & proteins: synthesis, characterization and application
- Healable electronic materials, devices, systems
- Various form factors of soft conducting materials (fibers, composites, 3D porous scaffolds)
- Soft conducting materials with additional/unique properties (healable, stretchable)
- Electronically and/or ionically conducting materials
- Bioinspired and biomimetic devices
- Hydrogels in soft robotics (e.g. actuators)
- Embodied self-awareness, 3D shape reconstruction
- Ionic, electronic, magnetic, and optical devices comprised of polymers, hydrogels, natural materials, and other hydrated materials
- Processing, patterning and manufacturing of polymer thin films, hydrogels
- Multimodal biointerfaces
- Brain-inspired computing

Joint sessions are being considered with **SB02 - Flexible, Stretchable Biointegrated Materials, Devices and Related Mechanics**.

Invited speakers include:

Eloise Bihar	University at Buffalo, The State University of New York, USA
Tricia Carmichael	University of Windsor, Canada
Vivian Feig	Stanford University, USA
Laure Kayser	University of Delaware, USA
Stéphanie Lacour	École Polytechnique Fédérale de Lausanne, Switzerland
Ting Lei	Peking University, China
Wei-lin Leong	Nanyang Technological University, Singapore
Jia Liu	Harvard University, USA
Nanshu Lu	The University of Texas at Austin, USA
Jenny Malmstrom	The University of Auckland, New Zealand

Ivan Minev	Leibniz Institut für Polymerforschung Dresden e.V., Germany
Charalampos Pitsalidis	Khalifa University, United Arab Emirates
Eleni Stavrinidou	Linköping University, Sweden
Bozhi Tian	The University of Chicago, USA
Helen Tran	University of Toronto, Canada
Christina Tringides	Rice University, USA
Lizhi Xu	The University of Hong Kong, Hong Kong
Cunjiang Yu	University of Illinois at Urbana-Champaign, USA
Xuanhe Zhao	Massachusetts Institute of Technology, USA

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Symposium SF01: Thermal Transport in Materials

This symposium will broadly cover topics related to thermal transport in materials, ranging from fundamental understanding at the nanoscale to applications in energy and thermal management. The first part of the symposium will focus on current and emerging thermal materials, exploring advancements in the fundamental understanding of heat transport phenomena. Discussions will include nanoscale transport that deviates from Fourier's diffusion theory, thermal conductivity of soft and amorphous materials, phonon dynamics in complex materials, as well as interfacial transport. Fundamental interactions between energy carriers, such as electrons, phonons, magnons, and/or photons, will also be included. The topics will further extend to the emerging phenomena, such as thermal Hall effect and chiral phonons. The second part of the symposium will focus on recent developments in methodology, both theoretical and experimental. This will explore simulation methods, including first principles, atomistic Green's function, and molecular dynamics, that lead to materials discovery and novel thermal science, which is further facilitated by machine learning and artificial intelligence. Discussions will also include advanced thermal metrology based on pump-probe, optical spectroscopy, electron microscopy, microfabricated platforms etc., that exhibit improved spatial and temporal resolutions, 3D depth-resolved scheme, high-throughput capability, and microscopic phonon dynamics. The third part of the symposium will focus on emerging functionalities of thermal materials and their applications in energy conversion and thermal management. The symposium will also feature insights from industry professionals who apply their understanding of heat transport to address practical engineering challenges.

Topics will include:

- Thermal conductance/conductivity of interfaces, amorphous materials, complex materials, and composites
- Thermal materials in extreme conditions
- Thermal radiation at the nanoscale
- Emerging phonon phenomena – phonon thermal hall effect and chiral phonons and underlying fundamental interactions
- Thermal metrology for materials and devices
- Modeling and theory of nanoscale heat transport
- Machine learning and artificial intelligence for thermal materials
- Thermal energy conversion and storage
- Thermal management of microelectronics and personal and energy systems

Invited speakers include:

David G. Cahill	University of Illinois at Urbana-Champaign, USA	**Amy Marconnet**	Purdue University, USA
Gang Chen	Massachusetts Institute of Technology, USA	**Alan McGaughey**	Carnegie Mellon University, USA
Renkun Chen	University of California, San Diego, USA	**Austin J. Minnich**	California Institute of Technology, USA
Patrick Hopkins	University of Virginia, USA	**Eric Pop**	Stanford University, USA
Ming Hu	University of South Carolina, USA	**Xiulin Ruan**	Purdue University, USA
Yongjie Hu	University of California, Los Angeles, USA	**Li Shi**	The University of Texas at Austin, USA
Seung Hwan Ko	Seoul National University, Republic of Korea	**Sunmi Shin**	National University of Singapore, Singapore
Chang-Seok Lee	Samsung Electronics, Republic of Korea	**Junichiro Shiomi**	The University of Tokyo, Japan
Baowen Li	Southern University of Science and Technology, China	**Xiaojia Wang**	University of Minnesota Twin Cities, USA
Deyu Li	Vanderbilt University, USA	**Yaguo Wang**	The University of Texas at Austin, USA
Lucas lindsay	Oak Ridge National Laboratory, USA	**Richard Wilson**	University of California, Riverside, USA
Jun Liu	North Carolina State University, USA	**Xianfan Xu**	Purdue University, USA
Tengfei Luo	University of Notre Dame, USA	**Mona Zebarjadi**	University of Virginia, USA
Jonathan Malen	Carnegie Mellon University, USA		

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Symposium SF02: Complex Oxide Epitaxial Thin Films

The interplay between charge, spin, lattice, and orbital degrees of freedom in strongly correlated oxide materials leads to a wide range of emergent phenomena that include ferroelectricity, magnetism, superconductivity, and tunable electrical/optical/catalytic properties. This symposium covers recent advances in the synthesis and characterization of complex oxide thin films, heterostructures, superlattices and vertical nanocomposites, strain/microstructure/property correlation and the emergence of unique properties. Topics of interest include epitaxy of complex oxides, stabilization, heterointerface engineering, emergent interfacial properties, new materials discovery, advanced characterizations, and device applications in energy harvesting, memories, and sensors, among others. Contributions that connect advances in synthesis science to structure and property trends are of particular interest, as are those which link theoretical/computational and experimental efforts. The goal of this symposium is to bring together international and interdisciplinary researchers with an interest in epitaxial thin films to exchange ideas and foster collaboration. The topics listed for this symposium reflect the needs and opportunities of strongly correlated oxide thin films towards the applications in spintronics, quantum information science, microelectronics, and clean energy.

Topics will include:

- Synthesis and characterization of epitaxial thin films, heterostructures, superlattices and nanocomposites
- Magnetism, ferroelectricity, multiferroicity and superconductivity
- Structure-property correlation
- Synthesis and characterization of metastable materials and high-entropy complex oxides in thin film form
- Phase change materials in thin film form
- Theoretical simulation and modelling of oxide heterostructures focused on strain, defects, and doping
- Emergent interface phenomena and defects
- Advanced characterization of structural and functional properties in complex oxide thin films by atomic/piezo force microscopy, electron microscopy, neutron scattering, and synchrotron radiation.
- Strain-, defect-, and interface-controlled device performance in energy harvesting, memories, and sensors, among others

Joint sessions are being considered with **QT04 - Transformative Oxide Heterostructures and Membranes for Microelectronics and Energy Technologies**.

Invited speakers include:

Charles Ahn	Yale University, USA
Ariando Ariando	National University of Singapore, Singapore
Christoph Baeumer	University of Twente, Netherlands
Anand Bhattacharya	Argonne National Laboratory, USA
Antia Botana	Arizona State University, USA
Jak Chakhalian	Rutgers University, USA
Si-Young Choi	Pohang University of Science and Technology, Republic of Korea
Ying-hao Chu	National Tsing Hua University, Taiwan
Yingge Du	Pacific Northwest National Laboratory, USA
Elliot Fuller	Sandia National Laboratories, USA
Chen Ge	Institute of Physics, Chinese Academy of Sciences, China
Xia Hong	University of Nebraska–Lincoln, USA
Harold Y. Hwang	Stanford University, USA
Shinbuhm Lee	Daegu Gyeongbuk Institute of Science and Technology, Republic of Korea
Danfeng Li	City University of Hong Kong, Hong Kong
Mingzhao Liu	Brookhaven National Laboratory, USA
Julia Mundy	Harvard University, USA
Yuefeng Nie	Nanjing University, China
Stuart Parkin	Max Planck Institute of Microstructure Physics, Germany
Km Rubi	Los Alamos National Laboratory, USA
Sverre M. Selbach	Norwegian University of Science and Technology, Norway
Kyle Shen	Cornell University, USA
Jeongkeun Song	Oak Ridge National Laboratory, USA
Hiroshi Takatsu	Kyoto University, Japan
Jean-Marc Triscone	University of Geneva, Switzerland
Susan Trolier-McKinstry	The Pennsylvania State University, USA
Haiyan Wang	Purdue University, USA
Lingfei Wang	University of Science and Technology of China, China
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Symposium SF03: From Robotic Toward Autonomous Materials

Soft robotics has made tremendous strides over recent years, with new forms of soft structures, 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 material 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 material 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. As the field continues to advance, we can expect to see more innovative solutions that push the boundaries of what is possible with soft robotics. 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, enduring and agile robots, 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:

Amir H. Alavi	University of Pittsburgh, USA
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
Monica O. De La Cruz	Northwestern University, USA
Michael Dickey	North Carolina State University, USA
Kristen Dorsey	Northeastern University, USA
Amir D. Gat	Technion–Israel Institute of Technology, Israel
Daniel I. Goldman	Georgia Institute of Technology, USA
Francesco Greco	Scuola Superiore Sant'Anna, Italy
Ryan Hayward	University of Colorado Boulder, USA
Josie Hughes	École Polytechnique Fédérale de Lausanne, Switzerland
Mirko Kovac	Imperial College London, United Kingdom
Shlomo Magdassi	The Hebrew University of Jerusalem, Israel
Barbara Mazzolai	Istituto Italiano di Tecnologia, USA
Shingo Meada	Tokyo Institute of Technology, Japan
Ankur mehta	University of California, Los Angeles, USA
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
Nancy Sottos	University of Illinois at Urbana-Champaign, USA
Timothy J. White	University of Colorado Boulder, USA
Renee Zhao	Stanford University, USA

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Symposium SF04: Flexoelectric Engineering of Functional Materials, Structures and Devices

Strain gradients break inversion symmetry and induce flexoelectric polarization in otherwise nonpolar materials, overcoming one of the major constraints imposed on crystalline symmetries by conventional piezoelectricity and ferroelectricity. Flexoelectricity thus presents a new paradigm for manipulating dielectric polarization and associated phenomena, and in recent years it has emerged as a powerful tool to engineer a wide range of materials, structures, and devices, including piezoelectric actuators, field effect transistors, and photodetectors. With rapid advances in characterization techniques and computational algorithms, the gap between theory and experiment is being bridged, and we are gaining unprecedented microscopic understanding of the flexoelectric effect. This enables not only design, development, and optimization of flexoelectric materials, structures and devices, but also provides new insight into novel polar topologies such as vortices, antivortices, and skymions. The symposium intends to bring together materials scientists, condensed matter physicists, electrical engineers, and solid mechanicians working on materials synthesis, device fabrication, modeling, as well as characterization aspects of flexoelectricity to survey the state of the art, exchange ideas, and foster collaborations. Abstracts in both fundamental and applied aspects of flexoelectricity are solicited, and potential topics of interest are listed in the following.

Topics will include:

- Flexoelectricity for design and optimization of functional materials
- Strain gradients in two-dimensional materials, nanostructures, and interfaces
- Effect of flexoelectricity on nontrivial polar topologies
- Modeling, theory and computation of flexoelectric effect
- Characterization and measurement of flexoelectric response
- Design and fabrication of flexoelectric structures and devices
- Flexoelectricity in electromechanical coupling, MEMS, and energy harvesting
- Flexoelectricity in semiconductors, memories, and field effect transistors
- Flexoelectricity in bulk photovoltaics, optoelectronics, and pyroelectrics
- Flexoelectricity in biological systems

Invited speakers include:

Nazanin Bassiri-Gharb	Georgia Institute of Technology, USA
Gustau Catalan	Catalan Institute of Nanoscience and Nanotechnology, Spain
Long-Qing Chen	The Pennsylvania State University, USA
Weijin Chen	Sun Yat-Sen University, China
Neus Domingo Marimon	Oak Ridge National Laboratory, USA
EA Eliseev	Institute for Problems of Materials Science, Ukraine
Jiawang Hong	Beijing Institute of Technology, China
Boyuan Huang	Southern University of Science and Technology, China

Xu Liang	Xi'an Jiaotong Unviersity, China
Patrycja Paruch	University of Geneva, Switzerland
Li-Hua Shao	Behang University, China
Alexander Tagantsev	École Polytechnique Fédérale de Lausanne, Switzerland
Susan Trolier-Mckinstry	The Pennsylvania State University, USA
Chan-Ho Yang	Korea Advanced Institute of Science and Technology, Republic of Korea
Mingmin Yang	University of Science and Technology of China, China
Pavlo Zubko	University College London, United Kingdom

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Symposium SF05: Building Advanced Materials via Aggregation and Self-Assembly

This symposium will cover a broad range of topics related to the construction of advanced materials using aggregation or self-assembly techniques, encompassing both experimental and theoretical aspects. Aggregation and self-assembly play critical roles in the natural formation of minerals and have become increasingly significant in the fabrication of advanced materials at both laboratory and industrial scales. Over time, materials synthesized through these methods have found applications in diverse fields, including biomedicine, energy, environment, catalysis, and optics. For example, interconnected nanoparticle superlattices created through the self-assembly of Fe_3O_4 nanoparticles have been employed as anodes to enhance lithium-ion battery performance. Additionally, advanced luminescent materials have been developed through aggregation-induced emission (AIE) of intrinsically non-emissive molecules. However, a major challenge in this rapidly expanding field is the need for 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; (5) Materials with AIE and their practical applications. This symposium aims to provide researchers with updated information on aggregation and self-assembly research. It is also designed to help experienced researchers deepen their knowledge, particularly in state-of-the-art theory and 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
- Mechanistic studies of aggregation or self-assembly pathways
- Theory and simulations of particle-based crystallization and assembly
- 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 January.

Invited speakers include:

Lluis Blancafort	Universitat de Girona, Spain
Jasna Bruji	New York University, USA
Qian Chen	University of Illinois at Urbana-Champaign, USA
Sijie Chen	The Chinese University of Hong Kong, Hong Kong
James De Yoreo	Pacific Northwest National Laboratory, USA
Julia Dshemuchadse	Cornell University, USA
Michael Engel	Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany
Hongyou Fan	Sandia National Laboratories, USA
Riccardo Ferrando	University of Genoa, Italy
Oleg Gang	Columbia University, USA
Pupa Gilbert	University of Wisconsin–Madison, USA
Sharon Glotzer	University of Michigan, USA
Jianping Gong	Hokkaido University, Japan
Yuning Hong	La Trobe University, Australia
Cherie Kagan	University of Pennsylvania, USA

Nicholas Kotov	University of Michigan, USA
Eugenia Kumacheva	University of Toronto, Canada
Bin Liu	National University of Singapore, Singapore
Xiaoding Lou	China University of Geosciences, China
Paul McGonigal	Durham University, United Kingdom
Chad Mirkin	Northwestern University, USA
Christopher Murray	University of Pennsylvania, USA
Kanyi Pu	Nanyang Technological University, Singapore
Andrea Pucci	Università di Pisa, Italy
Xin Qi	Dartmouth College, USA
Eric Rivard	University of Alberta, Canada
Youhong Tang	Flinders University, Australia
Dong Wang	Shenzhen University, China
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Symposium SF06: Advances in Chiral Materials

"Advanced Chiral Materials" epitomizes a burgeoning domain within materials research, dedicated to the exploration of substances exhibiting chirality—a fundamental property pervading disciplines such as chemistry, physics, and biology. This field meticulously investigates the asymmetric structures and unique properties inherent in chiral molecules, surfaces, and nanostructures, unveiling a diverse array of applications spanning pharmaceuticals, optoelectronics, catalysis, and nanotechnology. Its interdisciplinary nature renders it a pivotal topic of interest, attracting a diverse audience seeking insight into both foundational principles and practical implications in various industries.

The profound significance of this subject arises from its capacity to bridge disparate scientific realms, offering a convergence point for researchers, engineers, and practitioners keen on leveraging the distinctive traits of chiral materials for innovative solutions. Over time, the field has undergone notable evolution, characterized by advancements in synthetic methodologies, sophisticated characterization techniques, and groundbreaking applications. This evolutionary trajectory—from foundational principles to cutting-edge research—exemplifies the dynamic growth and immense potential inherent in chiral materials, propelling technological advancements.

While discussions encompass historical knowledge, they also underscore recent technical strides, making them integral components of the symposium for novices and platforms for experts to explore the latest breakthroughs. Inclusion in materials research serves a multifaceted role, disseminating historical context while illuminating the evolving landscape and future prospects within the sphere of chiral materials. This symposium encapsulates the comprehensive nature and enduring relevance of advanced chiral materials in the realm of materials research.

Topics will include:

- Chiral Nanomaterials
- Circularly Polarized Light Detecting Materials
- Chiroptical Spectroscopy
- Chiral Catalysis
- Chiral Plasmonics
- Chiral Sensors
- Chiral Spintronic Materials
- Chiral Surfaces and Interfaces
- Chiral Drug Development
- Chirality in Biomaterials
- Chiral Micromaterials
- 1D, 2D, and 3D chiral materials

Joint sessions are being considered with **SF07 - Complexity Engineering of Materials Combining Order, Disorder and Hierarchical Organization**.

Invited speakers include:

Thomas Buergi	University of Geneva, Switzerland	**Ron Naaman**	Weizmann Institute of Science, Israel
Nicholas Kotov	University of Michigan, USA	**Reiko Oda**	Institut Européen de Chimie et Biologie, France
Na Liu	Universität Stuttgart, Germany	**Jihyeon Yeom**	Korea Advanced Institute of Science and Technology, Republic of Korea

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Symposium SF07: Complexity Engineering of Materials Combining Order, Disorder and Hierarchical Organization

Learning from biology, we understand complexity as the performance-oriented structural organization of matter combining order and disorder. Complexity in various human-made and biological materials can be spontaneous but its emergence is hard to predict because it (1) originates from extensive multibody interactions; (2) incorporate diverse non-ideal components and (3) spans multiple lengths scales. The practical needs for complexity are vital and timely. They stem from the pursuit of specific combinations of properties exemplified by combinations of strength vs. lightweight, conductivity vs. transparency, and recyclability vs. environmental robustness. Incorporating complexity into material design makes it also possible to combine these and other properties while mimicking nature's energy efficiency.

The subtopics of our symposium will cover gel networks, high-performance composites, complex particles, high entropy materials, microscopy tools, additive manufacturing of complex materials using 3D printing, and self-organization phenomena. Mathematical methods applicable to complex materials exemplified by graph theory, network science, fractal mathematics, percolation theory and machine learning are also included.

Topics will include:

- Complex materials with hierarchical organization and controlled order and disorder
- Nanofiber composites with percolating networks
- Metamaterials with disorder
- Self-assembly and other pathways to complexity
- Chiral nanostructures and multifunctional materials thereof
- Bioinspired materials
- Composites, ceramics and metals with high and medium entropy
- Microscopy techniques in studying 3D nanostructures
- Rigidity percolation, charge transport, and heat transfer in complex matter
- Graph theoretical design parameters for composites and gels
- Fractal and multifractal characterization of materials and particles assemblies
- Percolation theory for materials and particles
- Machine learning approaches for materials with functional stochasticity.

Joint sessions are being considered with **SF05 - Building Advanced Materials via Aggregation and Self-Assembly**, and **SF06 - Advances in Chiral Materials**.
Also, a **tutorial** complementing this symposium is tentatively planned. Further information will be included in the MRS Program that will be available online in January.

Invited speakers include:

Archana Bhaw-Luximon	University of Mauritius, Mauritius	**Sharon Glotzer**	University of Michigan, USA
Nadja Bigall	Institut für Physikalische Chemie und Elektrochemie, Germany	**Abigail Juhl**	Air Force Research Laboratory, USA
Stephanie Brock	Wayne State University, USA	**Dan Liu**	Deakin University, Australia
Qian Chen	University of Illinois at Urbana-Champaign, USA	**Xiaoming Mao**	University of Michigan, USA
Emanuela Del Gado	Georgetown University, USA	**Bridget Mutuma**	University of Nairobi, Kenya
Lawrence Drummy	Air Force Research Laboratory, USA	**Timothy Sirk**	U.S. Army Research Laboratory, USA
Alexander Eychmueller	Technische Universität Dresden, Germany	**Martin Thuo**	North Carolina State University, USA

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Symposium SF08: Achieving and Exploiting Complexity Through the Synthesis and Application of Hybrid Hierarchical Materials

With living systems as inspiration, a grand challenge in materials research is achieving the rational design of hierarchical materials for complex functions based on a predictive understanding of materials synthesis across scales. This symposium will bring together experimental and computational researchers from across the science and engineering community to discuss innovative approaches to mastering the free energy landscapes that control the assembly of complex building blocks into ordered and functional hybrid hierarchical systems. This symposium is inspired by research pioneered at the Center for the Science of Synthesis Across Scales (CSSAS), an Energy Frontier Research Center.

This symposium will explore the convergence of science and engineering required for hierarchical materials design and the connection between building block synthesis and assembly to achieve hierarchy and emergent function. Key topics to be covered include 1) Fundamentals of Hierarchical Materials - We will delve into the foundational principles that govern the assembly of complex building blocks into ordered and functional hybrid hierarchical systems. This symposium will provide a platform to explore the convergence of scientific disciplines in the pursuit of this understanding; 2) Computational Insights - Computational approaches are integral in predicting and modeling the free energy landscapes that control materials assembly across scales. We will showcase cutting-edge computation, simulation, and modeling methods and their applications in hierarchical materials design; 3) Experimental Advances in Applications - The symposium will feature groundbreaking experimental research that translates theoretical insights into practical applications, including energy and sustainability, biology and medicine, and metamaterials and exotic physical phenomena. Attendees will gain valuable insights into the latest advances in the application of hierarchical hybrid materials to next-generation technologies.

Topics will include:

- Synthesis of hybrid hierarchical materials
- Application of hybrid hierarchical materials: Energy and the environment
- Application of hybrid hierarchical materials: Metamaterials
- Application of hybrid hierarchical materials: Biology and medicine
- Theory and simulation to predict the form and function of hybrid hierarchical materials

Joint sessions are being considered with **SF07 - Complexity Engineering of Materials Combining Order, Disorder and Hierarchical Organization**.

Invited speakers include:

Francois Baneyx	University of Washington, USA	**Valerie Marchi**	Université de Rennes, France
Qian Chen	University of Illinois at Urbana-Champaign, USA	**Sunita Srivastava**	Indian Institute of Technology Bombay, India
Patrick Huber	Technische Universität Hamburg, Germany	**Tiffany Walsh**	Deakin University, Australia
Yashuiro Ishida	RIKEN, Japan	**Uli Weisner**	Cornell University, USA
Robert Macfarlane	Massachusetts Institute of Technology, USA	**Shelley Wickham**	The University of Sydney, Australia

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Symposium SF09: Aerospace Materials for Extreme Environments

Ambitions for space exploration are driving the aerospace industry to develop materials capable of withstanding harsh, and ever-changing environments. These innovations have far-reaching impacts across civil and defense aviation. The next generation aerospace vehicles demand materials that can endure increasingly extreme temperatures, shock, vacuum, radiation, micrometeoroids, and corrosive substances. This is particularly challenging for space vehicles developed for human space exploration, and robust methods for assessing material survivability that simulate the precise details of specific environments are essential. Technologies such as additive manufacturing (AM), artificial intelligence (AI) and machine learning (ML) for composition selection, automated fiber placement (AFP), and functional metamaterials are driving material innovation. This symposium focuses on emerging materials design, fabrication, characterization, modelling, and test methods leveraged by the aerospace industry to meet the challenges associated with space travel. The trickle-down effect from these technologies that benefit the aerospace industry in general will also be addressed. This includes progress in sustainability through advanced materials selection for lightweighting and removal of hazardous chemicals, and materials fabrication optimization. Finally, with a rapidly changing landscape, the most pressing needs in aerospace materials will be presented and discussed by funding program officers in a panel Q&A session. Panelists will share emerging materials science needs and themes for aerospace applications.

Topics will include:

- Processing considerations for materials in extreme environments
- Multi-scale modelling of material structures and environments
- Funding trends in Aerospace Materials
- Advances in aerospace coating technologies
- Sustainable materials for aerospace applications
- Novel materials and structures for evolving space environments
- Multifunctional aerospace structures

Invited speakers include:

Michael Barako	Northrop Grumman, USA
Derek Barbee	Air Force Office of Scientific Research, USA
Michael Brindza	Naval Air Warfare Center, Aircraft Division, USA
Sang-Hyon Chu	NASA Langley Research Center, USA
Tim Fisher	University of California, Los Angeles, USA
Nancy Kelley-Loughnane	Air Force Research Laboratory, USA
Marianna Maiaru	Columbia University, USA
Kara Martin	Air Force Research Laboratory, USA
Scott McCormack	University of California, Davis, USA
Nobuyuki Odagiri	Kanazawa Institute of Technology, Japan
Michelle Povinelli	University of Southern California, USA
Nadine Rehfeld	Fraunhofer Institute for Manufacturing Technology and Advanced Materials, Germany
Ali Sayir	Air Force Office of Scientific Research, USA
Jill Seebergh	The Boeing Company, USA
Navid Zobeiry	University of Washington, USA

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Symposium SU01: Solid Materials for Sustainable Cooling—Caloric Effects and Devices

Billions of vapor-compressor devices employing potent greenhouse gases and with moderate efficiencies are responsible for ~8% of overall CO2-equivalent emissions. With this number increasing unceasingly and emerging regulations worldwide banning these fluids, developing more sustainable coolers and heaters is an urgent scientific and engineering challenge. This is leading to increasing efforts on this topic, like the "Clean and Efficient Cooling" Pathfinder Challenge EU call, aligned with the European Green Deal. According to a US DoE report, solid-state caloric materials are among the most promising alternatives. Although commercial competitiveness has yet to be achieved, the continuous improvement of figures of merit and an increasing number of publications and patents year after year are encouraging. This Symposium aims to bring together the state-of-the-art in the field of solid-state calorics, namely magnetocaloric, electrocaloric, mechanocaloric and multicaloric materials and devices, where new and improved solid refrigerants and designs will be presented to the community. From condensed matter physicochemistry to applications, from the atomistic scale to the macroscale, experimentally or theoretically, Symposium contributions will report on caloric materials including magnetocaloric behavior of new alloys at first-order or second-order transitions, in the cryogenic or room temperature regimes; novel lead-free electrocaloric ceramics, first-order or relaxors, and highly responsive polymers; fatigue-resistant shape-memory alloys and polymers for elastocaloric applications, and powerful barocaloric materials that respond reversibly at reduced pressures. Devices operating with passive or active regeneration and/or cascade modes and/or work recovery, and optimized material shapes for heat exchange will be also discussed. Other thermal-related applications of caloric materials (waste heat recovery, power generation, etc.) may be also presented.

Topics will include:

- Progress in magnetocaloric materials and devices: experiment, theory and modelling
- Progress in electrocaloric materials and devices: experiment, theory and modelling
- Progress in elastocaloric materials and devices: experiment, theory and modelling
- Progress in barocaloric materials and devices: experiment, theory and modelling
- Progress in multicaloric materials and devices: experiment, theory and modelling
- Thermal management developments
- Materials: alloys, ceramics, polymers, hybrids and composites
- Advances in theory, modelling and simulations
- New measurement and characterisation techniques
- Devices and applications

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

Invited speakers include:

David Boldrin	University of Glasgow, United Kingdom
Luana Caron	Bielefeld University, Germany
Alexandre Magnus Gomes Carvalho	Federal University of Sao Paulo, Brazil
Asaya Fujita	National Institute of Advanced Industrial Science and Technology, Japan
Oliver Gutfleisch	Technische Universität Darmstadt, Germany
Gian Guzman-Verri	University of Costa Rica, Costa Rica
Heike Herper	Uppsala University, Sweden
Claire Hobday	University of Edinburgh, United Kingdom
Fengxia Hu	Institute of Physics, Chinese Acadamy of Sciences, China
Bing Li	Institute of Metal Research, Chinese Academy of Sciences, China
Lluis Mañosa Carrera	Universitat de Barcelona, Spain
Jarad Mason	Harvard University, USA
Neil D. Mathur	University of Cambridge, United Kingdom
Xavier Moya	University of Cambridge, United Kingdom
Qibing Pei	University of California, Los Angeles, USA
Patrick Rosa	Institut de Chimie de la Matière Condensée de Bordeaux, France
Julie Slaughter	Iowa State University, USA
Ichiro Takeuchi	University of Maryland, USA
Alvar Torello	Universitat Politècnica de Catalunya, Spain
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Symposium SU02: Enabling Sustainable Polymers—A Holistic View from Feedstock and Synthesis to Application and End-of-Life

Polymers are essential materials in modern society with their production and consumption increasing exponentially. Post-consumer polymer waste is equally growing and leading to pervasive ecological impacts, threatening planetary boundaries and human health. The emerging concept of a circular bioeconomy unravels opportunities to create a sustainable society using abundant and economical bioresources while lowering the net carbon footprint by extending material life cycle. Enabling a circular bioeconomy for polymers requires an integrated, systems-based approach that considers biomass feedstock, green polymer synthesis, recycling-by-design and biodegradability while minimizing waste and energy costs. Some of the most promising and topical approaches to address these challenges include leveraging renewable biomass surrogates for petroleum-derived monomers to create synthetic biopolymers; directly utilizing native biopolymers; redesigning manufacturing and recycling processes to be less wasteful and consume less energy. Yet, for biomass-based materials there are historical challenges to address including inefficient separations and/or poor conversion yields; lowering waste and energy requirements for transformations; improving compatibility with legacy and emerging manufacturing methods; enabling economical scaling of processes; matching performance metrics for petroleum-derived polymers; ensuring benign environmental degradation. In addition, legacy waste (and currently produced) polymers must be integrated into the circular bioeconomy. State-of-the-art upcycling approaches employing efficient polymer deconstruction and/or functionalization techniques can valorize waste materials while re-integrating them into the material cycle. This symposium centers on these topics to address this multifaceted global challenge which requires collaboration from academic, industry, and government partners possessing expertise in chemistry, chemical and process engineering, environmental and materials science, among others.

Topics will include:

- Nanocellulose, lignin, chitin and other biological polymers: Extraction and characterization of materials and their hierarchical structures.
- Engineered living and/or bio-inspired materials, cell-based and biopolymer-based materials including plant or algal cell-based materials and protein-based materials.
- Functional structures from lignocellulose including functionalization and multi-functional composite materials.
- Wood nanotechnology: Wood nanostructure understanding, nanostructural control, and multi-functional materials design.
- Lignocellulosic biomass processing into feedstock for synthetic sustainable biopolymers
- Development of novel synthetic biodegradable and/or recyclable biopolymers.
- Waste-derived polymeric materials obtained from low-energy or wasteless processing methods.
- Valorization of polymer waste materials via upcycling using efficient chemical processes.
- Self-healing and adaptable (bio)polymers including depolymerizable materials, dynamic covalent network polymers, and supramolecular materials.
- Fundamental science of native and synthetic biopolymers: Mechanical, thermal, barrier, rheological, and optical properties. Nanostructuring and/or multi-scale modeling.
- Life-cycle-assessment of sustainable polymeric materials and their recycling processes and waste treatment of legacy polymers.
- Studies of biodegradation and recycling or regeneration of sustainable polymers.
- Emerging advanced applications based on biopolymers and biodegradable polymers such as additive manufacturing, batteries, electronics, biodevices, and energy management.

Invited speakers include:

R. Konane Bay	University of Colorado Boulder, USA
Eva Blasco	Universität Heidelberg, Germany
Yong Ding	ETH Zürich, Switzerland
Stephen Eichhorn	University of Bristol, United Kingdom
Brett Helms	Lawrence Berkeley National Laboratory, USA
Katrina Knauer	National Renewable Energy Laboratory, USA
Amy Landis	Colorado School of Mines, USA

Jeremy Luterbacher	École Polytechnique Fédérale de Lausanne, Switzerland
Caio Otoni	Universidade Federal de São Carlos, Brazil
Elisabeth Prince	University of Waterloo, Canada
Fernando Vidal	Polymat, University of the Basque County, Spain
Chen Wang	The University of Utah, USA
Jonathan Wilker	Purdue University, USA

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Symposium SU03: Sustainable Batteries—Recycling and Utilizing Earth-Abundant Materials

From handheld gadgets to electric vehicles and renewable energy storage, batteries have become deeply ingrained in our daily lives and industrial applications. As the utilization of batteries experiences a rapid surge, a substantial increase in spent batteries is anticipated in the years ahead. Simultaneously, the burgeoning battery manufacturing sector is poised to trigger resource shortages and price escalations for critical metals such as lithium (Li), cobalt (Co), nickel (Ni), and copper (Cu). Additionally, the improper disposal of used batteries, which yields flammable and toxic waste, poses a significant risk of environmental pollution if not handled with utmost care. Therefore, there is a pressing need to develop efficient technologies for the recycling and reusing of batteries, aiming to recapture valuable materials and alleviate environmental pollution. Furthermore, the pursuit of more sustainable materials, reducing reliance (or even eliminating it) on critical metals, opens up new possibilities for the creation of low-cost, earth-abundant and environmentally friendly energy storage devices and systems. Over the past few years, substantial efforts have been invested in developing improved methods for more efficient battery recycling and sustainable battery chemistries. In this symposium, our goal is to bring together a diverse array of researchers from academia, industry, and government, making it a truly global event with participants invited from around the world. The convergence of researchers on this vital topic has never reached such a pinnacle at this conference, and we aspire to draw renewed attention to it. We firmly believe that this is a rapidly expanding field, and the new direction we are taking will be of widespread interest to attendees.

Topics will include:

- Hydrometallurgical recycling of lithium-ion batteries
- Pyrometallurgical recycling of lithium-ion batteries
- Direct battery recycling
- Materials (cathode, anode, electrolyte) recycling and extraction
- Lithium-ion battery materials supply chain
- AI, Automation, and Recycling
- Polymers for solid-state electrolytes
- Organic active materials
- Polymer binders and separators
- Functional current collectors
- Life Cycle Assessment and technoeconomics of new materials and recycling methods

Invited speakers include:

Zhenan Bao	Stanford University, USA
Illias Belharouak	Oak Ridge National Laboratory, USA
Hye Ryung Byon	Korea Advanced Institute of Science and Technology, Republic of Korea
Kristina Edstrom	Uppsala University, Sweden
Brett Helms	Lawrence Berkeley National Laboratory, USA
Jihyun Hong	Korea Institute of Science and Technology, Republic of Korea
Liangbing Hu	University of Maryland, USA
Yi-Chun Lu Lu	The Chinese University of Hong Kong, Hong Kong
Jodie Lutkenhaus	Texas A&M University, USA
Francesca Pagnanelli	Università di Roma Sapienza, Italy
Jennifer Schaefer	University of Notre Dame, USA
Jeffrey Spangenberger	Argonne National Laboratory, USA
Xiaolei Wang	University of Alberta, Canada
Aiping Yu	University of Waterloo, Canada

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Symposium SU04: Protons in Solids, Fluids and Molecules

Protons are essential lightweight building blocks in all organic materials, the dominating element in universe and basic constituent of water. Protons are intermediates in water splitting, carbon and nitrogen fixation reactions; they are small and can intercalate materials, form bonds with the host and become part of their structure. The proton is an important, yet elusive, ionic charge carrier in electrochemistry and virtually also a hydrogen carrier in proton pumps and hydrogen separation membranes. In nature, proton gradients across membranes serve the photo-induced production of chemical energy in cells, and involved into neuro transmission and cellular communication. Protons are the foundation of a hydrogen economy.

This symposium features the logistics of protons with respect to their importance to energy materials in technology and nature, in experiment and computational modeling: proton conductivity, hydrogen storage, fuel cells, and artificial photosynthesis and synapse networks. The symposium is the discussion platform where engineers and scientists from seemingly unrelated fields may find common ground for the transition from basic science to applied sciences and technology.

In addition to applications and devices, the symposium will include the important and frequently underestimated basic science of the proton hosted in solids; the transition from hydrogen bonding to proton-phonon coupling; and its benign or malign impact on functionality, stability, and integrity of materials. A further aspect is the proton transport in liquids and molecules, because it is important in biological systems including photosynthesis and the metabolism in living cells. Since hydrogen is taking center stage in a future clean and renewable energy technology and economy, we welcome also contributions from industries.

Topics will include:

- Protons in electrocatalysis and photocatalysis
- Ceramic proton conductors
- Polymer proton conductors
- Protons in biological energy conversion and catalysis
- Fuel cells and electrolyzers
- Protons as information carriers for signaling and neurotransmitters
- Molecular dynamics calculation for proton trajectories
- Measuring low and high hydrogen concentrations

Invited speakers include:

Kondo-Francois Aguey-Zinsou	The University of Sydney, Australia
Hyun S. Ahn	Yonsei University, Republic of Korea
Seukheun Choi	Binghamton University, The State University of New York, USA
Huyen Dinh	National Renewable Energy Laboratory, USA
Chuancheng Duan	The University of Utah, USA
Maria A. Gomez	Mount Holyoke College, USA
Shu Hu	Yale University, USA
Mantao Huang	Massachusetts Institute of Technology, USA
Min Hwan Lee	University of California, Merced, USA
Qiyang Lu	Westlake University, China
Igor Lubomirsky	Weizmann Institute of Science, Israel
Jörg Pieper	University of Tartu, Estonia
Alexey Rulev	Empa–Swiss Federal Laboratories for Materials Science and Technology, Switzerland
Noriko Sata	Deutsches Zentrum für Luft- und Raumfahrt e.V., Germany
Sankaranarayanan Subramanian	University of Illinois at Chicago, USA
Massimo Trotta	Consiglio Nazionale delle Ricerche, Italy
Paul Weiss	University of California, Los Angeles, USA
Yoshihiro Yamazaki	Kyushu University, Japan
Arthur Yelon	Polytechnique Montréal, Canada
Bilge Yildiz	Massachusetts Institute of Technology, USA

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Symposium SU05: Materials Innovation for Sustainability and Energy Applications of Critical Elements

Critical elements and minerals are key materials with high risk of supply disruption that are essential to modern technologies, including solar panels, wind turbines, electric vehicles, microelectronics, biomedical imaging, energy-efficient lighting, and so on. These elements, especially lithium (Li), cobalt (Co), rare earth elements (REE), and platinum group elements (PGE), have unique electronic, magnetic, and chemical properties that are difficult to replace. Therefore, a sustained, multidisciplinary effort is urgently needed by integrating scientific research and engineering innovation to develop diverse solutions across the critical materials lifecycle, including separation, materials manufacturing, elemental substitution, and end-of-life recycling. This symposium highlights recent research efforts on separation, substituting, recycling, and materials-efficient manufacturing of critical elements and materials by bridging expertise on theoretical modeling/simulation, materials synthesis, functional measurement/control, and advanced characterizations. The symposium will bring together a diverse group of researchers, both from the materials community and other different communities to discuss the challenges and solutions for a circular economy of critical elements and minerals.

Topics will include:

- Materials and processes for critical element separation
- Reverse osmosis and nanofiltration membranes
- Electrochemical separation and remediation
- Materials for emerging contaminants
- Critical element enabled catalytic processes: materials efficiency and substitution
- Advanced *operando/ex situ* characterization for critical elements in different physical and chemical processes
- Methodological advances in theory, high-throughput computations, and machine-learning/artificial intelligence for predictive modeling and design of critical materials
- Molecular scale understanding of the migration and enrichment of critical materials in the earth's environments (magmatic, hydrothermal, sedimentary, and weathering)
- Life cycle analysis and assessment strategies on critical materials for environmental sustainability and socio-economic viability

Invited speakers include:

Paul Braun	University of Illinois at Urbana-Champaign, USA	**De-en Jiang**	Vanderbilt University, USA
Menachem Elimelech	Yale University, USA	**Young-Shin Jun**	Washington University in St. Louis, USA
Benny Freeman	The University of Texas at Austin, USA	**Valeria Molinero**	The University of Utah, USA
Yoshiko Fujita	Idaho National Laboratory, USA	**Pietro Papa Lopes**	Argonne National Laboratory, USA
Jeffrey Grossman	Massachusetts Institute of Technology, USA	**Eric Schelter**	University of Pennsylvania, USA
Brian Ingram	Argonne National Laboratory, USA	**Michael Whittaker**	Lawrence Berkeley National Laboratory, USA
Santa Jansone-Popova	Oak Ridge National Laboratory, USA		

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Symposium SU06: Degradable Materials and Devices

The degradation of devices is increasingly becoming a critical consideration for the sustainability of devices used outside the body and the functionality of medical devices used inside the body. Degradable medical devices that can be implanted or injected enable new treatment approaches and monitoring concepts without the need for surgery to remove the devices. For devices used outside the body, degradable materials are sought to reduce the accumulation of waste, which is particularly important for waste streams that produce toxic degradation products, exemplified by electronic devices.

This symposium brings together expertise in all areas of degradable materials and devices, including materials discovery, device engineering, and the impact of degradation products in the body or the environment. Devices should have stable functional properties until their function is complete, which can range from days for implantable devices to several years for IoT devices. This has motivated the development of materials that degrade on demand or in specific conditions, such as self-immolative polymers and pH-dependent degradation of nanomaterials. A key question the community is seeking to address is how to achieve performance comparable to traditional devices using degradable materials. Solutions include device optimization and improved understanding of the effect of manufacturing on composites and multilayered materials. As emphasized by increasing awareness of microplastics, understanding the effect of the degradation products will be a critical future challenge. The development of degradable devices will ultimately enable unprecedented capabilities in medical diagnostics and treatments while providing a route towards cost effective and sustainable consumer devices.

Topics will include:

- Chemistry of degradable polymers
- Materials processing to tune degradation
- Performance of degradable composites
- Performance of electronic devices made of degradable materials
- Sensors and actuators made of degradable materials
- Degradable batteries and power sources
- Degradable optical devices
- Degradable environmental sensors
- Degradable devices for medical applications
- Food monitoring degradable packaging
- Degradable wireless antennas and IoT applications
- Impact of degradation products on environmental and biological systems

Invited speakers include:

Matt Becker	Duke University, USA
Michael Dickey	North Carolina State University, USA
Thierry Djenizian	Ecole Des Mines, France
Elizabeth Gillies	University of Western Ontario, Canada
Suk-Won Hwang	Korea University, Republic of Korea
Mihai Irimia-Vladu	Johannes Kepler Universität Linz, Austria
Martin Kaltenbrunner	Johannes Kepler Universität Linz, Austria
Seung-Kyun Kang	Seoul National University, Republic of Korea
Gurvinder Singh Khinda	General Electric Company, USA
Thanh Duc Nguyen	University of Connecticut, USA
Ji-Ho Park	Korea Advanced Institute of Science and Technology, Republic of Korea
Rahim Rahimi	Purdue University, USA
Ritu Raman	Massachusetts Institute of Technology, USA
John Rogers	Northwestern University, USA
Simon Rondeau Gagne	Windsor University, Canada
Michael Sailor	University of California, San Diego, USA
Gregory Whiting	University of Colorado Boulder, USA
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