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Symposium BI01: Energy Justice in Materials Science and Engineering

As the transition from fossil fuels to renewable energy is enabled by materials science discoveries, there is both an opportunity to advance and a responsibility to consider social and energy justice in materials science and engineering research. This symposium will specifically explore the relationship between energy justice and materials research, raising awareness of this topic within the broader materials community. We will consider both the up-stream (supply chain) and down-stream (disposal or recycling) impacts of sustainable energy technologies. Abstracts will be solicited focusing on the implications of energy technologies on societal justice and equity – including batteries, photovoltaics, H_2 and NH_3 production and use, soft materials (e.g., polymers, plastic recycling), catalysis, biotechnology, solar fuels, and clean water – and on the material life cycles – including extraction, processing, manufacturing, and disposal. Within each technological topic, this symposium will cover the impacts of materials research and development with an emphasis on groups that are disproportionately impacted as well as explore the interrelationship between materials science and social inequities such as racism, sexism, and classism. One goal of this symposium is for materials researchers to learn how to think about the social justice implications of our research and how to use social and energy justice concepts to inform R&D.

Topics will include:

- Energy storage, including battery recycling and supply chain
- Clean water and separation membranes
- Photovoltaic technologies, including recycling and toxic materials use
- H_2 and NH_3 production, transport, and use
- Soft materials (e.g. polymers, biotech), including polymer recycling
- Materials supply chain, including extraction, processing, manufacturing, and recycling/disposal
- Catalysis
- Solar and biofuels
- Life cycle assessment

Invited speakers include:

Nikita Dutta	National Renewable Energy Laboratory, USA	**Jeff Reimer**	University of California, Berkeley, USA
Linda Gains	Argonne National Laboratory, USA	**Bethel Tarekegne**	Pacific Northwest National Laboratory, USA
Emma Kendrick	University College London, United Kingdom	**Taylor Uekert**	National Renewable Energy Laboratory, USA
Arumugam Manthiram	The University of Texas at Austin, USA	**Gerald Wang**	Carnegie Mellon University, USA
Karthish Manthiram	California Institute of Technology, USA	**Jennifer Wilcox**	University of Pennsylvania, USA

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Symposium CH01: Advanced Characterization Methods of Energy Material Applications

Nanoscale phenomena at surfaces and interfaces play an essential role in the performance of many renewable energy harvesting and energy storage devices. Rapid advances in experimental techniques (functional scanning probe microscopy, NMR, X-ray diffraction/scattering, electron microscopy, …) are currently enabling the characterization, understanding, and performance optimization of new next generation energy conversion and energy storage materials. This symposium focuses on these experimental advances, and how they are being used in research fields including photovoltaics, batteries, fuel cells, super-capacitors, as well as piezoelectric and thermoelectric energy harvesting materials.

Our aim is to bring together the scientists who develop and use these techniques to characterize energy conversion and storage materials across different application spaces. The symposium should lead to an exchange of knowledge on the properties of energy-related materials, as well as new characterization techniques. In particular, we hope to stimulate the development and dissemination of new methods for the characterization of nanoscale phenomena in energy-related materials. Such methods might include, for example, in operando studies, correlative and multi-modal microscopies, advances in machine learning and automated experimentation, or new modalities such as time-resolved methods of SPM and advanced modes combining nano-mechanical and potentiometric imaging capabilities. We expect that the interdisciplinary nature of this symposium will attract strong participation from both academia and industry in the multidisciplinary environment of MRS meetings.

Topics will include:

- Local performance of solar cells (organic, inorganic and hybrid materials)
- Time resolved EFM/KPFM imaging of the charge carrier dynamics of energy devices
- PiezoForce Microscopy on piezoelectric materials for mechanical energy harvesting flexible devices
- Advanced Scanning Probe Microscopy Modes (Scanning Microwave Impedance Microscopy, Infrared Microscopy, Scanning Capacitance Microscopy, Conductive and Photoconductive AFM, Scanning Electrochemical Microscopy, ...)
- Novel materials for Li-ion batteries (electrodes, …)
- Novel methods for electrochemical characterization of surfaces (for instance in batteries)
- (Photo)degradation of energy materials and devices (solar cells, lithiation/delithiation processes, etc.)
- Solid State NMR
- X-Ray scattering
- Electron microscopy
- Novel methodologies/processes for the data analysis including advanced statistics and machine learning
- Combined multimodal techniques
- Correlative microscopy, image/signal processing, and colocalisation tools

Invited speakers include:

Harald Ade	North Carolina State University, USA
Andrea Centrone	National Institute of Standards and Technology, USA
Raphaele Clement	University of California, Santa Barbara, USA
David Ginger	University of Washington, USA
Naomi Ginsberg	University of California, Berkeley, USA
Georg Gramse	Johannes Kepler Universität Linz, Austria
Benjamin Grevin	Centre National de la Recherche Scientifique, France
Ilka Hermes	Leibniz-Institut für Polymerforschung, Germany
Hyo Jung Kim	Pusan National University, Republic of Korea
Y. Shirley Meng	The University of Chicago, USA
Ellen Moons	Karlstads Universitet, Sweden
Hidenori Nakayama	Mitsubishi Chemical Corporation, Japan
Erin Ratcliff	University of Arizona, USA
Manjunatha Reddy	University of Lille, France
Michael Toney	University of Colorado Boulder, USA
Stefan Weber	Max Planck Institute for Polymer Research, Germany
Peter Zalar	TNO, Netherlands

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Symposium CH02: Advances in *In Situ* TEM Characterization of Dynamic Processes in Materials

In situ transmission electron microscopy (TEM) techniques have emerged as primary tools for characterizing the dynamics of materials formation and transformations. The development of in situ TEM capabilities, such as heating, cooling, biasing, ion irradiation, and mechanical testing, has led to rapid advances in our understanding of crystallization, electrochemical processes, and structure-function relationships in organic, semiconductor, metals, and other systems. The symposium covers a broad range of topics including particle nucleation and growth, phase transformations, and interface dynamics with gases, liquids, and solids. This symposium aims to provide a platform for discussion to understand the physical and chemical processes governing the dynamic process of behavior under different external stimuli using in-situ TEM, as well as computer-aided image analysis and data processing, e.g. artificial intelligence (AI) algorithms.

Topics will include:

- Nucleation and crystal growth from solutions, melts, and vapors
- Chemical and electrochemical reactions
- Particle self-assembly processes
- Phase transformation and dynamic process using heating, cooling, ion irradiation, mechanical testing
- Advancement in specialized holders and electron microscopes and practical challenges for in-situ microscopy of phase (trans)formation and chemical reactions (including corrosion)
- Integration of big data-driven image analysis (machine learning and AI) with in-situ TEM for quantitative studies
- Interface-driven processes and interface dynamics in gases and liquids
- Mechanically, electrically, or magnetically driven processes

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

Invited speakers include:

Qian Chen	University of Illinois at Urbana-Champaign, USA	**Xiaoqing Pan**	University of California, Irvine, USA
Yi Cui	Stanford University, USA	**Jungwon Park**	Seoul National University, Republic of Korea
James De Yoreo	Pacific Northwest National Laboratory, USA	**Vesna Srot**	Max Planck Institute for Solid State Research, Germany
Arnaud Demortiere	Centre National de la Recherche Scientifique, France	**Mitra Taheri**	Johns Hopkins University, USA
Xiaodong Han	Beijing University of Technology, China	**Yao Yang**	Cornell University, USA
Yu Han	King Abdullah University of Science and Technology, Saudi Arabia	**Qian Yu**	Zhejiang University, China
Andy Minor	Lawrence Berkeley National Laboratory, USA	**Haimei Zheng**	Lawrence Berkeley National Laboratory, USA

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Symposium CH03: Nanoscale Materials Characterization Through Atom Probe Tomography

Atom probe tomography (APT) is an increasingly important emergent materials characterization technique for quantitative nanoscale analysis within many fields of study. APT is currently the only characterization technique able to provide near-atomic-resolution, three-dimensional, chemically resolved images with sensitivity approaching 10s of ppm. While APT was initially limited to predominantly electrically conductive materials - such as metals - advances in instrument design, computers software and hardware, site-specific sample preparation techniques, and data analysis methods have facilitated a rapid expansion in the use of the technique to other application areas. A few examples are energy generation and storage, catalysis, geology, biomaterials, superconductors, and semiconductors. The symposium will broadly cover topics relating to nanoscale materials characterization through APT. Areas of interest include, but are not limited to, current and emerging research in the following areas: engineered and functional materials, natural materials, and materials applications; data analytics, computational techniques, and software developments; correlative and complementary analysis techniques; bridging the gaps between basic science and industrial applications; and instrument development.

Topics will include:

- APT characterization of metals including high entropy alloys, nuclear materials, high heterogeneity materials, and nanocrystalline materials
- APT for semiconducting materials for microelectronics, power electronics, and optoelectronics applications
- APT characterization of energy materials including solar cells, fuel cells, batteries, and thermoelectric materials
- APT for catalytic materials including zeolites, nanoparticles, and core-shell structures
- Pioneering in APT for novel material analysis
- Advanced data analytics, machine learning, and data standardization
- Correlative APT analysis with other microscopies
- Integration of APT data and atomic simulations
- Hardware advances in APT
- Cryo/Vacuum transfer for sensitive materials such as solid-liquid interfaces and biological materials

Invited speakers include:

Andrew Breen	The University of Sydney, Australia	**Elizabeth Kautz**	North Carolina State University, USA
Michele Conroy	Imperial College London, United Kingdom	**Alberto Perez-Huerta**	University of Alabama, USA
Alec Day	Steam Instruments, USA	**Konda Gokuldoss Pradeep**	Indian Institute Of Technology Madras, India
Arun Devaraj	Pacific Northwest National Laboratory, USA	**Katherine Rice**	AMETEK, Inc., USA
Peter Felfer	Friedrich-Alexander-Universität Erlangen-Nürnbergangen-Nürnberg, Germany	**Lorenzo Rigutti**	University of Rouen Normandie, France
Derk Joester	Northwestern University, USA	**Xuyang Zhou**	Max-Planck-Institut fuer Eisenforschung GmbH, Germany

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Symposium CH04: Emerging Electron Microscopy Techniques to Understand Structure-Property Relationship in Quantum Materials

Aberration-corrected (scanning) transmission electron microscopy (S/TEM) is one of the most versatile experimental techniques to explore the atomic scale structure-property relationships. Recent advancements in direct electron detectors, monochromators, cryo-holders and sophisticated data analysis techniques have enabled atomic-scale characterization of sensitive physical properties in quantum materials such as local strain ,electric field, magnetic field, and correlated electronic states. Such measurements are critical for designing artificial systems for quantum information science and engineering. The symposium proposed here will focus on advancement in electron microscopy techniques to characterize quantum materials, including novel data collection methods, advancement in holders, detectors, stages and analysis in hyperspectral data sets, such as spectrum images and four-dimensional STEM. Abstracts will be solicited from (but not limited to) studies of the local crystalline structure, strain fields, polarization, electric/magnetic fields, electronic band structure, quantum confined bosonic states in different types of materials such as ferroics, two-dimensional materials and correlated oxides under electric biasing and cryogenic temperature conditions. Abstracts based on the novel design of holders, spectrometers and data processing will be especially encouraged.

Topics will include:

- Applications of electron microscopy to characterize topological materials, ferroics and two-dimensional materials
- Nano-diffraction for strain and domain boundary mapping
- 4D-STEM ptychography foy unravelling electric and magnetic fields
- Applications of low EELS and cathodoluminescence to image hybrid light-matter interactions and correlated electronic excitations such as phonons, excitons, polaritons and plasmons
- Applications of cryo-analytical electron microscopy techniques to understand low-temperature structural and electronic phase transitions.
- Novel cryo-electron microscopy holders, data collection and analysis methods
- Machine Learning Methods

Invited speakers include:

Michele Conroy	Imperial College London, United Kingdom
Ondrej Dyck	Oak Ridge National Laboratory, USA
Joanne Etheridge	Monash University, Australia
Berit Goodge	Max Planck Institute for Chemical Physics of Solids, Germany
Jordan Hachtel	Oak Ridge National Laboratory, USA
Demie Kepaptsoglou	University of York, United Kingdom
Maureen J. Lagos	Mc Master University, Canada
James Lebeau	Massachusetts Institute of Technology, USA
Barnaby Levin	Direct Electron, USA
Yung-Chang Lin	National Institute of Advanced Industrial Science and Technology, Japan
Tracy Lovejoy	NION Company, USA
Ana M Sanchez	University of Warwick, United Kingdom
Sophie Meuret	Centre d'Élaboration de Matériaux et d'Etudes Structurales, France
Christian Monachon	Attolight AG, Switzerland
David Muller	Cornell University, USA
Colin Ophus	Lawrence Berkeley National Laboratory, USA
Phillip Pelz	Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany
Jan Ringnalda	Thermo Fisher Scientific, USA
Claus Ropers	Max Planck Institute for Multidisciplinary Sciences, Germany
Mary Scott	University of California, Berkeley, USA
Eren Suyolcu	Max Planck Institute for Solid State Research, Germany
Ray Twesten	AMETEK, Inc., USA
Jo Verbeeck	University of Antwerp, Belgium
Steffi Woo	Université Paris-Saclay, France
Xiuzhen Yu	RIKEN, Japan
Yimei Zhu	Brookhaven National Laboratory, USA
Jian-Min Zuo	University of Illinois at Urbana-Champaign, USA

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Symposium DS01: Accelerating Materials Research with AI-Assisted Experimentation

This symposium will bring together researchers from disparate facets of materials research who are interested in how to use artificial intelligence to perform experiments more rapidly, algorithmically select intelligents more effectively, and overall accelerate the development of new materials. There are now numerous examples of how artificial intelligence can accelerate experimental materials research. These include data mining from the literature to identify promising regimes, the fusion of theory and experiment, and robotic research systems that are guided by active learning. While the materials systems to which these have been applied are as varied as the materials research community itself, there are many common methods, successes, challenges, and opportunities that transcend individual materials systems. For instance, a common theme is to render experimental research processes closed-loop such that subsequent experiments are chosen based on all available information. Advances have been made in expanding the loop to encompass more data and data from varied sources. Furthermore, efforts have been made to convert autonomous experimental systems into fully self-driving laboratories in which artificial intelligence is used to assist the process end-to-end. Additionally, there are advances, and opportunities for further advancement, in the development of modular and transferable hardware platforms to allow such advanced experimental systems to be more rapidly and easily adopted. Such advances have also highlighted research into the evolving role of the human in the human-machine partnership embodied by autonomous experimentational systems. This symposium aims to capture the state-of-the-art in these areas and bring a community of researchers together to advance experimental materials science using artificial intelligence.

Topics will include:

- Materials discoveries made using autonomous research systems
- Comparisons of conventional high-throughput experimentation and active learning
- Benchmarking methods for quantifying efficacy of active learning methods
- Generality vs. specificity in terms of experimental platform development, including hardware, software, and ontologies
- Virtues and limitations of Bayesian optimization and comparisons between decision-making policies/surrogate models
- Uncertainty quantification and propagation for machine learning modeling of physical process
- Automated physical modeling and scientific learning
- Automatable infrastructure including hardware/software and distributed systems
- Modularity in hardware for autonomous and high-throughput experimentation
- Human-Machine partnering in materials research including visualization tools for active learning
- Open source software and hardware for rapid integration and adaptation
- Limitations of Gaussian Processes in describing materials systems
- Transfer learning, multiple-information source optimization, and contributions from simulation
- Strategies for data-fusion

Invited speakers include:

Peter Beaucage	National Institute of Standards and Technology, USA
Tonio Buonassisi	Massachusetts Institute of Technology, USA
Curtis Burlingette	University of British Columbia, Canada
Gerbrand Ceder	University of California, Berkeley, USA
Lee Cronin	University of Glasgow, United Kingdom
John Gregoire	California Institute of Technology, USA
Jason Hein	University of British Columbia, Canada
Kedar Hippalgaonkar	Nanyang Technological University, Singapore
A. Gilad Kusne	National Institute of Standards and Technology, USA
Jay Hyung Lee	Korea Advanced Institute of Science and Technology, Republic of Korea
Marina Leite	University of California, Davis, USA
Jiong Lu	National University of Signapore, Singapore
Benji Maruyama	Air Force Research Laboratory, USA
Marcus Noack	Lawrence Berkeley National Laboratory, USA
Jae-Hattrick Simpers	University of Toronto, Canada
Helge Stein	Karlsruhe Institute of Technology, Germany
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Symposium DS02: Automated Experimentation with Synchrotrons, Neutrons and Microscopes

The evolution of physical instrumentation from synchrotron and neutron sources to electron and scanning probe microscopes over the last three decades has revolutionized areas of science ranging from materials and condensed matter physics to chemistry and biochemistry. However, the search for material functionalities using these facilities has, until now, been based on human operators to identify objects of interest and operation. The rapid development of machine learning in the last decade makes it possible to analyze high-dimensional data and control microscopy, synchrotron, and neutron facilities with machine learning methods, a paradigm shift toward automated characterization of materials. Automated experimentation combines the power of machine learning and advanced characterization facilities to explore materials in a higher-throughput, more standardizable, and informed manner, allowing us to better understand traditionally complex concepts in physics. With these developments, we are able to perform many measurements without human intervention and accelerate the discovery process of new physics.

The symposium covers a range of topics related to microscopies, neutrons, and synchrotrons including the development of automated experiments, application of machine learning methods in microscope and diffraction data analysis, development of algorithms for physical science, etc. The goal of this symposium is to bring together researchers across the material science and machine learning communities to foster and accelerate the development of novel techniques for society.

Topics will include:

- Machine learning-driven automated experimentation in microscopy, neutron scattering, and synchrotron sources
- Autonomous experimentation for materials development
- Data-driven discovery and design of materials
- Data-driven modeling, analysis, and control in physical science
- Computer assistance and automation for materials characterization
- Image analysis and pattern recognition methods
- Machine learning models for materials characterization
- Algorithms for diffraction and imaging data

Invited speakers include:

Keith Brown	Boston University, USA
Ivano E. Castelli	Technical University of Denmark, Denmark
Sang-Joon Cho	Park Systems, Republic of Korea
Jeffrey Donatelli	Lawrence Berkeley National Laboratory, USA
Sijia Dong	Northeastern University, USA
Adam Foster	Aalto University, Finland
Ayana Ghosh	Oak Ridge National Laboratory, USA
Sang Soo Han	Korea Institute of Science and Technology, Republic of Korea
Sergei Kalinin	The University of Tennessee, Knoxville, USA
Young-Min Kim	Sungkyunkwan University, Republic of Korea
James Lebeau	Massachusetts Institute of Technology, USA
Mingda Li	Massachusetts Institute of Technology, USA
Yijin Liu	SLAC National Accelerator Laboratory, USA
Sandrine Lyonnard	Commissariat à l'énergie atomique et aux énergies alternatives, France
Klaus-Robert Müller	Technische Universität Berlin, Germany
Colin Ophus	Lawrence Berkeley National Laboratory, USA
Jenna Pope	Pacific Northwest National Laboratory, USA
Rama Vasudevan	Oak Ridge National Laboratory, USA
Robert A. Wolkow	University of Alberta, Canada
Iryna Zenyuk	University of California, Irvine, USA
Maxim Ziatdinov	Oak Ridge National Laboratory, USA

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Symposium DS03: Emerging Challenges and Opportunities in Materials by Design

This symposium will cover the challenges and emerging opportunities in machine learning for materials design. Given the exponential growth of this field in the past few years, this symposium will provide a forum for the community to evaluate and discuss the grand challenges and opportunities in methods and algorithms for data-driven materials design. Topics of discussion will include problems for which existing methods fail or remain inadequate, and areas of materials by design that have not been addressed to date. These grand challenges will be considered both from the perspective of methodology and applications. Core topics will include emerging technologies such as human-out-of-the-loop design, application-driven design, forward and inverse design from atoms to devices for healthcare, energy, quantum computing and other applications, and data-centric design, including advances in digital transformation in academia and industry. Emphasis will be placed also on methods for bridging both time and length scales in the design process.

Topics will include:

- Data-driven inverse design of materials and molecules
- Novel machine learning methods for materials research
- Feature representations including dimensionality reduction and topological descriptors
- Knowledge extraction and model interpretability
- Approaches to bridging length and time scales to enable atomic to microscale and realistic time scale simulations
- Approaches to handling data scarcity in physical sciences, including transfer and active learning, multi-fidelity models etc.
- Data management and creation of databases, including infrastructure, data standardization, and FAIR principles
- Addressing application-specific materials design challenges
- Application of machine learning methods to discover and design functional and structural materials.

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

Invited speakers include:

Niaz Abdolrahim	University of Rochester, USA	**Yousung Jung**	Seoul National University, Republic of Korea
Sneha Akhade	Lawrence Livermore National Laboratory, USA	**Heather Kulik**	Massachusetts Institute of Technology, USA
Simon Billinge	Columbia University, USA	**Rebecca Lindsey**	University of Michigan, USA
Tonio Buonassisi	Massachusetts Institute of Technology, USA	**Elsa Olivetti**	Massachusetts Institute of Technology, USA
Maria Chan	Argonne National Laboratory, USA	**Shyue Ping Ong**	University of California, San Diego, USA
Aurora Clark	University of Utah, USA	**Ghanshyam Pilania**	Los Alamos National Laboratory, USA
Ekin Dogus Cubuk	Google Brain, USA	**Mary Scott**	University of California, Berkeley, USA
Volker Deringer	University of Oxford, United Kingdom	**Kristen Severson**	Microsoft Research, USA
Claudia Draxl	Humboldt-Universität zu Berlin, Germany	**Taylor Sparks**	University of Utah, USA
Amir Barati Farimani	Carnegie Mellon University, USA	**Koji Tsuda**	University of Tokyo, Japan
Ayana Ghosh	Oak Ridge National Laboratory, USA	**Aron Walsh**	Imperial College London, United Kingdom
Anna Hiszpanski	Lawrence Livermore National Laboratory, USA	**James Warren**	National Institute of Standards and Technology, USA

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Symposium DS04: Accelerating Data-Driven Materials Research for Energy Applications

High-throughput experimentation (HTE), computation, data science, artificial intelligence (AI), and the tight integration of these fields have resulted in significant progress in accelerating the discovery and optimization of novel materials for clean-energy technologies to meet 2050 decarbonisation targets. More recently, autonomous materials discovery has been demonstrated by integrating these approaches into a holistic closed-loop approach to perform adaptive optimization and identify physical insights into material behavior. Meanwhile, some initiatives, such as Materials Genome Initiative, the Joint Center for Energy Storage Research, the Battery500 Consortium, the Battery 2030+, and the Acceleration Consortium have made significant advances in materials research by enabling effective collaboration between academia and industry. The ability of data-driven materials research to provide useful tools for scientific discovery and optimization has been demonstrated. However, the application of a data-driven research method to complex materials systems has specific hurdles, such as a lack of large-scale and high-quality datasets, appropriate algorithms, and the development of accurate/reliable prediction models. Global collaboration and continuing advancement in all these fields are essential to addressing these problems for next-generation clean energy technologies. This symposium will provide a platform for materials scientists, computational scientists, data scientists, and automation/robot experts to present their recent progress in accelerated materials discovery based on a data-driven research approach. The development of high-throughput experimental and computational methodologies, automation technologies, AI and related techniques, as well as their integration for autonomous materials discovery and optimization, will be covered. The topical list of this symposium is intended to cover a diverse range of data-driven materials discovery and development.

Topics will include:

- High-throughput experimental and computational approaches to novel materials discovery
- Automation platforms and workflows in the field of energy materials research and development
- AI/ML in materials science
- High-throughput data generation and management
- High-Throughput Virtual Screening (HTVS)
- AI-Powered Inverse Molecular Design
- ML assisted molecular simulations
- Uncertainty quantification, prior formation, and Bayesian methods in materials research

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

Invited speakers include:

Richard Braatz	Massachusetts Institute of Technology, USA
William Chueh	Stanford University, USA
Dominik Dworschak	Forschungszentrum Jülich GmbH, Germany
Roman Garnett	Washington University in St. Louis, USA
Grant Gavranovic	Unchained Labs, USA
John Gregoire	California Institute of Technology, USA
Jason Hein	University of British Columbia, Canada
Heather Kulik	Massachusetts Institute of Technology, USA
Alfred Ludwig	Ruhr-Universität Bochum, Germany
Benji Maruyama	Air Force Research Laboratory, USA
Elsa Olivetti	Massachusetts Institute of Technology, USA
Kristin Persson	Lawrence Berkeley National Laboratory, USA

Dierk Raabe	Max-Planck-Institut für Eisenforschung GmbH, Germany
Matthias Scheffler	Fritz Haber Institute of the Max Planck Society, Germany
Taylor Sparks	The University of Utah, USA
Shijing Sun	Toyota Research Institute, USA
Rajeev Surendran	Argonne National Laboratory, USA
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Symposium DS05: Polymer Informatics—Polymer Research with Classical and Data-Driven Informatics

Today's grand challenges of the polymer community are to improve polymer technologies and deployment faster and more cost efficient than before. Design and discovery strategies of the nascent field of polymer informatics are instrumental to overcome this challenge. Big data and classical modeling are only beginning to impact polymer research and industry but have shown that they act as the shining beacon for many future discoveries.

This symposium focuses on innovative methods for polymer data generation, data curation, knowledge discovery, property predictions, and intelligent design as well as synthesis for pure polymers, polymer blends, and formulations. The purpose of this symposium is to bring together materials scientists/engineers, chemists, physicists, and computer scientists across academia and industry to discuss current and future informatics efforts that advance polymer research. The scope of the discussion includes state-of-the-art methods, recent progress, and cutting edge approaches in classical and data-driven informatics. Potential classical methods include but are not limited to numerical approaches for differential equations, monte carlo simulations, molecular dynamics, and density functional theory. Data-driven approaches include all machine learning methods ranging from more traditional methods such as kernel ridgid, gaussian processes, and random forests to sophisticated neural networks architectures such as variational autoencoder, transformers, physics- or chemistry-informed models, or reinforcement learning.

Topics will include:

- Strategies for polymer chemical space exploration
- Polymer representations (fingerprints or descriptors) for informatics-based method
- High-throughput screening and experiments
- Length and time scale bridging with informatics
- Knowledge discovery and rule mining
- Numerical methods and algorithms for efficient data mining
- Prediction strategies using machine learning
- Uncertainty quantification
- Advanced machine learning methods
- Data extraction, organization and sharing
- Synthesis planning
- Autonomous polymer design
- Novel/Faster methods to compute polymer properties
- Active learning and polymer discovery

Invited speakers include:

Andrea Browning	Schrödinger, LLC., USA, USA	**Tyler Martin**	National Institute of Standards and Technology, USA
Adam Gormley	Rutgers University, USA	**Rampi Ramprasad**	Georgia Institute of Technology, USA
Kurt Kremer	Max Planck Institute for Polymer Research, Germany	**Antonia Statt**	University of Illinois at Urbana-Champaign, USA

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Symposium DS06: Integrating Machine Learning with Simulations for Accelerated Materials Modeling

The advent of high-speed computation has significantly accelerated the materials modeling and simulation paradigm in the past few decades. These simulations cover wide length-and time-scales using ab-initio first principle, atomistic, mesoscale, and continuum simulations. Despite the economical nature of these simulations in comparison to experiments, they still suffer from the major deficiencies, namely, limitations on the systems size, simulation time, accuracy of simulations, transferability of a simulation to different scenarios, to name a few. For example, while first principle simulations can provide accurate predictions on the material response to the electronic level, they are limited to a few hundreds of atoms. Recently, machine learning has shown promising means to address some of these challenges successfully. Some of these developments include machine-learned interatomic potentials, physics-informed neural networks, convolutional neural network based microstructure modeling, and graph neural networks for structure–property correlations. This symposium will highlight the latest development in machine learning for materials simulations with specific focus in three major areas: (i) supporting and accelerating simulations using machine learning (for example, machine learned potentials), (ii) interpreting and decoding simulations and high-throughput data using machine learning, (iii) replacing traditional differential equation-based simulations with machine-learned simulations.

Topics will include:

- Development of machine learned inter-atomic potentials
- Physics-informed machine learning models for materials simulation
- Graph neural networks for material modeling
- Development of realistic material models using image processing
- Transfer learning for materials modeling
- Topology optimization using machine learning
- Reduced order machine learning models for atomistic simulations
- Development of tailored microstructure using machine learning
- Machine learning for continuum simulations
- Using natural language processing for materials modeling
- Accelerating large scale simulations
- Active learning-based hybrid simulations
- Inferring materials response through machine learning models

Invited speakers include:

Pinar Acar	Virginia Tech, USA	**Binquan Luan**	IBM T.J. Watson Research Center,, USA
L. Catherine Brinson	Duke University, USA	**Shyue Ping Ong**	University of California, San Diego, USA
Kamal Choudhary	National Institute of Standards and Technology, USA	**Kiran Sasikumar**	Avant-garde Materials Simulation, Germany
Alexander Hartmaier	Ruhr-Universität Bochum, Germany	**Tess Smidt**	Massachusetts Institute of Technology, USA
Olexandr Isayev	Carnegie Mellon University, USA	**Rama Vasudevan**	Oak Ridge National Laboratory, USA

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Symposium EL01: Defects and Strain in Two-Dimensional Materials

Strain and defects often modulate the physical properties of materials and devices, offering the potential to engineer materials to achieve improved functionality. 2D materials are particularly exciting materials for strain-engineering because of their high elastic strain limit and their atomic-scale thickness, which opens many avenues for efficient strain-engineering, even at the nanometer-scale. 2D materials are also a promising canvas for defect-engineering because their atomic-scale thickness makes precise positioning of defects tractable due to the confined third dimension. In addition to modifying the properties of individual 2D material monolayers, strain and defects can play an important role in governing interfacial behavior between 2D material layers and between a 2D material and the environment. Therefore, strain and defects are critical aspects of 2D materials that are important to understand for future technological applications using these materials. This symposium will cover a broad range of topics dealing with strain and defects in 2D materials, including fundamental experimental and theoretical investigations of strain-property and defect-property relationships and applications of strain- and defect-engineered 2D materials in clean energy, health sensing, quantum technologies, etc.

Topics will include:

- Impact of strain and defects on thermal, electronic, optical, and magnetic properties of 2D materials
- Methods for strain characterization in 2D materials
- Strain-induced phase change in 2D materials
- Impact of strain and defects on 2D material single photon emitters
- Moiré patterns and atomic reconstruction in 2D heterostructures
- Topological phase transitions in strained 2D materials
- Devices leveraging strain tunability in 2D materials
- Emerging applications of defect- and strain-engineered 2D materials for clean energy, advanced health care, quantum systems, etc.
- Straintronics - Engineering 2D electronics through strain

Invited speakers include:

Jiun-Haw Chu	University of Washington, USA
Hui Deng	University of Michigan, USA
Madan Dubey	U.S. Army Research Laboratory, USA
Andrea C. Ferrari	University of Cambridge, United Kingdom
Laura Fumagalli	The University of Manchester, United Kingdom
Nicholas Glavin	Air Force Research Laboratory, USA
Wanlin Guo	Nanjing University of Aeronautics and Astronautics, China
Christopher Gutierrez	University of California, Los Angeles, USA
James Hone	Columbia University, USA
Han Htoon	Los Alamos National Laboratory, USA
Pinshane Huang	University of Illinois at Urbana-Champaign, USA
Moon-Ho Jo	Pohang University of Science and Technology, Republic of Korea
Berend Jonker	U.S. Naval Research Laboratory, USA
Chung Ning (Jeanie) Lau	The Ohio State University, USA
Ju Li	Massachusetts Institute of Technology, USA
Nanshu Lu	The University of Texas at Austin, USA
Galan Moody	University of California, Santa Barbara, USA
Ruth Pachter	Air Force Research Laboratory, USA
Johanna Palmstrom	Los Alamos National Laboratory, USA
Jong Hyun Park	LG, Republic of Korea
Tereza Porozova	HeXalayer, LLC, USA
Jürgen Rabe	Humboldt-Universität zu Berlin, Germany
Stephan Roche	Institut Català de Nanociència i Nanotecnologia, Spain
Arend van der Zande	University of Illinois at Urbana-Champaign, USA
Xiaojia Wang	The University of Minnesota, USA
Nai-Chang Yeh	California Institute of Technology, USA
Guangyu Zhang	Key Laboratory of Extreme Conditions Physics, Institute of Physics, Chinese Academy of Sciences, China
Yichao Zhang	University of Illinois at Urbana-Champaign, USA
Yuanbo Zhang	Fudan University, China
Xiaolin Zheng	Stanford University, USA

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Symposium EL02: Emerging Ultrafast Optical and Structural Probes in Materials Science

Time-resolved spectroscopies provide material scientists with high temporal resolution to characterize physical processes in a variety of complex and emerging materials, ranging from semiconductors and dielectrics to metals and superconductors. Recent advances in pulsed laser technologies have enabled ultrafast probes to explore a wide energy range from deep ultraviolet to the mid-infrared and terahertz, resulting in new perspectives of material characteristics that encompass optical, electronic, magnetic, thermal, and structural properties. The fundamental knowledge is further expanded to high spatial resolution via innovative microscopies and tip-based techniques coupled with ultrafast lasers. These emerging experimental methods are fueling many technologically and fundamentally relevant discoveries in various systems, including those which constitute biological matter, quantum materials, and materials for energy conversion and storage. Moreover, recent developments in pulsed X-ray and electron sources have further enabled material scientists to track the dynamic structural evolution under ultrafast photoexcitation, to reveal and access metastable material phases with unconventional structure-property relationships. This symposium brings together a unique and diverse set of ultrafast spectroscopies (e.g., optical, terahertz, X-ray, electron beam, quantum metrology) and material scientists to converge established and emerging techniques and to explore novel approaches to solve grand material science problems in quantum and energy sciences.

Topics will include:

- Ultrafast photo-excited charge carrier dynamics and mobility of materials examined by time-resolved, spatiotemporal optical probes (i.e., transient microscopy and imaging, tip-based transient infrared and terahertz spectroscopy) applied to solar energy, optoelectronic and quantum materials
- Energy and charge transfer processes and many-body physics in materials (nanocrystals, organic semiconductors, 2D materials, heterostructures, halide perovskites, epitaxial semiconductors) and at material interfaces probed by multi-dimensional and nonlinear optical spectroscopies
- Dynamics of photo-induced behaviors and phase transformations probed by time-resolved optical, X-ray absorption/diffraction and electron diffraction techniques applied to energy and quantum materials
- Defect physics, electron-phonon interactions and hot carrier effects in light-absorbing, light-emitting, plasmonic, and photonic materials probed by transient absorption and time-resolved photoluminescence spectroscopies
- Charge transfer and collection in heterostructures of mixed-dimensional nanomaterials and heterostructures
- Combination of time-resolved optical and electrical probes (e.g., spatiotemporal conductivity mapping)
- Understanding charge carrier transport, charge transfer and charge collection in emerging materials (e.g. electrically conductive metal-organic or covalent organic frameworks, MXenes, two-dimensional heterostructures, mixed-dimensional nanomaterials, nanowires) with contact-free time-domain optical spectroscopy (terahertz, mid-infrared)
- Ultrafast opto-electronic probes applied to functional devices or materials under perturbations (magnetic, electrical or pressure)
- Quantum-enhanced nonlinear spectroscopy

Joint sessions are being considered with **QT02 - Space, Energy and Time-Resolved Spectroscopies for Emergent Quantum 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 September.

Invited speakers include:

Andrea Cavalleri	Max Planck Institute for the Structure and Dynamics of Matter, Germany
Alexey Chernikov	University of Regensburg, Germany
David Flannigan	University of Minnesota, USA
Renee Frontiera	University of Minnesota, USA
Naomi Ginsberg	University of California, Berkeley, USA
Laura Herz	University of Oxford, United Kingdom
Libai Huang	Purdue University, USA
Rupert Huber	University of Regensburg, Germany
Henrik Lemke	Paul Scherrer Institute, Switzerland
Aaron Lindenberg	Stanford University, USA
Rebecca Milot	University of Warwick, United Kingdom
Omar Mohammed	King Abdullah University of Science and Technology, Saudi Arabia
Keith Nelson	Massachusetts Institute of Technology, USA
Akshay Rao	University of Cambridge, United Kingdom
Markus Raschke	University of Colorado Boulder, USA
Carlos Silva	Georgia Institute of Technology, USA
Brad Siwick	McGill University, Canada
Julia Stahler	Humboldt-Universtät zu Berlin, Germany
William Tisdale	Massachusetts Institute of Technology, USA
Xiaoyi Zhang	Argonne National Laboratory, USA
Shuyun Zhou	Tsinghua University, China
Xiaoyang Zhu	Columbia University, USA
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Symposium EL03: Ferroic Materials and Heterostructures

Recent progress in the synthesis of ferroic and heterostructures has led to new application paradigms for beyond-CMOS computing schemes. Further, non-trivial structures and the possible interplay between charge, spin, lattice, and orbital degrees of freedom in strongly correlated systems leads to a wide range of quantum phenomena not observed in conventional semiconducting compounds. These include polar order, magnetoelectricity, and systems with multiple complex order parameters (multiferroics as an example). Further, recent advances in synthesis have enabled the tailoring of symmetry and competing interactions to yield topologically non-trivial electronic and magnetic structures. The significant advancements in the area have generated world-wide excitement and a realization that deeper understanding, rational design, and control of the ferroic behavior of materials is necessary for efficient, scalable, and quantum information and communication technologies.

This symposium largely focuses on ferroics and related boundaries and textures rather than excitations. Albeit abstracts that investigate switching kinetics and dynamics in these systems are encouraged. For the materials synthesis, a particular focus will be placed on the growth of controlled 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 ferroic order with strain, interfaces, defects, disorder and scaling/dimension, spectroscopic and time-domain measurements of ferroic behavior. The topical list for this symposium reflects the needs and challenges towards the enhancement and control of trivial and non-trivial ferroic order in materials. Invited speakers will span the breadth of these interdisciplinary topics to accelerate fundamental understanding for the realization of unprecedented physical properties.

Topics will include:

- Magnetic, multiferroic, and magnetoelectric materials
- Heterostructures of, and interfaces in, thin films
- Ferroelectrics and antiferroelectric materials for devices
- Domain-wall nanoelectronics
- Topological textures in magnetic and polar materials
- Two-dimensional and freestanding functional materials and thin films
- Theory of polar textures and switching
- Device demonstration and integration

Joint sessions are being considered with **QT03 - Higher-Order Topological Structures in Real Space—From Charge to Spin**.

Invited speakers include:

Laurent Bellaiche	University of Arkansas, USA	**Dennis Meier**	Norwegian University of Science and Technology, Norway
Manuel Bibes	Centre National de la Recherche Scientifique, France	**Tianxiang Nan**	Tsinghua University, China
Felix Cassanova	CIC nanoGUNE, Spain	**Olga Ovchinnikova**	Oak Ridge National Laboratory, USA
Michele Conroy	Imperial College London, United Kingdom	**Silvia Picozzi**	Consiglio Nazionale delle Ricerche, Italy
Catherine Dubourdieu	Helmholtz-Zentrum Berlin, Germany	**John Plombon**	Intel, USA
Manfred Fiebig	ETH Zürich, Switzerland	**Ramamoorthy Ramesh**	University of California, Berkeley, USA
Eric Fullerton	University of California, San Diego, USA	**Caroline Ross**	Massachusetts Institute of Technology, USA
Megan Holtz	Colorado School of Mines, USA	**Tiffany Santos**	Western Digital Corporation, USA
Bharat Jalan	University of Minnesota, USA	**Nagarajan Valanoor**	University of New South Wales, Australia
Asif Khan	Georgia Institute of Technology, USA	**Ruijuan Xu**	North Carolina State University, USA
Lane Martin	University of California, Berkeley, USA	**Di Yi**	Tsinghua University, China

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Symposium EL04: Materials and Devices for Neuromorphic Electronics and Bio-interfaces

Development of materials, devices and systems that can intelligently and dynamically interface with biology are becoming increasingly important in designing biosensors and neuromorphic electronics. This symposium aims to find the common intersection of several topics some of which are already covered in separate sections at MRS. It is becoming well-known that traditional computing systems are unable to capture the efficiency of the brain in information processing. The computational primitives of biological neural networks on device and circuit level are the first step towards efficient neuromorphic computing systems that are able to analyze, interpret, perceive and act upon a dynamic, real-world environment. Thus, a new era of smart sensor and actuation applications is emerging with systems that perceive and interact with the world and efficiently couple with biological environments. Nevertheless, such intelligent agents also require novel algorithmic support in a co-design fabric. Allowing actual biological substrates to compute is an even longer-term approach to directly harness the biological level of computational efficiency.

In this symposium, the latest advancements of inorganic and organic materials for bio-inspired information processing bio-computation and biosensing will be covered. Emerging applications will be showcased in neuromorphic computing, sensing, actuation and nano-scale bio-interfacing along with recent advancements in algorithmic development. This symposium aspires to bring together world-wide experts in the fields of neuromorphic computing, bioelectronics and neuroscience in order to enhance transdisciplinary interactions and thus bridge the gaps between materials science, computing and neuroscience by initiating a dialogue around the proposed emerging topic.

Topics will include:

- Bio-inspired information processing
- Adaptive bio-interfacing
- Neural interface devices
- Memristive materials / devices at the interface with biology
- Nano-bioelectronics
- Systems neuroscience
- Algorithmic advances for neuro-inspired computing and smart sensing
- Algorithm-hardware co-design for neuro-inspired computing

Invited speakers include:

Fabio Biscarini	University of Modena, Italy	**Jennifer Rupp**	Massachusetts Institute of Technology, USA
Monica Burriel	Imperial College London, United Kingdom	**Alberto Salleo**	Stanford University, USA
Bianxiao Cui	Stanford University, USA	**Xenofon Strakosas**	Linköping University, Sweden
Shadi Dayeh	University of California, San Diego, USA	**Benjamin Tee**	National University of Singapore, Singapore
Regina Dittmann	Forschungszentrum Jülich GmbH, Germany	**Kazuya Terabe**	National Institute for Materials Science, Japan
Julie Grollier	Centre National de la Recherche Scientifique, France	**Fabrizio Torricelli**	Università degli Studi di Brescia, Italy
Daniele Ielmini	Politecnico di Milano, Italy	**Ioulia Tzouvadaki**	Ghent University, Belgium
Seyoung Kim	Colby College, USA	**Yoeri van de Burgt**	Eindhoven University of Technology, Netherlands
Duygu Kuzum	University of California, San Diego, USA	**Sheng Xu**	University of California, San Diego, USA
Andreas Offenhaeusser	Forschungszentrum Jülich GmbH, Germany	**Bilge Yildiz**	Massachusetts Institute of Technology, USA

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Symposium EL05: Soft Optics

This symposium will broadly cover current and upcoming soft optical materials and devices. Soft optical materials are emerging as new platforms to modulate light, as photomechanical actuators, and as intrinsically stretchable alternatives to electronic sensors in soft robotics and other extreme-deformation environments. There are parallels to the recent growth of soft and stretchable electronics, but the materials set for soft optics is limited by low optical transmission (vs. fused silica), and processing methods for soft optical materials are in early development. The goal of this symposium is to gather together researchers across departments in academia, government, and industry to share the latest advances in soft optics and encourage rapid translation of emerging materials to applications. Potential session titles grouped around invited speakers include: structural optics of soft materials; soft photonics; stretchable optical waveguides for sensors and robotics; interplay between composition, processing, and optical properties of soft materials; bioinspired and conformal soft optics; and optical properties/characterization/actuation of liquid crystalline materials. A joint session is tentatively planned with SB04, Conducting and Functional Hydrogels, for papers on optical properties and applications of hydrogels. Another possible joint session is with SB05, Biohybrid and Soft Functional Interfaces. Symposium contributions should address fundamental connections between materials' structure and optical properties, or explore new applications related to soft materials' optical properties. Abstracts will be solicited in the following areas: Polymer materials and processing, soft robotics and wearables, photonics, single-mode polymer waveguide and polymer FBG sensors, 3D printing of soft optical materials, optical properties of liquid crystal elastomers, optogenetics with soft waveguides & other bio applications.

Topics will include:

- Optical properties of silicones, gels, thermoplastic elastomers, and other highly deformable materials.
- Simulations and experiments on relationship between structure and properties; methods for investigating the optical properties of soft materials
- Intrinsically soft light sources, light waveguides, and detectors; powering optical sources and detectors in soft materials
- Soft materials and structures whose optical properties respond to temperature, deformation, shear, and other signals from the environment
- Photonics on flexible and/or stretchable substrates, including new materials and conventional materials in new formats
- Deformable lenses and conformal optics
- Methods for integrating soft optics into sensors and other systems. Applications as sensors for soft robotics, wearables, and other soft systems
- Optically-driven soft actuators including liquid crystal elastomers; soft liquid crystal materials as light modulators
- 3D printing of optical systems including waveguides and lenses
- Optical properties of photopolymers
- Methods to manipulate the refractive index and optical transmission of soft waveguides, fibers, films and resins

Joint sessions are being considered with **SB04 - Conducting and Functional Hydrogels—From Materials to Devices**, and **SB05 - Biohybrid and Soft Functional Interfaces**.
Also, a **tutorial** complementing this symposium is tentatively planned. Further information will be included in the MRS Program that will be available online in September.

Invited speakers include:

Aránzazu del Campo	INM–Leibniz Institute for New Materials, Germany	**Tse Nga Ng**	University of California, San Diego, USA
Eric Fujiwara	Universidade Estadual de Campinas, Brazil	**Robert Shepherd**	Cornell University, USA
Xiaoting Jia	Virginia Tech, USA	**Young Min Song**	Gwangju Institute of Science and Technology, Republic of Korea
Matthias Kolle	Massachusetts Institute of Technology, USA	**Fabien Sorin**	École Polytechnique Fédérale de Lausanne, Switzerland
Oleg Lavrentovich	Kent State University, USA	**Jarrett Vella, Jr.**	Air Force Research Laboratory, USA
Lan Li	Westlake University, China	**Timothy J. White**	University of Colorado Boulder, USA
Danqing Liu	Eindhoven University of Technology, Netherlands	**Ming Xiao**	Sichuan University, China
Yi Long	Nanyang Technological University, Singapore	**Shu Yang**	University of Pennsylvania, USA
Nanshu Lu	The University of Texas at Austin, USA	**Lan Yin**	Tsinghua University, China
Mark MacLachlan	University of British Columbia, Canada	**Huichan Zhao**	Tsinghua University, China
Jeroen Missinne	Ghent University, Belgium		

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Symposium EL06: Metamaterials Innovation in Photonics, Acoustics, Fluidics and Thermal Sciences

Metamaterials, composed of artificially designed “meta-atoms”, have demonstrated great potential to tailor wave phenomena in manners unforeseen by nature. This symposium aims to overview and bridge cutting-edge advances in metamaterials across the disciplines of photonics, acoustics, fluidics and the thermal sciences. Emergent advances and challenges of next-generation metamaterials lie at the boundary between disciplines. This symposium aims to foster an interdisciplinary dialogue to ignite new avenues of metamaterials innovation.

Recent innovative progress in nanophotonics, photoacoustics, optofluidics and near-field thermal radiation will be presented, with a focus on novel material properties and design, tailored wave-matter interactions and device platforms for societally relevant applications. The symposium covers fundamental materials science, promising applications, and novel fabrication techniques. The realization of metamaterials which fully leverage wave-matter interactions requires an in-depth understanding of materials physics which ranges across disciplines promising improved performance, miniaturization, tunability and lower cost. Multiphysics metamaterials promise breakthrough solutions which can be made widely available in industries ranging from healthcare to energy.

Topics will include:

- Multiphysics of multidimensional optical metamaterials
- Optofluidic metamaterial devices and sensors
- Mechanical and photoacoustic metamaterials
- Metamaterials for medical diagnostics
- Emerging mechanisms for dynamically switchable and reconfigurable metamaterials
- Design approaches for complex multifunctional metamaterials
- Metamaterials and structures for radiative heat management
- Energy harvesting and sustainability
- Metamaterials for photo(electro)chemistry
- Quantum metamaterials

Joint sessions are being considered with **EL08 - Emerging Material Platforms and Fundamental Approaches for Plasmonics, Nanophotonics and Metasurfaces**.

Invited speakers include:

Alessandro Alabastri	Rice University, USA
Hatice Altug	École Polytechnique Fédérale de Lausanne, Switzerland
Abdul Azad	Los Alamos National Laboratory, USA
Nicholas Boechler	University of California, San Diego, USA
Mark Brongersma	Stanford University, USA
Hong-Tong Chen	Los Alamos National Laboratory, USA
Renkun Chen	University of California, San Diego, USA
Jennifer Dionne	Stanford University, USA
David Erickson	Cornell University, USA
Nicholas Fang	Massachusetts Institute of Technology, USA
Andrei Faraon	California Institute of Technology, USA
Javier Garay	University of California, San Diego, USA
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Hayk Harutyunyan	Emory University, USA
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Boubacar Kante	University of California, Berkeley, USA
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Peter Nordlander	Rice University, USA
Georgia Papadakis	ICFO–The Institute of Photonic Sciences, Spain
Junghyun Park	Samsung, Republic of Korea
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Symposium EL07: 1D and 2D Materials—Electronic Properties and Device Applications

Emerging nanoscale quantum materials, including 1D (nanotubes, nanoribbons, nanowires, etc.) and 2D materials (graphene, phosphorene, silicene, telurene, transition metal di-/tri-chalcogenides, group-III/-IV chalcogenides, transition metal phosphorus trisulfide, MXenes, oxides, nitrides and carbides), provide unique opportunities for the exploration of exotic physical phenomena at the very bottom. New physics associated with the quantum-confined nanostructures and/or the unique crystalline and electronic structures may emerge only in these low-dimensional quantum material systems, which would enable novel electronic and quantum device applications with unprecedented functionality, energy efficiency, and form factors. This symposium will focus on the fundamental and practical aspects of various emerging functionalities and innovative technologies enabled by 1D and 2D materials. Interdisciplinary topics related to the physics, chemistry, and device applications of these emerging quantum materials will be covered, including electronic and transport properties; device physics and process engineering for advanced logic, memory, and interconnect applications; as well as the recent progress of heterogeneous integration, non-von Neumann computing architectures, in-memory and in-sensor computing, and wearable electronics enabled by these materials.

Topics will include:

- Electronic structures and transport properties of 1D and 2D materials
- Metallic, semiconducting, and insulating 1D and 2D materials for emerging computing technologies (including logic, memory, and interconnect)
- Ferromagnetic, ferroelectric, multiferroic, and phase-change properties and emerging neuromorphic and in-memory computing technologies based on 1D and 2D materials
- Spintronics and quantum information technologies based on 1D and 2D materials
- Sensors, actuators, and other functional devices based on 1D and 2D materials
- Heterogeneous integration, flexible and wearable electronics enabled by 1D and 2D materials

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

Invited speakers include:

Jeorg Appenzeller	Purdue University, USA
Michael Arnold	University of Wisconsin–Madison, USA
Amin Azizi	Taiwan Semiconductor Manufacturing Company, Taiwan
Judy Cha	Cornell University, USA
Manish Chhowalla	University of Cambridge, United Kingdom
Susan Fullerton	University of Pittsburgh, USA
Aran Garcia-Lekue	Donostia International Physics Center, Spain
Mark Hersam	Northwestern University, USA
Ernesto Joselevich	Weizmann Institute of Science, Israel
Philip Kim	Harvard University, USA
Mario Lanza	King Abdullah University of Science and Technology, Saudi Arabia
Xi Ling	Boston University, USA
Yuanyue Liu	The University of Texas at Austin, USA
Jun Lou	Rice University, USA
Vincent Meunier	The Pennsylvania State University, USA
Zafer Mutlu	University of Arizona, USA
Farnaz Niroui	Massachusetts Institute of Technology, USA
Taisuke Ohta	Sandia National Laboratory, USA
Tomás Palacios	Massachusetts Institute of Technology, USA
Eric Pop	Stanford University, USA
Deborah Prezzi	Consiglio Nazionale delle Ricerche, Italy
Xiaofeng Qian	Texas A&M University, USA
Iuliana Radu	Taiwan Semiconductor Manufacturing Company, Taiwan
Joshua A. Robinson	The Pennsylvania State University, USA
Pascal Ruffieux	Empa–Swiss Federal Laboratories for Materials Science and Technology, Switzerland
Hatef Sadeghi	Warwick University, United Kingdom
Hyeon-Jin Shin	Samsung Advanced Institute of Technology, Republic of Korea
Herre van der Zant	Delft University of Technology, Netherlands
Xu Zhang	Carnegie Mellon University, USA
Wenjuan Zhu	University of Illinois at Urbana-Champaign, USA

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Symposium EL08: Emerging Material Platforms and Fundamental Approaches for Plasmonics, Nanophotonics and Metasurfaces

This symposium addresses emerging topics in plasmonics, nanophotonics, and metasurfaces to overcome existing fundamental 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 metasurfaces, and their applications. Novel nonlinear and quantum phenomena and advanced design methods for metasurface and plasmonic materials/devices are also of interest to this symposium.

Topics will include:

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

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

Invited speakers include:

Andrea Alù	The City University of New York, USA
Harry Atwater	California Institute of Technology, USA
Koray Aydin	Northwestern University, USA
Alexandra Boltasseva	Purdue University, USA
Wenshan Cai	Georgia Institute of Technology, USA
Wen-Hui Cheng	National Cheng Kung University, Taiwan
Artur Davoyan	University of California, Los Angeles, USA
Chloe Doiron	Sandia National Laboratories, USA
Nader Engheta	University of Pennsylvania, USA
Shangjr Gwo	National Tsing Hua University, Taiwan
Tony Heinz	Stanford University, USA
Ortwin Hess	Trinity College Dublin, The University of Dublin, Ireland
Deep Jariwala	University of Pennsylvania, USA
Yuri Kivshar	The Australian National University, Australia
Yongmin Liu	Northeastern University, USA

Stefan Maier	Monash University, Australia
Francesco Monticone	Cornell University, USA
Teri Odom	Northwestern University, USA
Lisa Poulikakos	University of California, San Diego, USA
Stephanie Reich	Freie Universität Berlin, Germany
Junsuk Rho	Pohang University of Science and Technology, Republic of Korea
Vladimir Shalaev	Purdue University, USA
Gennady Shvets	Cornell University, USA
Giulia Tagliabue	École Polytechnique Fédérale de Lausanne, Swaziland
Din-Ping Tsai	City University of Hong Kong, Hong Kong
Jason Valentine	Vanderbilt University, USA
Prabhat Verma	Osaka University, Japan
Pin-Chieh Wu	National Cheng Kung University, Taiwan
Anatoly Zayats	King's College London, United Kingdom
Yang Zhao	University of Illinois at Urbana-Champaign, USA

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Symposium EL09: 2Ds Go Hybrid—Properties and Applications of Dimensionally Hybrid Systems

2D materials have the potential to revolutionize current technologies through on-chip integration of ultra-thin semiconductors with layer-dependent band structure and strain-tunable functional properties. The scientific community has explored the fabrication of planar 2D stackings for applications in photonics, optoelectronics, straintronics, valleytronics and twistronics, unlocking wide knowledge of the integration of 2D materials on different substrates and paving the way for more elaborate heterostructures. Which novel avenues can be unveiled in semiconductor stackings having different dimensionalities?

This symposium will gather the semiconductor and the 2D material communities to discuss the challenges and opportunities of non-planar heterostructures based on 2D materials. There will be a particular focus on dimensionally hybrid semiconductor heterostructures (2D/1D and 2D/0D systems), as well as heterostructures based on different 2D materials and on how recent research progress can improve existing and novel technologies in different application areas. The topic will be addressed with an interdisciplinary approach to maximize its impact and the generation of new ideas will be ensured by including researchers from related, but distinct subareas. The following topics are of particular interest: (i) Impact of morphology and chemistry of the individual components on the properties of the hybrid structure; (ii) Dimensionally mixed interfaces: surface confinement in 2D/1D and 0D stacking; (iii) High space- and/or time- resolution characterization techniques applied to hybrid structures; (iv) Experimental observation of 1D and 0D component-induced variation in parameters such as strain and the effects on optical and electronic response; (v) Charge and energy transfer in hybrid heterostructures; (vi) Insights into the integration process of multidimensional systems; (vii) Dimensionally hybrid systems that combine semiconducting with other properties such as magnetism. Contributions are also sought that advance understanding and control of quantum properties in 2Ds, envisioned to be coupled with other semiconductors for emerging areas where 2D materials show promising properties applicable in functional technologies.

Topics will include:

- Relevant synthesis aspects for hybrid heterostructuring and high-throughput integration processes
- Chemical, structural, and property characterization at multiple length scales, with high spatial and temporal resolution
- Interplay between dimensional mismatching, defects and strain distribution in the 2D component and impact on the overall functional behavior
- Environmental perturbations: effect of the environment on the functional properties in vacuum, controlled atmosphere and standard conditions.
- Quantum properties in dimensionally hybrid heterostructures
- Fundamental and technological limits in fabrication scalability
- Hybrid systems beyond semiconductors (e.g., superconductor, magnetic ordering, 2D magnets) and their integration with other low dimensional materials
- Towards electronic, optoelectronic, photonic, energy conversion and sensing applications

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

Invited speakers include:

Igor Aharonovic	University of Technology Sydney, Australia	**Jeehwan Kim**	Massachusetts Institute of Technology, USA
Michal Baranowski	Wroclaw University of Science and Technology, Poland	**Dehui Li**	Huazhong University of Science and Technology, China
Jessica Boland	University of Manchester, United Kingdom	**Xiuling Li**	University of Illinois at Urbana-Champaign, USA
Kirill Bolotin	Freie Universität Berlin, Germany	**Yuerui Li**	The Australian National University, Australia
Jennifer Dionne	Stanford University, USA	**Vinod Menon**	City University of New York, USA
Andrea C. Ferrari	University of Cambridge, United Kingdom	**Prineha Narang**	University of California, Los Angeles, USA
Anna Fontcuberta i Morral	Ecole Polytechnique Fédérale de Lausanne, Switzerland	**Antonio Polimeni**	Sapienza Università di Roma, Italy
Young Joon Hong	Pohang University of Science and Technology, Republic of Korea	**Eric Pop**	Stanford University, USA
Shengxi Huang	The Pennsylvania State University, USA	**Sumeet Walia**	Royal Melbourne Institute of Technology, Australia
Ernesto Joselevich	Weizmann Institute of Science, Israel	**Ilaria Zardo**	Universität Basel, Switzerland
Hannah Joyce	University of Cambridge, United Kingdom		

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Symposium EL10: Understanding the Inorganic-Organic Interface—The Case of Colloidal Nanoscale Materials

Colloidal inorganic nanocrystals exhibit size-, composition- and shape-tunable optical and electronic properties. These include plasmonic metal nanostructures, magic size nanoclusters, magnetic nanocrystals, as well as luminescent semiconductor and perovskite quantum dots. They have generated great scientific interest over the past three decades, for use in many energy- and bio-related areas, e.g., photovoltaic, light emitting and other optoelectronic devices, catalysis, biosensing and *in vivo* tissue imaging. These materials share one important characteristic. They have large surface areas, which provide many opportunities for manipulating their shape, their size and other properties via interfacial passivation using bifunctional organic molecules, polymers, metal-free inorganic ligands and even biomolecules.

The coating, which controls the interface between these materials and the surrounding environment, is very complex, yet crucially important to all aspects affecting their behavior. The nature of the ligands, their density and lateral extension play an important role in defining the nanomaterials properties, e.g., long-term stability (colloidal and structural), hydrodynamic size, absorption, fluorescence emission and carrier transport properties. A thorough understanding of the interface is essential for optimizing the material's performance in all conditions. Several highly effective characterization strategies have been applied to various colloidal nanomaterials and data have yielded new and remarkably detailed information and understanding of these systems. These techniques include a battery of 1D and 2D NMR spectroscopy techniques, X-ray diffraction and small angle X-ray scattering, XPS, EDX, FT-IR, and mass spectrometry.

This symposium intends to bring together a group of chemists, physicists, biologists and engineers actively using such tools to characterize and understand the interfacial properties of these systems and their implications in various technological applications.

Topics will include:

- Understanding the interfacial properties of semiconductor quantum dots, metallic and magnetic nanocrystals (i.e., surface chemistry, colloidal stabilization, solution processing, …)
- Passivation and stabilization of perovskite nanocrystals.
- Passivation of perovskite thin films (including all inorganic and organic/inorganic hybrids)
- The importance of Lewis acids/bases interactions
- Characterization of the interface using advanced spectroscopy techniques (e.g., fluorescence spectroscopy, NMR spectroscopy, FTIR spectroscopy, X-ray photoelectron spectroscopy)
- Energy transfer interactions (e.g., Förster type and triplet-triplet annihilation)
- Electron/Charge transfer interactions and their implication in photocatalytic properties
- Modeling of the surface properties
- Integration into optoelectronic devices (photovoltaic and light-emitting devices)

Invited speakers include:

Moungi G. Bawendi	Massachusetts Institute of Technology, USA
Maryna Bodnarchuk	Empa–Swiss Federal Laboratories for Materials Science and Technology, Switzerland
Ou Chen	Brown University, USA
Bruce Cohen	Lawrence Berkeley National Laboratory, USA
Nikolai Gaponik	Technische Universität Dresden, Germany
Andrew B. Greytak	University of South Carolina, USA
Zeger Hens	Ghent University, Belgium
Sandrine Ithurria	École Supérieure de Physique et de Chimie Industrielles, France
Eunjoo Jang	Samsung Electronics, Republic of Korea
Lea Nienhaus	Florida State University, USA
Jonatan S. Owen	Columbia University, USA
Wolfgang Parak	University of Hamburg, Germany
Teresa Pellegrino	Istituto Italiano di Tecnologia, Italy
Lakshmi Polavarapu	University of Vigo, Spain
Thomas Pons	École Supérieure de Physique et de Chimie Industrielles, France
Loredana Protesescu	University of Groningen, Netherlands
Elena V. Shevchenko	Argonne National Laboratory, USA
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Symposium EL11: Ultra-Wide Bandgap Materials, Devices and Applications

Research in ultra-wide-bandgap (UWBG) semiconductor materials 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 research and device physics. 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. While not the focus of the symposium, topics of current interest in the more traditional wide-bandgap materials will also be considered.

Topics will include:

- Bulk crystals and substrates
- Epitaxial growth
- Theory and first-principles calculations
- Defect science, including doping
- Novel polarization effects and utilization in devices
- UWBG heterostructures
- Device performance and reliability
- Low-dimensional structures
- Carrier recombination dynamics
- Gate and passivation dielectrics
- Thermal properties and thermal engineering
- Advanced materials characterization techniques
- Color centers for quantum technologies
- Ultraviolet emitters and detectors

Joint sessions are being considered with **EL14 - Diamond Electronics, Devices and Sensors**.

Invited speakers include:

Enrico Bellotti	Boston University, USA	**Tom Kazior**	Defense Advanced Research Projects Agency, USA
Josephine Chang	Northrop Grumman Corporation, USA	**Manos Kioupakis**	University of Michigan, USA
Srabanti Chowdhury	Stanford University, USA	**Sriram Krishnamoorthy**	University of California, Santa Barbara, USA
Alan Doolittle	Georgia Institute of Technology, USA	**David Meyer**	U.S. Naval Research Laboratory, USA
Dan Dryden	Air Force Research Laboratory, USA	**David Moran**	University of Glasgow, United Kingdom
Yasuaki Einaga	Keio University, Japan	**Sergei Novakov**	University of Nottingham, United Kingdom
Jack Flicker	Sandia National Laboratories, USA	**Naoteru Shigekawa**	Osaka Metropolitan University, Japan
Eienne Gheeraert	Centre National de la Recherche Scientifique, France	**Zlatko Sitar**	North Carolina State University, USA
Ken Haenen	Hasselt University, Belgium	**Carol Trager-Cowan**	University of Strathclyde, United Kingdom
Debdeep Jena	Cornell University, USA	**Grace Xing**	Cornell University, USA
Riena Jenno	University of Tokyo, Japan	**Enrico Zanoni**	Università degli Studi di Padova, Italy

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Symposium EL12: Perspective on Applications of Metasurfaces—Advances in Metasurface Design, Fabrication, Integration and Material

Metasurfaces are artificially engineered composite surfaces with deep subwavelength units, and they exhibit optical characteristics that cannot be obtained in nature. This symposium aims at providing a forum for cross-disciplinary discussions on the applications perspective of metaphotonics. Particularly, we will focus on the rising cycle from synergy between innovations in materials science and metaphotonics. Leveraging the pioneering demonstrations of the on-demand amplitude/phase/polarization control, researchers have made continuous and significant advances in the field of metasurfaces, including space-time-modulated metasurfaces, nonlocal metasurfaces, large-scale optimizations, novel design methods beyond parameter sweeping to generate look-up tables, and high-volume fabrications. These advances have facilitated practical applications such as polarization-independent broadband metalenses with large sizes and multifunctional metasurfaces with substantially suppressed cross-talks, which could be used for computational photonics, super-resolution imaging, and biochemical sensing. To highlight the status and perspective of applications of metasurfaces, we will arrange talks on recent advances in mass production technology for metaphotonics with presenters from various fields of industry. In addition, the systematic studies in combination of novel material platform and strong light-matter interaction have empowered time-varying modulation of metasurfaces. Highly-tunable materials include low-loss phase-change materials, 2D materials, and MXene, which could be integrated with nano-resonators, paving a way toward novel applications such as LiDAR and free-space optical communications. This symposium also covers new possibilities coming from Rendezvous between the metaphotonics and artificial intelligence (AI), focusing on both AI for photonics and photonics for AI. Various models and concepts developed in the field of AI have been implemented, yet there are still missing components such as efficient activation units. We seek to bring together researchers with diverse backgrounds from materials science, physics, electrical/chemical engineering, and computer science/vision to share recent groundbreaking advances in AI-empowered metaphotonics.

Topics will include:

- Multi-functional and All-dielectric metasurfaces
- Reconfigurable/tunable metasurfaces and their applications; Metalenses and flat optics for practical applications
- Atomically-thin metasurfaces using 2D materials;Super-resolution imaging, computational imaging, and depth sensing using metasurfaces
- 3D displays, AR/VR displays, LiDAR, optical computing, optical memory; New manufacturing techniques for metasurfaces
- Novel fabrication techniques for improving plasmonics/metasurface properties
- Advanced nanophotonic design strategies including machine learning, deep learning, topological optimizations, and inverse design, as well as new simulation methods
- Nonlocal metasurfaces in momentum domain for optical computing and in spatial domain for ultra-high Q resonance
- Meta-photonic integrated devices; Biological and chemical sensing with metasurfaces

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

Invited speakers include:

Ali Adibi	Georgia Institute of Technology, USA
Federico Capasso	Harvard University, USA
Debashis Chanda	University of Central Florida, USA
Xianzhong Chen	Heriot-Watt University, United Kingdom
Tie Jun Cui	Southeast University, China
Robert Devlin	Metalenz, USA
Ramon Paniagua Dominguez	Agency for Science, Technology and Research, Singapore
Huigao Duan	Hunan University, China
Johnathan Fan	Stanford University, USA
Vivian Ferry	University of Minnesota, USA
Juejun Hu	Massachusetts Institute of Technology, USA
Sejeong Kim	University of Melbourne, Australia
Philippe Lalanne	Institut d'Optique, France
Howard Ho Wai Lee	University of California, Irvine, USA
Guixin Li	Southern University of Science and Technology, China

Laura Na Liu	Universität Stuttgart, Germany
Zhaowei Liu	University of California, San Diego, USA
Stefan Maier	Ludwig-Maximilians-Universität München, Germany
Ragip Pala	Meta Materials Inc., USA
Cheng-Wei Qiu	National University of Singapore, Singapore
Sookyoung Rho	Samsung Advanced Institute of Technology, Republic of Korea
Volker Sorger	George Washington University, USA
Isabelle Staude	Friedrich-Schiller-Universität Jena, Germany
Takuo Tanaka	RIKEN, Japan
Robert Visser	Applied Materials, Inc., USA
Jelena Vuckovic	Stanford University, USA
Thomas Zentgraf	Universität Paderborn, Germany
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Shuang Zhang	University of Birmingham, United Kingdom

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Symposium EL13: Multiferroics and Magnetoelectrics

This symposium is focused on the fast-growing field of multiferroics and magnetoelectrics in which two or more ferroic (ferroelectric, ferro/anti-ferro magnetic, ferroelastic, etc.) orders coexist. The cross coupling between the magnetic and electric orders, i.e. magnetoelectric coupling, enables voltage control of spin degrees of freedom and vice verses that is crucial for the applications of ultra-low-power spintronics and magnetic sensors. On the other hand, these materials with interplay among spin, charge, orbit, and lattice degrees of freedom offer a remarkable platform for fundamental studies in materials science and condensed matter physics. Our symposium will highlight the most recent progress of this field including the theory of multiferroic materials, magnetic sensors and antennas, voltage-controlled magnetic anisotropy, magnetic memories, magnonics, magnetoelectric heterostructures and nanostructures, and imaging techniques of multiferroics and magnetoelectrics domains. This interdisciplinary symposium will bring together a diverse host of experts across academia, national laboratories and industry to discuss the recent development in theory, synthesis, characterizations, devices as well as the opportunities and challenges in the on-chip integration of multiferroic and magnetoelectric materials. The symposium aims to promote communications and discussions among material scientists, physicists, and electrical engineers for accelerating the development of multiferroic materials for information processing, storage, wireless communication and magnetic sensing applications.

Topics will include:

- Theory and simulation of magnetoelectric materials
- Magnetoelectric sensors, antennas, and energy harvesters
- Voltage-controlled magnetic anisotropy
- Magnetoelectric magnetic memories
- Magnonics in multiferroics and magnetoelectrics
- Magnetoelectric heterostructures and nanostructures
- Advanced imaging techniques for multiferroics and magnetoelectrics

Joint sessions are being considered with **EL03 - Ferroic Materials and Heterostructures**.

Invited speakers include:

Manuel Bibes	Centre National de la Recherche Scientifique, France
Christian Binek	University of Nebraska–Lincoln, USA
Longqing Chen	The Pennsylvania State University, USA
Sang-wook Cheong	Rutgers University, USA
Kathrin Dorr	Martin-Luther-Universität-Halle-Wittenberg, Germany
Judith Driscoll	University of Cambridge, United Kingdom
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Lingyuan Gao	University of Arkansas, USA
Martina Gerken	Kiel University, Germany
Massimo Ghidini	University of Cambridge, United Kingdom
Jiamian Hu	University of Wisconsin–Madison, USA
Quanxi Jia	University at Buffalo, The State University of New York, USA
Hwaider Lin	Northeastern University, USA
Ming Liu	Xi'an Jiaotong University, China

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Lane Martin	University of California, Berkeley, USA
Jeffrey McCord	University of Kiel, Germany
Julia Mundy	Harvard University, USA
Asuka Namai	University of Tokyo, Japan
Yoshichika Otani	University of Tokyo, Japan
Michael Page	Air Force Research Laboratory, USA
Xiaoqing Pan	University of California, Irvine, USA
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Symposium EL14: Diamond Electronics, Devices and Sensors

Due to its unique properties diamond is a material that enables device applications in challenging environments. Recent development in the areas of power and RF electronics, heat spreaders, sensors, MEMs, room temperature quantum applications, tissue engineering and catalysis at extreme potentials are among the most promising. This was fueled by achievements such as the very recent announcement of 2 inch single crystalline diamond substrates from hetero-epitaxy to become commercially available by the next few months. This is expected to reply to the increased demand for high quality single crystalline diamond films with large and smooth surfaces (opto-electronics, waveguides), defect free surfaces, which can be wafer bonded to III-V-materials and 3D-device -architectures for power electronics and high quality electronic components made out of diamond such as vertical and lateral devices, Schottky junctions, pin-diodes and field-effect-transistors. In addition, diamond based electron emitters for the generation of solvated electrons in buffer solutions is now a uniquely efficient and cheap solution to reduce CO(2) or N(2) into fuels, chemical building blocks or ammonia, as a means to cope with greenhouse gas emissions and the increasing demand for fuels and fertilizers. Further, the application of lattice defects such as NV, GeV and SnV for magnetometry gains increasing momentum for the generation of new devices related to navigation, local current sensing, geology, MRI and many more. Hybrid electronic systems that combine diamonds excellent thermal properties with materials such as GaN based MMICs have been demonstrated, where diamond is applied on the back side by wafer bonding but also on the hot-spot gate (front side) by plasma deposition. Beyond monocrystalline diamond, applications of functionalized nanodiamonds as biomarkers and for drug delivery, cancer diagnosis and therapy as well as in tissue engineering and catalysis. Diamond coatings have demonstrated they can be biocompatible and can be functionalized for in-vivo applications ranging from tissue engineering to neuron interfaces and stimulants.

This symposium will bring together researchers from academia and industry, to discuss and introduce the perspectives and possibilities of diamond as well as diamond hybrid materials and heterojunction development. As a recurring event at MRS Fall since 2006, this symposium promotes new applications, new ideas and collaborations in the science communities ranging from biology, quantum technology to electronic applications all over the world.

Topics will include:

- Recent breakthroughs in large area (>2 in) homo- and hetero-epitaxial-growth of single-crystalline diamond.
- Novel wafer bonding approaches with III/V and other materials
- Synthesis of diamond with intentionally created defects, impurities and doping of diamond and correlated electrical, optical and mechanical properties.
- Diamond materials for magnetometry and single photon-generation, e.g. supporting architectures, wave-guides, couplers, etc
- Nanoscopic diamond powders/films for photocatalytic and electrocatalytic applications
- High performance diamond-based electronic devices, hydrogen-terminated 2D hole-gas devices, high power devices, GaN/diamond hybrids, high frequency devices and IGFETs.
- Efficient diamond-based radiation detectors for applications in harsh environments
- Diamond and diamond based hetero-structures in thermionic, photo-induced and field-emission devices.
- Nanodiamond for drug delivery, cancer diagnosis and therapy and recent developments
- Nanoscopic diamond powders/films and their functionalization for gas and bio-sensors coupled with SAW, MEMS/NEMS and photonic devices
- Diamond biocompatible implants and biosensors for neural interfacing: from fabrication to in vivo evoque action potential measurements
- Optical and electrical platforms for chemical/biosensing (including fabrication, chemical modification and measurement/application).

Joint sessions are being considered with **EL11 - Ultra-Wide Bandgap Materials, Devices and Applications**.
Also, a **tutorial** complementing this symposium is tentatively planned. Further information will be included in the MRS Program that will be available online in September.

Invited speakers include:

Chia-Ching Chang	National Yang Ming Chiao Tung University, Taiwan
Shery Chang	University of New South Wales, Australia
Srabanti Chowdhury	Stanford University, USA
Stoffel Janssens	Okinawa Institute of Technology, Japan
Ania Jayich	University of California, Santa Barbara, USA
Georgina Klemencic	Cardiff University, United Kingdom
Patrick Salter	University of Oxford, United Kingdom
Aparajita Singha	Max Planck Institute for Solid State Research, Germany
Alastair Stacey	Royal Melbourne Institute of Technology, Australia
Mariko Suzuki	Universidad de Cádiz, Spain
Kenji Ueda	Waseda University, Japan
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Symposium EL15: Chiral Materials—New Structures and Properties

In the past few years, driven by the discoveries of many new chiral electronic, optoelectronic, and photonic materials, researchers started to realize the unprecedented opportunities of designing chiral materials for a wide spectrum of symmetry-broken-enabled physical properties, as well as relevant applications from energy harvesting to information processing. This symposium aims to serve as a platform for materials researchers working on the concept of chirality across different communities to exchange their physical principles, computational and experimental approaches, recent progresses, and outstanding challenges, so as to inspire design and creation of novel chiral functionalities from molecular to device scale.

Topics will include:

- Design of chiral materials and structures
- Chiral electronic and spintronic properties
- Chiral optoelectronics and photonic materials
- Chiral bosonic excitations in materials
- Quantum properties in chiral materials

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

Invited speakers include:

Andrea Alu	The City University of New York, USA	**Joel E. Moore**	University of California, Berkeley, USA
Sang-Wook Cheong	Rutgers University, USA	**Vladimiro Mujica**	Arizona State University, USA
Xiangfeng Duan	University of California, Los Angeles, USA	**Ron Naaman**	Weizmann Institute of Science, Israel
M. Zahid Hasan	Princeton University, USA	**Colin Nuckolls**	Columbia University, USA
Song Jin	University of Wisconsin–Madison, USA	**Dali Sun**	North Carolina State University, USA
Nicholas A. Kotov	University of Michigan, USA	**Vladimir Tsukruk**	Georgia Institute of Technology, USA
Lucas Lindsay	Oak Ridge National Laboratory, USA	**David Waldeck**	University of Pittsburgh, USA
David Mitzi	Duke University, USA	**Peide Ye**	Purdue University, USA

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Symposium EL16: Carrier-Dopant Interactions in Organic Semiconductors—From Fundamentals to Applications

This symposium will bring together experimental and computational researchers to discuss advances in our knowledge of doped organic semiconductors and organic mixed ionic-electronic conductors. Organic semiconductors are typically doped to raise their electrical conductivity by exposing them to molecules—termed dopants—that add or remove electrons. Doping can adversely impact charge transport and the origin of this impact has been studied invoking competing hypotheses. These include the formation of deep traps, energetic disorder from Coulombic interactions between dopant and carriers, charge transfer complexes, and many others. Recent research has demonstrated novel ways to minimize the adverse impact of dopants on transport, ranging from lengthening side chains to increase charge separation, multi-charge transfer, disorder compensation between the polymer and the dopant-induced energetic disorder, as well as numerous other advances. This symposium will focus on these recent advances in doping strategies, doping mechanisms as well as their influence on carrier transport of organic semiconductors and the avenues they open toward better organic electronics, thermoelectrics and photovoltaics. Of particular interest are the studies that probe the impact of polymer and small molecule structure, polymer morphology, dopant structure, additives, and the location of dopants within the polymer on the electronic and charge transport properties. The aim of this symposium is for researchers from diverse backgrounds and locations to come together and openly discuss the recent developments in this area, with the common goals of developing unifying hypotheses and design strategies that can lead to high performance doped organic semiconductors.

Topics will include:

- Materials for Energy: Conversion, Harvesting, Storage and Beyond

Invited speakers include:

Zlatan Akšamija	University of Utah, USA
Kilwon Cho	Pohang University of Science and Technology, Republic of Korea
Kenneth Graham	University of Kentucky, USA
Kedar Hippalgaonkar	Nanyang Technological University, Singapore
Antoine Kahn	Princeton University, USA
Howard Katz	Johns Hopkins University, USA
Norbert Koch	Humboldt-Universität zu Berlin, Germany
Anna Köhler	Universität Bayreuth, Germany
Jan Anton Koster	University of Groningen, Netherlands
Martijn Kremerink	Universität Heidelberg, Germany
Karl Leo	Technische Universität Dresden, Germany
Franziska Lissel	Leibniz-Institut für Polymerforschung, Germany

Seth Marder	University of Colorado Boulder, USA
Adam Moulé	University of California, Davis, USA
Christian Müller	Chalmers University of Technology, Sweden
KS Narayan	Jawaharlal Nehru Institute for Advanced Scientific Research, India
Shrayesh Patel	The University of Chicago, USA
Ingo Salzmann	Concordia University, Canada
Geneviève Sauvé	Case Western Reserve University, USA
Benjamin Schwartz	University of California, Los Angeles, USA
Alessandro Triosi	University of Liverpool, United Kingdom
Deepak Venkateshwaran	University of Cambridge, United Kingdom
Wei You	University of North Carolina at Chapel Hill, USA

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Symposium EL17: Synthesis, Properties and Applications of 2D MXenes

Two-dimensional (2D) transitional metal carbide, nitrides and carbonitrides, collectively referred to as MXenes, are a large family of materials with remarkable physical and chemical properties. In the past few years, experimental studies on various MXenes have revealed their great promise for a wide range of applications including electrochemical energy storage (batteries and supercapacitors), flexible and transparent electronics, sensing applications, water desalination and removal of heavy metals and organic molecules from water, electromagnetic shielding, catalysis, and antibacterial films, to name a few. Moreover, many other composition-dependent properties of MXenes such as their remarkable thermoelectric, magnetic, and mechanical properties have been theoretically predicted. This symposium aims at being an international forum for the discussion of the synthesis, properties, and applications of MXenes. All aspects of fundamental experimental and theoretical research related to MXenes including materials discovery and synthesis, characterizations of the electrical, electrochemical, thermal, mechanical properties of MXenes, and their assembly and integration into functional devices will be covered in this symposium.

Topics will include:

- Experimental and theoretical advances in the discovery and synthesis of MXenes
- Atomic structure and surface chemistry of MXenes
- Optical and electronic properties of MXenes
- Catalytic properties and applications of MXenes
- Thermal and thermoelectric properties of MXenes
- Mechanical and tribological properties of MXenes
- Biomedical applications of MXenes
- Electromagnetic interference applications of MXenes
- MXene-based sensors, actuators, and other devices
- MXenes thin films, composites, hybrids, and 3D structures and their applications

Invited speakers include:

Husam Alshareef	King Abdullah University of Science and Technology, Saudi Arabia
Anasori Babak	Indiana University–Purdue University Indianapolis, USA
Michel Barsoum	Drexel University, USA
Christina Birkel	Arizona State University, USA
Alexandra Boltasseva	Purdue University, USA
Lucia Gemma Delgado	Università degli Studi di Padova, Italy
Yury Gogotsi	Drexel University, USA
Tae Hee Han	Hanyang University, Republic of Korea
Qing Huang	Ningbo Institute of Materials Technology & Engineering, Chinese Academy of Sciences, China
Sarah King	The University of Chicago, USA
Chong Min Koo	Sungkyunkwan University, Republic of Korea
Maria Lukatskaya	ETH Zürich, Switzerland
Khaled Mahmoud	Qatar Environment and Energy Research Institute, Qatar
Vadym Mochalin	Missouri University of Science and Technology, USA
Valeria Nicolosi	Trinity College Dublin, The University of Dublin, Ireland
Ilkwon Oh	Korea Advanced Institute of Science and Technology, Republic of Korea
Masashi Okubo	Waseda University, Japan
Volker Presser	Saarland University, USA
Miladin Radovic	Texas A&M University, USA
Johanna Rosen	Linköping University, Sweden
Zhi Wei Seh	Agency for Science, Technology and Research, Singapore
Patrice Simon	Université Paul Sabatier, France
Dmitri Talapin	The University of Chicago, USA
Lyubov Titova	Worcester Polytechnic Institute, USA
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Symposium EL18: 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, 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:

- Design and synthesis of new materials
- Organic (semi)conductors
- Radical polymers
- Perovskites and hybrid materials
- Device engineering
- Optimization of electrochemical transistors
- Fundamentals of ion and electron/hole transport
- In-situ and in-operando characterization
- Mechanical and electronic stability
- Theory, modeling, and molecular dynamics simulations

Invited speakers include:

Bryan Boudouris	Purdue University, USA	**Christian Nielsen**	Queen Mary University of London, United Kingdom
Gitti Frey	Technion–Israel Institute of Technology, Israel	**Jianyong Ouyang**	National University of Singapore, Singapore
Aristide Gumyusenge	Massachusetts Institute of Technology, USA	**Jonathan Rivnay**	Northwestern University, USA
Sahika Inal	King Abdullah University of Science and Technology, Saudi Arabia	**Julia Schneider**	Fordham University, USA
Jodie Lutkenhaus	Texas A&M University, USA	**Eleni Stavrinidou**	Linköping University, Sweden
Jenny Nelson	Imperial College London, United Kingdom	**Takeo Suga**	Waseda University, Japan

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Symposium EL19: Atomically-Thin 2D Materials and Heterostructures—Synthesis, Properties and Applications

Unique properties arise in the atomically-thin limit of matter, driving substantial interest in fundamental science and promising applications of graphene, transition metal dichalcogenides, and other layered and ultra-thin materials. Typically characterized by anisotropy with strong in-plane bonds and weak out-of-plane interactions, the family of 2D materials has continually grown to include a multitude of metals, insulators, semiconductors, magnets, superconductors, and topological materials. Increasingly, the heterostructures of these 2D layers have revealed more than the sum of their parts, with interlayer charge transfer, moiré physics, proximity effects, and lattice rearrangement realizing unprecedented and highly tunable properties. The advent of moiré materials in particular has generated excitement due to engineered flat bands (yielding strongly correlated quantum phases including superconductivity, topological, and magnetic states), tunable quantum dot arrays (yielding single photon emitters), and moiré ferroelectrics. Initial results on 2D materials exfoliated from single crystals motivated the development of large-area, high purity synthesis and heterojunctions with atomically clean interfaces. Achievements in synthesis, heterostructure assembly, contact engineering and doping have enhanced our ability to access stronger signatures of quantum phenomena and new regimes of electronic and optical properties. These new properties and synthesis capabilities in turn are opening the door to novel applications and new approaches that mix chemistry, biology, and condensed matter physics. This symposium will bring together a diverse set of researchers – from academia to national labs and fundamental physics to synthesis and devices – who are at the forefront of advancing our understanding of 2D materials and their potential. We welcome contributions on the latest developments in 2D materials and heterostructures, including their properties, synthesis, and characterization, spanning 2D layered materials (MXenes, oxides, nitrides, carbides, transition-metal di-/tri-chalcogenides, group-III/-IV chalcogenides), and emerging organic and hybrid materials.

Topics will include:

- Large-area growth, doping, and processing of 2D materials
- Growth and assembly of van der Waals heterostructures
- Electronic, optical, and magnetic properties of 2D materials and van der Waals heterostructures
- Structure, dynamics, and properties of moiré superlattices
- Characterization techniques for 2D materials and van der Waals heterostructures
- Industry perspectives on 2D materials
- 2D materials, devices, and heterostructures for quantum information science

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

Invited speakers include:

Deji Akinwande	The University of Texas at Austin, USA
Zakaria Y. Al Balushi	University of California, Berkeley, USA
Kwabena Bediako	University of California, Berkeley, USA
Nicholas Borys	Montana State University, USA
Kyung-Eun Byun	Samsung Advanced Institute of Technology, Republic of Korea
Hugh Churchill	University of Arkansas, USA
Xiangfeng Duan	University of California, Los Angeles, USA
Goki Eda	National University of Singapore, Singapore
James Edgar	Kansas State University, USA
Roman Gorbachev	University of Manchester, United Kingdom
Joshua Hendrickson	Air Force Research Laboratory, USA
Stephan Hoffman	University of Cambridge, United Kingdom
Pinshane Huang	University of Illinois at Urbana-Champaign, USA
Deep Jariwala	University of Pennsylvania, USA
Jyoti Katoch	Carnegie Mellon University, USA

Jeehwan Kim	Massachusetts Institute of Technology, USA
Chul-Ho Lee	Korea University, Republic of Korea
Lain-Jong (Lance) Li	Hong Kong University, Hong Kong
Jiwoong Park	The University of Chicago, USA
Su Ying Quek	National University of Singapore, Singapore
Joan Redwing	The Pennsylvania State University, USA
Daniel Rhodes	University of Wisconsin–Madison, USA
Joshua A. Robinson	The Pennsylvania State University, USA
Rodney Ruoff	Ulsan National Institute of Science and Technology, Republic of Korea
Hyeon Suk Shin	Ulsan National Institute of Science and Technology, Republic of Korea
Christoph Stampfer	RWTH Aachen University, Germany
Han Wang	University of Southern California, USA
Alexander Weber-Bargioni	Lawrence Berkeley National Laboratory, USA
Ursula Wurstbauer	Technical University of Munich, Germany
Boris Yakobson	Rice University, USA

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Symposium EL20: Future Materials and Technologies Toward Sustainable Heterogeneous Computing and Energy-efficient Machine Learning

New computing techniques, supported by emerging materials and devices, are changing the way information is processed. Innovations in operating speed, functional density, and power draw are progressing rapidly. Highly energy efficient intelligence to distributed sensors, imperceptible wearables and transient electronics would enable a fully connected world beyond the current IoT vision. However, this requires concerted advances at every level, from low thermal budget materials with competitive performance and interface engineering to modelling and system design. This symposium will address the multifaceted progress toward these goals via advances in materials, processes, simulation tools, devices, and systems. Discussion of fundamental material science; synthesis, growth mechanisms, fabrication routes and methods to improve important properties are encouraged.

The translation to large scale manufacturing brings additional challenges: cost-effective scale-up, reliability, uniformity and yield rely simultaneously on process control, fundamental material considerations and judicious device engineering. Successful integration with mature technologies continues to be a priority. Key is facilitating a rapid transition from basic science to practical deployment across the broad range of emerging applications including IoT and edge computing. To this end, solutions that cross traditional boundaries are being sought.

A third, strongly budding element is the focus on sustainability for electronic devices and systems, both in the ecological and economical dimensions. Complementing the efforts to reduce e-waste and the reliance on harmful products, such advances are increasingly favoured. Contributions are encouraged on ecological materials and on techniques with reduced manufacturing energy.

Topics will include:

- Physics, modeling and technology of memristive nanomaterials and devices
- Advances in devices that emulate the synaptic or neuron functionality
- Emerging materials (organic, inorganic, ferroelectric, spintronic, phase-change) for neuromorphic devices
- Emerging computational primitives for neuromorphic engineering
- Materials and devices for in-sensor computing
- Integration and interfacing with mature commercial technologies e.g. back-end integration with CMOS
- Sustainable and energy-efficient approaches to functional materials and device/system fabrication
- Manufacturability, reliability and yield, in particular advances in materials and processes

Joint sessions are being considered with **QT01 - Excitonic Materials**.

Invited speakers include:

Elisabetta Chicca	University of Groningen, Netherlands
Elliot Fuller	Sandia National Laboratories, USA
Dimitra Georgiadou	University of Southampton, United Kingdom
Julie Grollier	CNRS/Thales, France
Daniele Ielmini	Politecnico di Milano, Italy
Duygu Kuzum	University of California, San Diego, USA
Mario Lanza	King Abdullah University of Science and Technology, Saudi Arabia
Adnan Mehonic	University College London, United Kingdom
Gianluca Milano	Istituto Nazionale di Ricerca Metrologica, Italy
Enrique Miranda	Universitat Autònoma de Barcelona, Spain
Gang Niu	Xi'an Jiaotong University, China
Beatriz Noheda	University of Groningen, Netherlands
Kaushik Roy	Purdue University, USA
Yulia Sandamirskaya	Ruhr-Universität Bochum, Germany
Heidemarie Schmidt	Friedrich-Schiller-Universität Jena, Germany
Sabina Spiga	Institute for Microelectronics and Microsystems, Italy
Dmitri Strukov	University of California, Santa Barbara, USA
Kazuya Terabe	National Institute for Materials Science, Japan
Hsinyu (Sidney) Tsai	IBM T.J. Watson Research Center, USA
Rainer Waser	Forschungszentrum Jülich GmbH, Germany
Christian Wenger	Leibniz Institute for High Performance Microelectronics, Germany
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Yuchao Yang	Peking University, China
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Symposium EN01: Energy Solutions for Unconventional Applications

Advances in electrochemistry and fabrication have enabled wide-scale adoption of electric vehicles and a strong push for electrification of power grids across the world. In parallel, progress in materials chemistry and processing has enabled significant advances in small and soft robotics, medical devices, and wearables, pushing the boundaries of how and where humans and robots interact. However, a fundamental mismatch has emerged: these novel soft and small machines operate in environments which are incompatible with conventional energy storage solutions. Soft and wearable systems need to accommodate mechanical strain, while small devices require batteries at scales not accessible by conventional production techniques. Current limitations in the design, fabrication, and integration of these systems restricts their practical utility and meaningful use beyond the laboratory. In recognition of the interdisciplinary challenges facing the design and fabrication of energy materials at small scales and in mechanically challenging environments – the objective of this symposium is to bring together researchers from the fields of electrochemistry, soft and microscale robotics, stretchable electronics, additive manufacturing, and chemical engineering and highlight research that advances energy materials as key robotic components. This symposium will focus on three key research areas: novel chemistries for deformable energy storage, integrated design and fabrication strategies for stretchable devices, and multifunctional devices for energy conversion and storage.

Topics will include:

- Stretchable batteries and super capacitors
- Liquid and deformable electrodes
- Microfabrication of electrochemical components
- Flexible energy storage
- Hydrogel / ionogel based systems
- Additive manufacturing
- 2D and 3D printing of electrochemical materials
- Origami and kirigami methods for accommodating strain
- Fiber based energy storage and integration

Invited speakers include:

Ana Claudia Arias	University of California, Berkeley, USA
Rita Baddour-Hajdean	Centre National de la Recherche Scientifique, France
Nazek El-Atab	King Abdullah University of Science and Technology, Saudi Arabia
Sanket Goel	Birla Institute of Technology and Science, Pilani, India
Diana Golodnitsky	Tel Aviv University, Israel
Nicholas A. Kotov	University of Michigan, USA
Pooi See Lee	Nanyang Technological University, Singapore
Jan Macak	University of Pardubice, Czech Republic
John Madden	University of British Columbia, Canada
Carmel Majidi	Carnegie Mellon University, USA
Markus Niederberger	ETH Zürich, Switzerland
Soojin Park	Pohang University of Science and Technology, Republic of Korea
James Pikul	University of Pennsylvania, USA
Jeong Sook Ha	Korea University, Republic of Korea
Chunyi Zi	City University of Hong Kong, Hong Kong

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Symposium EN02: Solid-State Batteries—Materials, Processes, Characterizations and Scale-up

Solid state battery (SSB) is one of the most promising next generation battery technologies beyond commercial Li-ion batteries. SSBs can potentially enable Li metal, silicon, S or other new cathodes and anodes, new battery interface, architecture, and device design for high energy density, fast charging and discharging, and ultra-long cycling lifetime. While significant progress has been made in the past decade, numerous materials-related challenges remain to be addressed for the practical use of SSB. This symposium will invite diverse and world-leading experts in SSBs to discuss state-of-the-art advances in topics broadly covering materials synthesis, transport and interfacial properties, Li or alloy anodes, intercalation or conversion-based cathodes, electro-mechanical behavior, advanced characterization and simulation methods, solid-state electrolyte processing, cell integration, and battery manufacturing. The symposium aims to understand material science limitations in SSBs, while addressing key challenges in this growing research space, with the goal of widespread SSB technology adoption. Through this symposium we also aim to facilitate the discussion on a few debatable scientific and engineering topics in the SSB field, a better understanding of which will greatly speed up the design of next generation SSB, including but not limited to advanced conductivity mechanisms, interface passivation mechanisms, lithium plating and stripping mechanisms, the role of stack pressure, the role of electrode particle coating, the role of critical materials at anode (indium, silver, carbon, graphite, silicon, etc.), the anode free design, the cathode materials beyond NMC, the SSB device design originated from pouch, cylindrical, and prismatic cells.

Topics will include:

- Novel synthesis and processing of solid electrolytes, and development of thin electrolyte layers
- Novel in situ and operando characterization techniques
- High voltage and high energy cathode development and high areal loading and high-power performance
- Li metal anodes, other high capacity anodes, and anode-free designs
- Solid state batteries beyond Li
- Machine learning and artificial intelligence

Invited speakers include:

Yi Cui	Stanford University, USA
Neil Dasgupta	University of Michigan, USA
Bruce Dunn	University of California, Los Angeles, USA
Steven Harris	Lawrence Berkeley National Laboratory, USA
Kelsey Hatzell	Princeton University, USA
Enyuan Hu	Brookhaven National Laboratory, USA
Liangbing Hu	University of Maryland, USA
Jürgen Janek	Justus-Liebig-Universität Giessen, Germany
Yoon Seok Jung	Yonsei University, Republic of Korea
Ju Li	Massachusetts Institute of Technology, USA
Jun Liu	University of Washington, USA
Ping Liu	University of California, San Diego, USA
Dongping Lu	Pacific Northwest National Laboratory, USA
Matthew McDowell	Georgia Institute of Technology, USA
Y. Shirley Meng	The University of Chicago, USA

YIfei Mo	University of Maryland, USA
Cewen Nan	Tsinghua University, China
Linda Nazar	University of Waterloo, Canada
Yue Qi	Brown University, USA
Jeff Sakamoto	University of Michigan, USA
Yang Shao-Horn	Massachusetts Institute of Technology, USA
Xueliang Sun	University of Western Ontario, Canada
Kenneth Takeuchi	Stony Brook University, The State University of New York, USA
Chunsheng Wang	University of Maryland, USA
Donghai Wang	The Pennsylvania State University, USA
Huolin Xin	University of California, Irvine, USA
Guiliang Xu	Argonne National Laboratory, USA
Yuan Yang	Columbia University, USA
Yan Yao	University of Houston, USA
Hongli Zhu	Northeastern University, USA

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Symposium EN03: Biodegradable, Resorbable and Sustainable Materials

At present the waste produced from discarded consumer electronics, medical devices, and packaging materials is tremendous and unsustainable. For example, according to a recent UN report, as much as 50 million metric tons of consumer e-waste a year is produced globally, of which only 20% is recycled. Similarly, hospitals generate ~5 million metric tons of medical waste (around 29 pounds per bed per day). Even grimmer statistics exist for plastics – a ubiquitous class of materials. The world produces ~400 million metric tons each year and the majority of it is either dumped in dumping grounds or incinerated. Development of biodegradable and sustainable materials is therefore crucial for establishing a circular economy and for solving the grave global challenges associated with pollution and climate change. In this context, materials science and engineering plays a critical role. Emerging demonstrations of biodegradable electronics and packaging materials illustrate the power of innovation in materials in developing sustainable, bio-friendly alternatives to conventional, toxic, and non-recyclable products. This symposium will focus on the fundamental and applied research in the area of biodegradable, resorbable, and sustainable materials. It will cover a broad range of research areas that encompass advances in polymer science, green chemistry, device design engineering, computational modelling of biodegradable materials, and sustainable fabrication processes. Topics of interest include but are not limited to biodegradable and sustainable electronics, sensors, energy sources, and packaging materials. The proposed symposium will thus provide a unique avenue to share ideas amongst researchers from disparate domains spanning materials synthesis and processing, computational materials science, and device fabrication who share a common goal of reducing waste and establishing a sustainable world economy.

Topics will include:

- Understanding the thermodynamics and kinetics controlling biodegradation of materials
- Computational modelling of biodegradable materials and predicting device performance
- New biodegradable and sustainable materials and composites
- Sustainable manufacturing processes
- Biodegradable and sustainable electronics
- Biodegradable and sustainable optoelectronics
- Bioresorbable implants
- Biodegradable and sustainable energy storage systems
- Biodegradable and sustainable energy harvesters
- Biodegradable and sustainable sensors
- Green electronics or zero-waste electronics

Invited speakers include:

Magnus Berggren	Linköping University, Sweden
Mario Caironi	Istituto Italiano di Tecnologia, Italy
Fabio Cicoira	Polytechnique Montréal, Canada
Ravinder Dahiya	Northeastern University, USA
John Fisher	University of Maryland, USA
Aaron Franklin	Duke University, USA
Eric Glowacki	Central European Institute of Technology, Czech Republic
Ximin He	University of California, Los Angeles, USA
Liangbing Hu	University of Maryland, USA
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
Zhou Li	Institute of Oceanology, Chinese Academy of Sciences, China
Chase Linsey	University of California, Los Angeles, USA
Helen Lu	Columbia University, USA
Markus Niederberger	ETH Zürich, Switzerland
Victoria Piunova	Loliware Inc, USA
Vladimir Pozdin	Florida International University, USA
John Rogers	Northwestern University, USA
Clara Santato	Polytechnique Montréal, Canada
Xudong Wang	University of Wisconsin–Madison, USA
Xinge Yu	City University of Hong Kong, Hong Kong
Peter Zalar	TNO, Netherlands
Yi Zhang	University of Connecticut, USA
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Symposium EN04: Decoding Halide Perovskites—Advanced Characterization Towards Optimization and Discovery

Over the last decades, metal halide perovskites became the materials of choice for a variety of applications including solar cells, photodetectors, light emitting diodes, lasing, high energy radiation sensors and memristors. Functionality of these materials is controlled by an interplay between many different phenomena, including phase polymorphism, variations in dimensionality (zero to three dimensions), ionic dynamics, electrochemical processes, and transfer dynamics. Exploiting the full spectrum of the functionality of metal halide perovskites will only be made possible by developing a detailed understanding of both their physical properties and ionic and transfer dynamics. In this symposium, we aim to present the most recent advances in exploring metal halide perovskites materials and devices using advanced characterization techniques including optical spectroscopies, chemical imaging, electron/scanning-probe microscopy, Mossbauer spectrometry and other state-of-the-art spectroscopic and microscopic methods.

Topics will include:

- Micro- and nano-scale characterization of halide perovskites
- Excitons in perovskites
- Hot carriers in perovskites
- The role of interfaces in perovskite degradation
- Electronic defects
- Mapping and imaging of ions and their dynamics
- The role of band alignment in perovskite solar cells
- Surface chemistry
- Perovskites deposited by vapor processes

Joint sessions are being considered with **EN05 - Halide Perovskites—From Fundamentals to Applications**.

Invited speakers include:

Antonio Abate	Helmholtz-Zentrum Berlin, Germany
Aram Amassiam	North Carolina State University, USA
Pablo Boix	Universitat de València, Spain
Henk Bolink	Universitat de València, Spain
Jing Guo	First Solar, USA
Peijun Guo	Yale University, USA
Bin Hu	The University of Tennessee, Knoxville, USA
Alex Jen	City University of Hong Kong, Hong Kong
Dinesh Kabra	Indian Institute of Technology Bombay, India
Prashant Kamat	University of Notre Dame, USA
Marina Leite	University of California, Davis, USA
Linn Leppert	University of Twente, Netherlands
Monica Lira-Cantu	Catalan Institute of Nanoscience and Nanotechnology, Spain
Maria Antonietta Loi	University of Groningen, Netherlands
Ana Flavia Nogueira	Universidade Estadual de Campinas, Brazil
Selina Olthof	University of Cologne, Germany
Nam Gyu Park	Sungkyunkwan University, Republic of Korea
Yabing Qi	Okinawa Institute of Science and Technology, Japan
Erin Ratcliff	University of Arizona, USA
Michael Saliba	Universität Stuttgart, Germany
Laura Schelhas	National Renewable Energy Laboratory, USA
Carolin Sutter-Fella	Lawrence Berkeley National Laboratory, USA
Konrad Wojciechowski	Saule Technologies, Poland
Jingbi You	Institute of Semiconductors, Chinese Academy of Sciences, China

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Symposium EN05: Halide Perovskites—From Fundamentals to Applications

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

Topics will include:

- Stability and degradation mechanisms in hybrid perovskites
- Advances in fabrication methods
- Data science applied to halide perovskites
- Excitons, phonons, polarons, and carrier-phonon coupling
- Role of defects, impurity doping, and mobile ions, interfaces and surfaces
- Low dimensional systems
- Sn-Pb alternatives
- Spectroscopy and non-linear optical behavior
- Micro- and nano-scale imaging methods
- Dynamic properties and methods to interrogate them
- Theory and modeling
- Applications: photovoltaics, LEDs, photodetectors, transistors and thermoelectric devices

Invited speakers include:

Mashid Ahmadi	The University of Tennessee, Knoxville, USA
Tonio Buonassisi	Massachusetts Institute of Technology, USA
Dan Congreve	Stanford University, USA
Juan-Pablo Correa-Baena	Georgia Institute of Technology, USA
Joanne Etheridge	Monash University, Australia
Feng Gao	Linköping University, Sweden
David Ginger	University of Washington, USA
Giulia Grancini	Università degli studi di Pavia, Italy
Laura Herz	University of Oxford, United Kingdom
Yi Hou	National University of Singapore, Singapore
Libai Huang	Purdue University, USA
Mercouri Kanatzidis	Northwestern University, USA
Maksym Kovalenko	ETH Zürich, Switzerland
Monica Lira-Cantu	Catalan Institute of Nanoscience and Nanotechnology, Spain
David Mitzi	Duke University, USA
Monica Morales-Masis	University of Twente, Netherlands
Lea Nienhaus	Florida State University, USA
Nakita Noel	University of Oxford, United Kingdom
Young-Young Noh	Pohang University of Science and Technology, Republic of Korea
Nitin Padture	Brown University, USA
Annamaria Petrozza	Istituto Italiano di Tecnologia, Italy
Loredana Protesescu	University of Groningen, Netherlands
Ted Sargent	Northwestern University, USA
Laura Schelhas	National Renewable Energy Laboratory, USA
Aron Walsh	Imperial College London, United Kingdom
Yuanyuan (Alvin) Zhou	Hong Kong Baptist University, Hong Kong

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Symposium EN06: Emerging Energy Applications of Low-Dimensional Layered and Crystalline Materials

Materials that implement intrinsically reduced dimensionality, including layered 2D materials and low-dimensional (0D, 1D, 2D) hybrid organic inorganic halide perovskites (HOIP) have been attracting enormous attention owing to their unique properties, such as their layer dependent band gap, piezoelectricity, strong light absorption, magnetism, and their polymorphism. These properties enable tuning of electronic, optical, chemical and catalytic functionality via engineering structure, doping, and phase transitions. This symposium will showcase the use of these materials for a wide range of energy applications including theoretical modeling/simulations, materials applications, materials synthesis, and advanced characterization of materials.This symposium will highlight applications where layered 2D and low dimensional crystalline materials are the main active component such as battery electrodes, fuel cells, emitting diodes, photodetectors (including chiroptical emission and detection), supercapacitors, piezoelectrics, thermoelectrics, magnetoelectrics and (photo)electrocatalysis.

Topics will include:

- 2D layered transition-metal di-/tri-chalcogenides, MXenes, transition metal oxides, graphene, group-III/-IV chalcogenides, graphitic carbon nitride, 0D, 1D, 2D hybrid halide perovskite (HOIP), layered covalent-organic framework
- 2D materials for energy or hydrogen storage, water splitting, catalysis, thermo/magneto//ferroelectricity, light emission and detection.
- 2D materials and Low-Dimensional HOIP electronic, chemical and catalytic functionality via engineering structure, doping, and phase transitions.
- Machine Learning, Artificial Intelligence, and computational methods for structure description and discovery

Invited speakers include:

Mahshid Ahmadi	The University of Tennessee, Knoxville, USA	**Tae Woo Lee**	Seoul National University, Republic of Korea
Carmela Aruta	Consiglio Nazionale delle Ricerche, Italy	**Maria Antonietta Loi**	University of Groningen, Netherlands
Volker Blum	Duke University, USA	**Jodie Lutkenhaus**	Texas A&M University, USA
Cinzia Casiraghi	The Univeristy of Manchester, United Kingdom	**Aditya Mohite**	Rice University, USA
Manish Chhowalla	University of Cambridge, United Kingdom	**Alexander Norquist**	Haverford College, USA
Albert Davydov	National Institute of Standards and Technology, USA	**Annamaria Petrozza**	Istituto Italiano di Tecnologia, Italy
Letian Dou	Purdue University, USA	**Kevin Sivula**	École Polytechnique Fédérale de Lausanne, Switzerland
Jacky Even	Institut National des Sciences Appliquées, France	**Andre Taylor**	New York University, USA
Yury Gogotsi	Drexel University, USA	**Maria Vasilopoulo**	National Centre For Scientific Research Demokritos, Greece
Xiong Gong	University of Akron, USA	**Damian Voiry**	Université de Montpellier, France
Giulia Grancini	Università degli Studi di Pavia, Italy	**Yanfa Yan**	University of Toledo, USA
Mercouri Kanatzidis	Northwestern University, USA	**Mona Zebarjadi**	University of Virginia, USA
Hemmala Karunadasa	Stanford University, USA	**Hongli (Julie) Zhu**	Northeastern University, USA

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Symposium EN07: Emerging Electrocatalytic Materials and Devices for Clean Energy and Environmental Applications

This symposium is designed to highlight the most recent advances in the design, synthesis, characterization, and device evaluation of advanced electrocatalysts for energy and environmental applications. The development of highly efficient and low-cost electrocatalytic systems is at the core of electrochemical energy storage and conversion, fuel and chemical production, and environmental remediation. The mechanistic understanding and design of catalysts have been greatly improved by recent progress in precision synthesis of well-defined materials at multiple lengths (molecular/single-atom, cluster, nanoparticles and macroscale materials), advanced characterization technologies with in-situ or operando probes, and multiscale simulation methods. In addition, the transition from fundamental understanding to practical application has been accelerated by the emerging design of reaction systems and reactors that complement and maximize the performance of electrocatalysts. This symposium will provide an interactive forum for scientists from various fields who are interested in developing new catalytic materials and novel reactors, as well as in the advanced characterization of catalytic processes at surfaces and interfaces. Reactions of interest will include electrochemical water splitting and fuel cell reactions, CO_2 conversion, nitrogen cycle electrochemistry, C-H functionalization, biomass valorization, and wastewater treatment, etc. This symposium will help encourage the implementation of predictive design, smart synthesis/control and advanced characterization approaches to advance the electrocatalysis for energy and environmental applications.

Topics will include:

- Catalytic sites functionalized by molecular/atomic structure and coordination environment
- Heterogenization of molecular catalysts
- Novel approaches to synthesizing functional electrocatalysts
- Structural characterization of complex and dynamic catalyst surfaces and interfaces
- Interfacial phenomena in electrochemical reactors
- Development of catalytic system with cooperative interactions between sites/phases
- Computational work demonstrating the reactivity and promise of active sites
- In-situ/operando characterization of electrocatalytic reaction and conversion processes
- Machine learning/Artificial intelligence (ML/AI) assisted electrocatalyst development
- New electrochemical reactor design

Invited speakers include:

Héctor D. Abruña	Cornell University, USA	**Ted Sargent**	Northwestern University, USA
Raffaella Buonsanti	École Polytechnique Fédérale de Lausanne, Switzerland	**Marcel Schrier**	University of Wisconsin–Madison, USA
Jillian Dempsey	University of North Carolina at Chapel Hill, USA	**Yang Shao-Horn**	Massachusetts Institute of Technology, USA
Zhenxing Feng	Oregon State University, USA	**Samira Siahrostami**	University of Calgary, Canada
Shoji Hall	Johns Hopkins University, USA	**Ifan Stephens**	Imperial College London, United Kingdom
Marta Hatzell	Georgia Institute of Technology, USA	**Dong Su**	Institute of Physics, Chinese Academy of Sciences, China
Frances Houle	Lawrence Berkeley National Laboratory, USA	**William Tarpeh**	Stanford University, USA
Paul Kenis	University of Illinois at Urbana-Champaign, USA	**Francesca Toma**	Lawrence Berkeley National Laboratory, USA
Christina Li	Purdue University, USA	**Jesus Velazquez**	University of California, Davis, USA
Yuanyue Liu	The University of Texas at Austin, USA	**Younan Xia**	Georgia Institute of Technology, USA
Smaranda Marinescu	University of Southern California, USA	**Zhichuan Xu**	Nanyang Technological University, Singapore
Akinobu Nakada	Kyoto University, Japan	**Peidong Yang**	University of California, Berkeley, USA
Beatriz Roldán Cuenya	Fritz Haber Institute of the Max Planck Society, Germany	**Iryna Zenyuk**	University of California, Irvine, USA

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Symposium EN08: Materials for Emerging Electrochemical Separations

This symposium will broadly cover the fast-growing field of emerging electrochemical systems for energy and environmental separations. Major themes include emerging selective water purification electrode materials and membranes, materials and electrochemical systems for CO_2 separation and sequestration, and the production of environmentally-friendly synthetic fuels.

A key focus will be on societally-important separations, including novel material designs and electrochemical systems, resulting material or device performance, and development of fundamental material structure-function relationships. The symposium will focus on fundamental material science and electrochemistry enabling innovative solutions to outstanding energy and environmental problems, such as removal of CO_2 from the atmosphere or from water, emerging pollutants such as per- and polyfluoroalkyl substances (PFAS) from water, ion-selective water purification, nutrient recovery via N-and-P-containing species separations from water, metal ion recovery, such as Li from brines, and towards zero liquid discharge water purification. Also, electrochemical separations related to the energy transition are of interest, including material and cell designs enabling energy-efficient separations, electrochemical separations towards production of synthetic fuels (H_2, CO, formic acid, methanol, etc.), process intensification for co-production of water, electricity and/or synthetic fuels. Electrode materials of interest include nanoporous carbons, intercalation compounds, redox-active electrodes, electrocatalysts, as well as novel polymeric and electrically-addressable ion exchange membranes.

Topics will include:

- Ion-selective pollutant removal with nanoporous carbons, intercalation chemistry, or redox-active materials
- Material design for energy-efficient electrochemical separations
- Electrode or membrane materials for effective PFAS removal from water
- Novel electrochemical systems and materials for atmospheric CO_2 removal
- High-value materials recovery and production (e.g. Li, P, Fe, etc).
- Material designs and performance of ion-selective ion exchange membranes
- Electrically-addressable membrane design and application
- Electrochemical separations towards production of synthetic fuels
- Electrochemical water desalination (electrodialysis, capacitive deionization, redox-based desalination)
- Nanopore structure-function relationships for species-selective water purification
- Electrochemical materials and systems to enable zero-liquid discharge water purification
- New process operations for electrochemical separations or process intensifications

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

Invited speakers include:

Husam Alshareef	King Abdullah University of Science and Technology, Saudi Arabia	**Yayuan Liu**	Johns Hopkins University, USA
Martin Bazant	Massachusetts Institute of Technology, USA	**Volker Presser**	INM–Leibniz Institute for New Materials, Germany
Hanieh Bazyar	Delft University of Technology, Netherlands	**Karin Schroen**	University of Twente, Netherlands
Alan Hatton	Massachusetts Institute of Technology, USA	**Xiao Su**	University of Illinois at Urbana-Champaign, USA
Chengxiang Jiang	California Institute of Technology, USA	**William Tarpeh**	Stanford University, USA
Ryan Kingsbury	Princeton University, USA	**Lea Winter**	Yale University, USA

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Symposium EN09: Lithium-Ion Battery Recycling and Reuse

With the rapid rise and deployment of lithium ion batteries for portable and long-duration energy storage, concern has emerged regarding the resiliency of the materials supply chain. A lack of access to reliable recycling has emerged as the bottleneck toward a sustainable supply chain. In fact, the Department of Energy estimates that only 5% of discarded lithium-ion batteries get recycled. Due to this growing need, there has been a rise in the research and development conducted in industry, academia, and national labs related to recycling lithium ion batteries.

Thus, the primary scope of this symposium aims to develop a transdisciplinary research program focused on various materials related aspects of lithium ion battery recycling. The broad scope will cover research focused on unearthing critical information needed for recycling. This may range from microscopy and diagnostics of failed batteries, to the efficiency of current and emerging recycling processes, to life cycle assessments of recycling processes. The specific topic areas are listed on the next few pages.

We aim to invite a broad range of researchers from academia, industry, and government. We also intend to make this a global symposium, with researchers invited from around the world. The convergence of researchers on this topic has never taken place at this conference, and thus we aim to draw new attention towards it. We believe this is a rapidly growing area, and with the strong historical focus on materials for batteries, we believe that this new direction will be widely of interest to attendees.

Topics will include:

- Recycling Methods
- Cathode Recycling
- Electrolyte Recycling
- Green Batteries
- Life Cycle Assessment of Lithium Ion Batteries
- Safety and Hazards of Lithium ion battery recycling
- Second use of Lithium ion batteries
- Technoeconomics of Lithium ion battery recycling
- Lithium ion battery materials supply chain
- Circular economy of lithium ion batteries
- AI, Automation, and Recycling
- Hydrometallurgy and LIBs
- Pyrometallurgy and LIBs
- Electro-extraction

Invited speakers include:

Yaocai Bai	Oak Ridge National Laboratory, USA	**Steve Sloop**	OnTo Technology LLC, USA
Illias Belharouak	Oak Ridge National Laboratory, USA	**Jeffrey Spangenberger**	Argonne National Laboratory, USA
Zhongwei Chen	University of Waterloo, Canada	**Xiao Su**	University of Illinois at Urbana-Champaign, USA
Rebecca Ciez	Purdue University, USA	**Pingfeng Wang**	University of Illinois at Urbana-Champaign, USA
Sheng Dai	Oak Ridge National Laboratory, USA	**Xiaolei Wang**	University of Alberta, USA
Li Li	Beijing Institute of Technology, China	**Yan Wang**	Worcester Polytechnic Institute, USA
Oana Luca	University of Colorado Boulder, USA	**Benjamin Zahirisabzevar**	University of Illinois at Urbana-Champaign, USA
Hans Merlin	Circular Energy Storage Consultants, United Kingdom		

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Symposium EN10: From Single Atom to Device—Interfaces Under Electrochemical Conditions

The advancement and application of electrochemical energy storage and conversion systems have pushed to extremes for electrified interfaces where many important physical and (electro) chemical processes take place. In one extreme, academic researchers look at the single atom level to facilitate the interfacial reactions (e.g, oxygen reduction reaction) in fuel cells and (photo) electrolyzer. In another extreme, industrial scientists assemble thousands of atoms at solid/solid and solid/liquid interfaces of battery with a goal to deliver high energy density, superior power, and long life. The two directions appear distinct but require the high-performance interfaces under electrochemical conditions. To address the pressing opportunities and challenges, we have designed this symposium to highlight the recent frontiers at electrochemical interfaces for energy systems. The symposium will bridge expertise in academia research and industrial applications from electrochemical deposition, reactions, functional control, advanced characterizations to applications of energy devices. Particular attention will be paid to the understanding of interfacial chemistry, the control, and multimodal *operando* characterization of materials in catalysts, energy storage and conversion. This topic may also include novel architectures for mechanistic studies, such as the use of epitaxial thin film and single entities as model systems. This symposium will provide an interactive forum for scientists from various fields interested in the application of interfacial engineering to both classical and emerging applications. Specific sessions will be organized based on scientific theme topics to foster cross-fertilization of ideas and strategies. We hope this symposium will benefit materials scientists from various backgrounds, and will help encourage the implementation of rational design, smart control and advanced characterization approaches to solve the needed problems at atomic scale and device level.

Topics will include:

- Atomically dispersed catalysts for energy storage and conversion
- Single molecular and single entity electrochemistry
- Additive engineering of interfaces and interphases in energy storage
- Interfacial electrochemistry induced phase transformations in battery, fuel cell and water splitting
- The electrode/electrolyte (e.g. solid/liquid and solid/solid) interfaces in energy storage and conversion
- *In situ* and *operando* characterizations of electrochemical interfacial processes (e.g. synchrotron X-ray, neutron, TEM and Cryo-EM) in functional materials
- Single crystal, thin film and substrate supported model systems for electrochemical energy systems
- Fundamental reactions, structures and transport at electrochemical interfaces under extreme conditions

Joint sessions are being considered with **SF02 - Crystallization and Assembly at Interfaces—Fundamental Breakthroughs Enabled by Data-Centric Analysis and *In Situ/Operando* Techniques**.
Also, a **tutorial** complementing this symposium is tentatively planned. Further information will be included in the MRS Program that will be available online in September.

Invited speakers include:

Miaofang Chi	Oak Ridge National Laboratory, USA	**Shelley Minter**	University of Utah, USA
William Chueh	Stanford University, USA	**Yifei Mo**	University of Maryland, USA
Neil Dasgupta	University of Michigan, USA	**Marie-Ingrid Richard**	European Synchrotron Radiation Facility, France
Frank de Groot	Utrecht University, Netherlands	**Vasiliki Tileli**	École Polytechnique Fédérale de Lausanne, Switzerland
Shougo Higashi	Toyota Central R&D Lab, Japan	**Luisa Whittaker-Brooks**	University of Utah, USA
Yaqin Huang	Beijing University of Chemical Technology, China	**Gang Wu**	University at Buffalo, The State University of New York, USA
Boryann Liaw	Idaho National Laboratory, USA	**Sen Zhang**	University of Virginia, USA
Edvin Lundgren	Lund University, Sweden	**Huiyuan Zhu**	University of Virginia, USA
Miaomiao Ma	U.S. Naval Research Laboratory, USA		

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Symposium QT01: Excitonic Materials

Excitons or bound electron-hole pairs form the backbone of a large class of low-dimensional and quantum materials showing exotic physical and chemical properties. Current studies in Excitonic Materials are really progressing very rapidly in newer directions as well as in novel materials. Therefore, the main focus of this symposium will be to catch the recent progresses in the materials science of Excitonic Materials from both fundamental science and emerging applications. Another important objective of the proposed symposium on Excitonic Materials will be to have cross-disciplinary exchange of results and ideas among researchers working on different aspects of excitons.

Topics will include:

- Excitons in Novel Materials: 2D Materials, Perovskites, Oxides, Group IV, II-VI and III-V semiconductors, Colloidal Nanocrystals, Organic Semiconductors and Polymers, Synthesis & Fabrication, Metamaterials.
- Excitonic phenomena: Exciton Transport, Spintronics & Magneto-optical properties, Excitonic BEC etc, Excitonic Molecules, Rydberg Excitons, Mahan excitons, Excitons under strain and electric fields.
- Time resolved studies of Excitons: Exciton-Polaritons, Plexitons, Non-linear Optical Properties, Ultra-fast Spectroscopy.
- Excitons in Quantum Materials and Quantum Technologies: Excitonic Qubits, Quantum Control of Single Excitons, Quantum Coherent Control of Excitons, Single-photon emitters based on Excitons.
- Different varieties of Excitons: Topological Excitons, Interfacial Excitons, Hybrid Frenkel-Mott Wannier Excitons, Electronic Structure Calculation of Excitonic Materials, Dark and Bright Excitons, Interlayer excitons.
- Device Applications of Excitons: Excitonic Photochemistry and Photocatalysis, Energy Harvesting and Solar Energy Conversions, Energy Efficient Solid State Lighting, Biomaterials and Biotechnology.

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

Invited speakers include:

Ashish Arora	Indian Institute of Science Education and Research, Pune, India
Uri Banin	Hebrew University of Jerusalem, Israel
Rudolf Bratschitsch	University of Münster, Germany
Andrey Chaves	Universidade Federal do Ceara, Brazil
Keshav M. Dani	Okinawa Institute of Science and Technology, Japan
Hui Deng	University of Michigan, USA
Subhabrata Dhar	Indian Institute of Technology Bombay, India
Jaroslav Fabian	Universität Regensburg, Germany
Robert Hoye	University of Oxford, United Kingdom
Deep Jariwala	University of Pennsylvania, USA
Dinesh Kabra	Indian Institute of Technology Bombay, India
Bumjoon Kim	Korea Advanced Institute of Science and Technology, Republic of Korea
Jeongyong Kim	Sungkyunkwan University, Republic of Korea
Julian Klein	Massachusetts Institute of Technology, USA
Maksym Kovalenko	ETH Zürich, Switzerland
Martin Kroner	ETH Zürich, Switzerland
Makoto Kuwata-Gonokami	University of Tokyo, Japan
Kai-Qiang Lin	Xiamen University, China
Kaushik Majumdar	Indian Institute of Science, Bengaluru, India
Liberato Manna	Istituto Italiano di Tecnologia, Italy
Xavier Marie	Institut National des Sciences Appliquées, France
Oksana Ostroverkhova	Oregon State University, USA
Marcos A. Pimenta	Universidade Federal de Minas Gerais, Brazil
Paulina Plochocka	Centre National de la Recherche Scientifique, France
Marek Potemski	Centre National de la Recherche Scientifique, France
Karthik Shankar	University of Alberta, Canada
Michelle Yvonne Simmons	University of New South Wales, Australia
Daniel Wigger	Trinity College Dublin, The University of Dublin, Ireland
Stefan Zollner	New Mexico State University, USA
Xiaolong Zou	Tsinghua University, China

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Symposium QT02: Space, Energy and Time-Resolved Spectroscopies for Emergent Quantum Materials

Quantum materials are materials in which electrons behave collectively in ways unpredictable from the reductive models. These collective electronic properties exhibit quantum effects over wide energy and length scales. Information about these collective properties and the underlying entanglement are encoded in a supporting space composed of real-space, reciprocal space, and energy space, requiring precise characterizations using microscopy, diffraction, and spectroscopy. In recent years, the rapid technical developments such as synchrotron X-ray, terahertz laser, and free-electron laser have enabled characterization, control, and design of emergent quantum phases at an unprecedented level.

Given these rapid development advanced spectral characterization methods in quantum materials, we feel obliged to organize a symposium to address the vast opportunities and challenges faced by these techniques and leading to new discoveries in quantum materials. We envision this symposium to highlight most recent progress, applications and forefront challenges in various types of quantum materials, such as superconductors, topological materials, strange metals, and frustrated magnets. We emphasize the recent progress in spectral techniques, such as angular-resolved photoemission spectroscopy (ARPES), neutron scattering, X-ray-absorption (XAS), inelastic resonance X-ray scattering (RIXS), and their nonequilibrium extensions. The goal of this symposium is to provide an interactive forum to facilitate materials scientists in various fields to digest the exciting progress of quantum materials with reduced knowledge barrier and identify new opportunities. Specific sessions will be organized regarding the scientific theme topics rather than with the similarity of a category of materials to benefit cross-fertilization. A couple of sessions will focus on recent methodological advances of the spectral techniques, recent discoveries of quantum phases enabled by these techniques, and computational breakthroughs.

Topics will include:

- Novel phases in functional quantum materials and their characterizations
- Hallmark time-resolved characterization and ultrafast control of quantum materials
- High-precision characterization thin films and heterostructures toward quantum control and manipulation
- Multimodal 2D materials for fundamental quantum properties exploration.
- Materials with quantum information applications and quantum control.
- State-of-the-art photoemission spectroscopies and their role for material studies
- State-of-the-art neutron and X-ray scattering to explore orders in correlated materials.
- Femtosecond to attosecond ultrafast free electron laser for materials properties far away from equilibrium.
- Unconventional emerging materials characterization techniques
- Theory and numerical methods about quantum materials and their spectroscopies

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

Invited speakers include:

Peter Abbamonte	University of Illinois at Urbana-Champaign, USA	**Wei-Sheng Lee**	SLAC National Accelerator Laboratory, USA
Charles Ahn	Yale University, USA	**Young S. Lee**	Stanford University, USA
Edoardo Baldini	The University of Texas at Austin, USA	**Claudio Mazzoli**	Brookhaven National Laboratory, USA
Andrew Boothroyd	University of Oxford, United Kingdom	**Daniel Mazzone**	Paul Scherrer Institute, Switzerland
Andrea Cavalleri	Max Planck Institute for the Structure and Dynamics of Matter, Germany	**Jill Miwa**	Aarhus University, Denmark
Riccardo Comin	Massachusetts Institute of Technology, USA	**Claude Monney**	University of Fribourg, Switzerland
Mark Dean	Brookhaven National Laboratory, USA	**Sakura Pascarelli**	European XFEL, Italy
Adrian Feiguin	Northeastern University, USA	**Heike Pfau**	The Pennsylvania State University, USA
Brent Fultz	California Institute of Technology, USA	**Angel Rubio**	University of the Basque Country, Germany
Martin Greven	University of Minnesota, USA	**Virginie Simonet**	Centre National de la Recherche Scientifique, France
Emmanuel Gull	University of Michigan, USA	**Takami Tohyama**	Tokyo University of Science, Japan
Steve Johnston	Oak Ridge National Laboratory, USA	**Ming Yi**	Rice University, USA

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Symposium QT03: Higher-Order Topological Structures in Real Space—From Charge to Spin

Real space structures with non-trivial topology, such as skyrmions, merons, dislocations and domain walls, are rich sources for emergent functional phenomena, enabling local control of magnetic, electronic and ionic transport properties, light-matter interactions, propagation of (electro)magnons and phonons, and more. The concept of topology has led to a strong cross-disciplinary dimension connecting the ferroelectrics and the magnetism communities. It is now clear that higher-order topological charge and spin textures open up a plethora of possible future dynamic nanoelectronics, spintronics and quantum devices. The beauty and connections of the unifying scientific concepts in materials with electric and / or 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 aims to bring together scientific experts and young scientists with an interest in topologically non-trivial charge and spin textures that arise in real space, fostering interactions and advancing knowledge of higher-order topological structures in ferroelectrics, multiferroics and magnetic materials.

Topics will include:

- Skyrmions and chiral textures, higher-order topological structures
- Domains and domain walls, dislocations and disclinations
- Vortex, anti-vortex, and vertex structures
- Nanoelectronics and unconventional computing using topological defects
- Interactions with extrinsic and intrinsic defects
- Emergent functional properties (transport, light-matter interactions, propagation of (electro)magnons and phonons, etc.)
- Materials (bulk crystals, thin films, superlattices, quasi-2D and free-standing systems)
- Controlled formation and movement of electric and magnetic topological structures
- Atomic-scale charge, spin and phonon characterization
- Three-dimensional characterisation and reconstruction of high order topologies
- In-situ/operando characterization of dynamic processes via electron, x-ray, optical and scanning and microscopy
- Scale-bridging characterizarion: from picometer to micrometer, from picosecond to metastable
- Scale-bridging theoretical simulation and modelling: from atomistic to mesoscopic, from equilibrium to driven processes

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

Invited speakers include:

Marin Alexe	University of Warwick, United Kingdom
Laura Begon-Lours	IBM Ltd., Switzerland
Gustau Catalan	Catalan Institute of Nanoscience and Nanotechnology, Spain
Miaofang Chi	Oak Ridge National Laboratory, USA
Claire Donnelly	Max Planck Institute for Chemical Physics of Solids, Germany
Rafal Dunin-Borkowski	Forschungszentrum Jülich GmbH, Germany
Paul Evans	University of Wisconsin–Madison, USA
Claudia Felser	Max Planck Institute for Chemical Physics of Solids, Germany
Yukako Fujishiro	RIKEN, Japan
Jorge Iniguez	University of Luxembourg, Luxembourg
Katherine Inzani	University of Nottingham, United Kingdom
Lane Martin	University of California, Berkeley, USA
David Muller	Cornell University, USA
Julia Mundy	Harvard University, USA
Kayla Nguyen	University of Illinois at Urbana-Champaign, USA
Beatriz Noheda	University of Groningen, Netherlands
Xiaoqing Pan	University of California, Irvine, USA
Licong Peng	RIKEN, Japan
Amanda Petford-Long	Argonne National Laboratory, USA
Roger Proksch	Oxford Instruments Asylum Research, USA
Ramamoorthy Ramesh	University of California, Berkeley, USA
William Ratcliff	National Institute of Standards and Technology, USA
Jan Seidel	University of New South Wales, Australia
Naoya Shibata	The University of Tokyo, Japan
Sandhya Susarla	Lawrence Berkeley National Laboratory, USA
Rina Takagi	University of Tokyo, Japan
Phoebe Tengdin	École Polytechnique Fédérale de Lausanne, Switzerland
Morgan Trassin	ETH Zürich, Switzerland
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Symposium QT04: 2D Topological Materials—Theoretical Models, Growth and Applications

2D Topological materials are a new class of materials that can, thanks to their extraordinary properties, project us in the Beyond CMOS world. The symposium will cover the growth, the theoretical models on physics and the applications for 2D topological materials. The first part will focus on the growth of 2D materials. The growth of the new generation of 2D topological materials such as Stanene, Plumbene, Bismuthene or Tellurene will be presented and will have an important place. We will highlight the issues concerning the capacity to obtain layers that do not react with ambient environment using opportune protection without changing the layer properties and on their functionalization for band gap engineering. The second part of the symposium will deal with the theoretical models explaining the topological behavior. A part will be devoted to the way and the conditions for the Quantum Spin Hall effect (QSH) to take place in 2D Topological insulators. Theoretical models that will link the QSH with other properties, such as ZT (figure of merit) for Thermoelectrics (TE) materials will be highlighted. The way to decouple phonon and charge in these materials exploiting functionalization or adding defects will be pointed out in this session. In the third part of the symposium, first applications of these materials will be presented. 2D topological materials can be a game changer in different fields such as TE with large ZT (i.e. avionics, space, energy consumption reduction in new intelligent buildings), new forms of quantum computing/memories at subatomic level and beyond CMOS electronics exploiting spin transport with very low energy consumption.

Topics will include:

- 2D Topological materials growth
- Chemical approach to grow and taylor 2D Topological materials
- Surface functionalisation
- 2D Topological insulators : physics, models and QSHE evidence
- 2D Topological materials and van der Waals structures: new physics and potential applications
- Ambient stability of 2D topological materials
- Applications : thermoelectrics, spin-computing, spin-transport,...
- Beyond CMOS electronics based on 2D materials
- Exotic properties of 2D topological materials

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

Invited speakers include:

Monica Allen	University of California, San Diego, USA
Kwabena Bediako	University of California, Berkeley, USA
Bogdan Bernevig	Princeton University, USA
Mads Brandbyge	Technical University of Denmark, Denmark
Ralph Claessen	Julius-Maximilians-Universität Würzburg, Germany
Maria Davila	Spanish National Research Council, Spain
Athanasios Dimoulas	Institute of Nanocience and Nanotechnology, Greece
Yannick Fagot-Revurat	Université de Lorraine, France
Claudia Felser	Max Planck Institute for Chemical Physics of Solids, Germany
Albert Fert	Thales, France
Giorgia Fugallo	Université de Nantes, France
Zahid Hasan	Princeton University, USA
Anna Isaeva	Technische Universität Dresden, Germany
Charles Kane	University of Pennsylvania, USA
José Lado	Aalto University, Finland

Annick Loiseau	Office National d'Etudes et de Recherches Aérospatiales, France
Marie-Blandine Martin	Thales, France
Nadya Mason	University of Illinois at Urbana-Champaign, USA
Cecilia Mattevi	Imperial College London, United Kingdom
Marco Minissale	Aix-Marseille Université, France
Laurens W. Molenkamp	Julius-Maximilians-Universität Würzburg, Germany
Isabel Montero	Spanish National Research Council, Spain
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Symposium SB01: Engineering Future Food Materials—Ingredients, Processes and Fabrication

As the global population rises alongside a worsening climate outlook, alternative strategies to mitigate and reduce the negative effects of animal agriculture are needed. Alternative proteins such as plant and cell-based meat provide exciting avenues for meeting the increasing demand for meat sourced from animals and have implications for planetary and human health. The creation of new food technologies which are appetizing, affordable, and scalable enough to shift towards alternative food sources requires significant scientific efforts and investment. While food science is a well-established field with a rich history, inclusion of methods and research paradigms from the materials community can accelerate the development of promising food technologies. Engineering these new technologies requires a deeper understanding of functional plant-sourced ingredients, relationships between processing and material structure, biomaterial development, and methods for prolonging food longevity. In this symposium, we bring together industry and academic leaders from across disciplines to discuss applications of chemistry, engineering, and materials science towards the advanced food technologies.

Topics will include:

- Hydrocolloids and food microstructures
- Methodologies for characterization, modeling, and discovery in food science
- Protein polysaccharide interactions
- Biomimetic and bio-inspired systems
- Reversible gelation, temperature-dependent gelation
- Structured lipids and oleogels
- Flavor compounds, natural pigments and oxidative properties, and analytical chemistry
- Processing and applications of novel ingredients
- Biomaterial mimicry, biopolymer processing and properties
- Packaging, longevity, shelf-life, and food quality preservation and monitoring
- AI and machine learning for food development
- Biofabrication
- Tissue engineering and scaffold materials

Invited speakers include:

Ester Caffarel	Massachusetts Institute of Technology, USA	**Benedetto Marelli**	Massachusetts Institute of Technology, USA
Laura Domigan	The University of Auckland, New Zealand	**Mark Miodownik**	University College London, United Kingdom
David Kaplan	Tufts University, USA	**Fiorenzo Omenetto**	Tufts University, USA
Jess Krieger	Ohayo Valley, USA	**Vayu Maini Rekdal**	University of California, Berkeley, USA
Kent Leach	University of California, Davis, USA	**Begoña Ruiz**	AINIA, Spain
Alejandro Marangoni	University of Guelph, Canada	**Karin Schroen**	Wageningen University, Netherlands

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Symposium SB02: Biomimetic Organic and Hybrid Frameworks for Imaging, Encapsulation and Delivery

Nature embraces the principles of supramolecular chemistry, exploiting noncovalent interactions and coordination chemistry in various ways to facilitate all biological processes. Inspired by nature, the assembly of complex synthetic systems in both solution and the solid state is becoming increasingly feasible. This often requires that known systems be modeled, explored, and fine-tuned in order to develop further systems or biomimics of even higher complexity. In this symposium, we will focus on biomimetic organic and hybrid frameworks that are specifically designed for biological and biomedical applications. Research on metal-organic frameworks, hydrogen-bonded frameworks and covalent organic frameworks has tremendously increased over the past decade. Coordination-based delivery vehicles, which include nanosized extended metal organic frameworks (nMOFs) and discrete coordination cages, have gained a lot of attention because of their remarkable biocompatibility, in-vivo stability, on-demand biodegradability, high encapsulation efficiency, easy surface modification and moderate synthetic conditions. Consequently, these systems have been extensively utilized as carriers of biomacromolecules for biomedical applications. In this symposium, we will focus on the major achievements in this field and the hurdles that we still need to overcome to move closer into pharmaceutical translation. We believe this is a very timely topic and will be of big interest to MRS attendees.

Topics will include:

- Metal-Organic Frameworks (MOFs) for biomedical applications
- Covalent-Organic Frameworks (COFs) for biomedical applications
- Hydrogen- Bonded Organic Frameworks (HOFs) for biomedical applications
- Porous and Coordination Cages
- Biocompatible self-assemblies for encapsulation and delivery

Invited speakers include:

Jia Min Chen	University of Vienna, Austria	**Chinedum Osuji**	University of Pennsylvania, USA
Seth Cohen	University of California, San Diego, USA	**Gangfeng Ouyang**	Sun Yat-Sen University, China
Paolo Falcaro	Graz University of Technology, Austria	**Zachariah Page**	The University of Texas at Austin, USA
Omar Farha	Northwestern University, USA	**Joe Patterson**	University of California, Irvine, USA
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Roberto Fernandez	Basque Center on Materials, Applications and Nanostructures, Spain	**Christian Serre**	Ecole Normale Supérieure, France
Jeremiah Gassensmith	The University of Texas at Dallas, USA	**Fa-Kuen Shieh**	National Central University, Taiwan
Nathan Gianneschi	Northwestern University, USA	**Clemence Sicard**	Université de Versailles Saint-Quentin-en-Yvelines, France
Mónica Giménez-Marqués	Universitat de València, Spain	**Ronald Smaldone**	The University of Texas at Dallas, USA
Jennifer Hiscock	University of Kent, United Kingdom	**Ali Trabolsi**	New York University Abu Dhabi, United Arab Emirates
Patricia Hocajada	IMDEA, Spain	**Ying-wei Yang**	Jilin University, China
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Symposium SB03: Molecular Biomimetics—Biology Meets Materials Science and Artificial Intelligence at the Molecular Dimensions

Biological hard tissues have been the inspiration for scientists and engineers due to their extraordinary hierarchical structural organization and the resultant multifunctional properties. These natural composites of minerals are formed by proteins and peptides that enable the nucleation and growth of inorganic solids and control the shape of minerals in organisms. Inspired by biology at the lowest dimensional scale, molecular biomimetics utilizes short peptides (solid binding peptides) developed using directed evolution with affinities to inorganics. The last two decades have seen the development of this fledgling field at the cross-sections of molecular biology/genetics, materials science/engineering, and computational sciences/informatics. This symposium will bring materials scientists, condensed- and soft-matter physicists and chemists, molecular biologists, and geneticists with computational and machine intelligence scientists in a truly convergent science platform to review the evolution of the molecular biomimetics concepts and approaches during the last decades and explore its widening potential, both in fundamentals and practical implementations into the future, including materials and bio/physico/chemistry of molecular recognition and signal transduction, quantum biology, genetically enabled bio-electronic,-magnetic and -photonic materials, sensors, and logic devices as well as mainstream applications in bone and dental tissue engineering, biomedical materials coatings, and as peptide-functionalized drugs and delivery systems.

Topics will include:

- Lessons from Biology at the Molecular Dimensions
- High throughput Approaches for Selection and Screening of Peptides
- Self-assembled Peptide Nanostructures
- Molecular Bioelectronics, Biophotonics, and Biomagnetics
- Peptide-guided Machinery for Biosensing, Energy Harvesting, and Green Synthesis
- Repair and Regeneration of Biological Hard Tissues
- Catalytic Peptides for Bio/Nanotechnology and Medicine
- Chimeric Peptides – Tools for materials and medicine
- Machine Learning Approaches for the Predictive Design of Soft Bio/Nano Interfaces
- Computational Modeling of Peptide-Solid Interactions

Invited speakers include:

Nurit Ashkenasy	Ben-Gurion University of the Negev, Israel
David Baker	University of Washington, USA
Francois Baneyx	University of Washington, USA
Bikramjit Basu	Indian Institute of Science, Bengaluru, India
Stefano Corni	Università degli Studi di Padova, Italy
Nora de Leeuw	University of Leeds, United Kingdom
James De Yoreo	Pacific Northwest National Laboratory, USA
Takeshi Fukuma	Kanazawa University, Japan
Paula Hammond	Massachusetts Institute of Technology, USA
Hendrik Heinz	University of Colorado Boulder, USA
Christian Hellmich	Technische Universität Wien, Austria
Dinesh Katti	North Dakota State University, USA
Alvaro Mata	University of Nottingham, United Kingdom
Rajesh Naik	Wright-Patterson Air Force Base, USA
Roger Narayan	North Carolina State University, USA
Carole Perry	Nottingham Trent University, United Kingdom
Bryan Reed	Integrated Dynamic Electron Solutions, Inc., USA
Ram Samudrala	University at Buffalo, The State University of New York, USA
Mehmet Sarikaya	University of Washington, USA
Kiyotaka Shiba	Japanese Foundation for Cancer Research, Japan
Candan Tamerler	University of Kansas, USA
Tiffany Walsh	Daekin University, Australia
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Symposium SB04: Conducting and Functional Hydrogels—From Materials to Devices

Hydrogels are water-swollen natural and synthetic polymer networks which mimic the extracellular matrix of biological tissues. Due to their high water content (>90% by mass), hydrogels uptake their surrounding medium, such as ions, small molecules, and dissolved oxygen in biological fluids (e.g. cell culture media, interstitial fluid). Beyond ionic conductivity, hydrogels may be engineered to possess functional properties such as electrical, magnetic, optical, and piezoelectric. For example, hydrogels may be made of intrinsically electronically conducting polymers, such as conjugated polymers and mixtures based on thiophenes, pyrroles, or anilines. Additionally, active additives (e.g. polymers, nanomaterials, drugs) can be embedded in the matrices to impart other properties. Such functional hydrogels are being explored as part of bioelectronic, ionotronic, and photonic devices. In addition to functional properties, hydrogels may be designed to have unique mechanical properties that outperform their non-hydrogel counterparts. Soft hydrogels with mechanical profiles comparable to biological tissues may be ideal for biointerfacing, or formulations with high toughness or self-healing properties may useful in strain-dynamic applications. Despite these successful demonstrations, the synthesis and processing to achieve mutually exclusive properties, such as high conductivity with high stretchability, remains challenging. In various applications, hydrogels and their assembled devices are required to perform in complex environments, which imposes additional constraints on fundamental materials properties.

This symposium will bring together investigators from multiple disciplines to address the synthesis, characterization, processing, and fabrication of hydrogels or other hydrated materials that either (1) possess advanced properties including electronic, ionic, magnetic, optical, and piezoelectric or (2) are used in the construction of functional devices, such as electrode arrays, sensors, wearables for biological interfacing; biomimetic devices; soft robotics, and actuators; devices for monitoring and controlling cellular systems in vitro.

Topics will include:

- Conducting hydrogels & proteins: synthesis, characterization and application
- Various form factors of soft conducting materials (fibers, composites, 3D porous scaffolds)
- Electronically and/or ionically conducting materials
- Soft conducting materials with additional/unique properties (healable, stretchable)
- Cell-laden or biohybrid electronics and/or living hydrogels and their applications
- Bioinspired and biomimetic bioelectronics
- Smart and programmable hydrogels
- Hydrogels in soft robotics (e.g. actuators)
- Ionic, electronic, magnetic, and optical devices comprised of hydrogels, natural materials, and other hydrated materials
- Studies of aqueous operation and stability of electronic materials and devices as well as material interfaces
- Additive manufactured hydrogels and devices (3D, 4D)
- Hydrogels combined with synthetic biology approaches

Joint sessions are being considered with **EL05 - Soft Optics**, and **SB10 - From Soft Hydrogel Materials to Hard Materials for Sports Equipment—Bridging the Gap with Additive Manufacturing**.

Invited speakers include:

Maria Asplund	Chalmers University of Technology, Sweden	**Ivan Minev**	University of Sheffield, United Kingdom
Eloise Bihar	University of Colorado Boulder, USA	**Seongjun Park**	Korea Advanced Institute of Science and Technology, Republic of Korea
Fabio Cicoira	Polytechnique Montréal, Canada	**Khalil Ramadi**	New York University, USA
Rylie Green	Imperial College London, United Kingdom	**Anderson Shum**	University of Hong Kong, Hong Kong
Laure Kayser	University of Delaware, USA	**Eleni Stavrinidou**	Linköping University, Sweden
Dae-Hyeong Kim	Seoul National University, Republic of Korea	**Jadranka Travaš-Sejdic**	The University of Auckland, New Zealand
Jiyun Kim	Ulsan National Institute of Science and Technology, Republic of Korea	**Cunjiang Yu**	The Pennsylvania State University, USA
Wei Lin Leong	Nanyang Technological University, Singapore	**Hyunwoo Yuk**	SanaHeal, USA
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Symposium SB05: Biohybrid and Soft Functional Interfaces

In billions of years, natural evolution has perfected many biological machines that are multifunctional and sustainable. This has inspired researchers to realize artificial systems that recapitulate biological design and function by using novel materials and architectures with the ability to process electronic or photonic signals, as well as by exploring the integration of living organisms with synthetic organic or inorganic components. The goal of the symposium is to discuss the state-of-the-art in functional materials, devices and processes for realizing biohybrid systems and soft functional interfaces that mimic the natural communication/signaling mechanisms in biological systems. This symposium will broadly cover emerging materials and architectures used in abiotic-biotic hybrid systems and functional interfaces, their fundamental design and properties, as well as their applications for biomedical technologies, actuators, or sensors integrated with microorganisms, cells, and tissues, including plants. Bridging the world of biology together with other technological areas such as photonics, electronics, and nanotechnology, this interdisciplinary symposium will bring together the cutting-edge chemical, physical, and biological aspects of current and future biohybrid and soft functional interfaces.

Topics will include:

- Soft electronic materials and biological systems interface
- Functional electroactive biomaterials
- Biodegradable electroactive small molecules and polymers
- Conducting and multifunctional hydrogels
- Flexible, stretchable active/passive materials forused in bioelectronics
- Novel biological signal transduction approaches
- Devices and materials that combine multiple sensing or stimulation modalities
- Biosensing/stimulation devices, and closed loop sensing/stimulation
- Brain-machine interfacing and health monitoring
- Materials for I/O neuronal interfaces
- Plant micro- and nanobionics
- Plant biohybrid systems
- Microorganisms and cells engineering for biosensing and energy applications
- Bio-fabrication with electroactive systems
- Cell-based biohybrids systems for biomedical applications

Invited speakers include:

Polina Anikeeva	Massachusetts Institute of Technology, USA
Guillermo Bazan	National University of Singapore, Singapore
Ardemis Boghossian	École Polytechnique Fédérale de Lausanne, Switzerland
Ritchie Chen	Stanford University, USA
Tzahi Cohen-Karni	Carnegie Mellon University, USA
Tracy Cui	University of Pittsburgh, USA
Tal Dvir	Tel Aviv University, Israel
Gianluca Farinola	Università degli Studi di Bari Aldo Moro, Italy
Guosong Hong	Stanford University, USA
Neel Joshi	Northeastern University, USA
Dae-Hyeong Kim	Seoul National University, Republic of Korea
Stéphanie P. Lacour	École Polytechnique Fédérale de Lausanne, Switzerland
Róisín Owens	University of Cambridge, United Kingdom
Kit Parker	Harvard University, USA
Giuseppe Paterno	Politecnico di Milano, Italy
Jacob Robinson	Rice University, USA
Alberto Salleo	Stanford University, USA
Francesca Santoro	RWTH Aachen University, Germany
Deblina Sarkar	Massachusetts Institute of Technology, USA
Su Ryon Shin	Brigham and Women's Hospital, USA
Michael Strano	Massachusetts Institute of Technology, USA
Bozhi Tian	The University of Chicago, USA
Claudia Tortiglione	Consiglio Nazionale delle Ricerche, Italy
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Symposium SB06: Experimental and Computational Advances in Biomolecular Electronics

This symposium will cover recent advances in BioMolecular Electronics. In particular, the focus will be on recent advances in measuring and tuning the charge transport through individual biomolecules or biological complexes. The first part will focus on the latest experimental advances in charge transport measurements in biomolecules at the single-molecule level, including self-assembling approaches that use biomolecules to generate nanostructures and nanodevices. The second will highlight computational methods and emerging data analysis, such as Machine Learning applied to study these fascinating systems. Joint sessions will be flexible, too, including combined and synergistic research to stimulate discussions.

Materials science in general, and nanoscience and nanotechnology, in particular, have promised multiple applications enabled by an unprecedented control of matter. One of them is the ultimate miniaturization of electronic components and circuits to the scale of individual molecules. This exciting field is known as Molecular Electronics. Shortly after opening the door for reliable single-molecule conductance measurements, biomolecules were also considered for these studies. The field of single-molecule bioelectronics has experienced a boom in the last decades. Nanoscience tools such as Scanning Tunneling Microscopy (STM) or Break-Junctions have enabled single-molecule electronic studies of biomolecules, including nucleic acids, peptides, redox proteins, and more complex biosystems. BioMolecular Electronics is an emerging field with applications that may contribute to solving present and future societal challenges.

Topics will include:

- Single-molecule electrical measurements on nucleic acids
- Single-molecule measurements on peptides, proteins, and biomolecular interactions
- BioMolecular Spintronics
- Quantum effects in the charge transport through Biomolecules
- Single-molecule Electrical Biosensors
- BioMolecular Electronics applications in nanotechnology: bottom-up approaches and self-assembled circuits
- Coupled Molecular Dynamics-Quantum Transport Calculations
- New experiment-theory-computation synergies in BioMolecular Electronics
- Emerging computational approaches: Machine Learning in BioMolecular Electronics
- Data analysis for single-molecule results interpretation
- Experimental advances and New techniques in biomolecular electronics
- Emerging BioMolecular Electronics Applications
- The Charge Transport Mechanisms in Biomolecules: Experimental Evidence, Computational approaches, and current controversies

Invited speakers include:

Nadav Amdursky	Technion–Israel Institute of Technology, Israel
Albert Aragones	Universitat de Barcelona, Spain
David Cahen	Weizmann Institute of Science, Israel
James Canary	New York University, USA
Ismael Diez-Perez	King's College London, United Kingdom
Andy Ellington	The University of Texas at Austin, USA
Ersin Emre Oren	TOBB University of Economics and Technology, Turkey
Yueqi Li	University of Science and Technology of China, China
Stuart Lindsay	Arizona State University, USA
Hashem Mohammad	Kuwait University, Kuwait
Vladimiro Mujica	Arizona State University, USA
Tomoaki Nishino	Tokyo Institute of Technology, Japan
Luisa Torsi	Università degli Studi di Bari Aldo Moro, Italy

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Symposium SB07: Translational Neuroelectronic Materials and Devices for Bioelectronic Medicine

The convergence of biomaterials and electronic devices provides an intellectual landscape that spans a variety of disciplines including materials science and engineering, physics, chemistry, polymer sciences, and medicine. Of particular interest are materials that act at the interface between electronics and biology e.g. supporting sensing, stimulation and signal transduction or actively modulating the tissue microenvironment. One example is neural interfaces, which are devices that are implanted into the nervous system for communication with neural tissue (recording from and stimulation of), e.g. to treat or assist patients with disabilities or neurological disorders.

The quality of signal transduction between the electrodes and neurons depends on physical and chemical properties of the electrode-tissue interface that ultimately relies on the specifics of the material design that enables a long-term stable and functional interface. The challenge for materials science is to design and develop advanced multifunctional biomaterials to safely integrate with neural tissue with minimal biological response. Substrates and electrode materials must meet strict electrochemical requirements such as long-term stability, biocompatibility, and resistance to corrosion in physiological environment. Furthermore, the implant materials and structure should match the mechanical properties of surrounding tissue to prevent injury due to micromotion and allow for adequate exchange of nutrients and waste so that the surrounding tissue remain healthy. Last, but not least, there is a translational challenge, and a need to streamline process technologies to match stringent regulatory requirements.

This symposium will focus on the latest advances in biomaterials to control/engineer neuron- and bio-electronic interfaces to produce stable and functional systems with greater longevity than what is possible today. Session topics will spotlight the latest efforts to achieve the most effective and safest strategies to communicate with neurons. The symposium is not limited to applications in the nervous system, but will address the broader context of bioelectronic medicine.

Topics will include:

- Flexible neural electrodes
- Neural electrode materials
- Surface modification of neural electrodes
- Biocompatibility of neural electrodes
- Artificial retina, Cochlear implants, Artificial senses
- Drug delivery to the brain
- Materials at the interface with biology
- Axonal guidance
- Biostability of the neuroprosthetics
- Integrated sensors and recording
- Limb prostheses

Invited speakers include:

Mohammad Reza Abidian	University of Houston, USA	**Eric Glowacki**	CEITEC - Central European Institute of Technology, Czech Republic
Polina Anikeeva	Massachusetts Institute of Technology, USA	**Dion Khodagholy**	Columbia University, USA
Zhenan Bao	Stanford University, USA	**Tae-il Kim**	Sungkyunkwan University, Singapore
Elisabetta Chicca	University of Groningen, Netherlands	**Stéphanie P. Lacour**	École Polytechnique Fédérale de Lausanne, Switzerland
Tiago Costa	Delft University of Technology, Netherlands	**John Rogers**	Northwestern University, USA
Timothy Denison	University of Oxford, United Kingdom	**Darren Svirskis**	University of Auckland, New Zealand
José Garrido	Catalan Institute of Nanoscience and Nanotechnology, Spain	**Benjamin Tee**	National University of Singapore, Singapore

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Symposium SB08: Bio-Based Polymers and Composites for Sustainable Manufacturing

Demand for sustainable and environmentally friendly alternatives to conventional carbon-intensive and petroleum-derived products has grown tremendously in recent years. This growth is only expected to continue with an increasing public awareness on the deleterious effects of industrial processes and nonrenewable materials as well as a high number of companies declaring climate pledges and striving to be carbon-neutral or "net zero" within the next few decades. Renewable materials with a low carbon footprint are sought as alternatives in a wide variety of industries including packaging, consumer products, electronics and energy storage, building and construction, automotive, wind energy, and marine. However, matching the performance of incumbent petroleum-derived or nonrenewable materials with bio-based materials has remained a challenge in many of these areas. This symposium solicits emerging research in bio-based polymers and composites with a focus on manufacturing and applications of these materials on a large scale. Materials wholly or partly derived from biomass with unique structures and/or functionalities and their potential industrial impact are of interest. Research in the fields of chemistry, materials engineering, advanced computing, manufacturing science, chemical and process engineering, and biochemistry and bioengineering that are advancing the forefront of technology in bio-based materials and sustainability in manufacturing practices are invited for submission.

Topics will include:

- Scalable polymer synthesis from biological precursors
- Biodegradable/compostable polymers and composites
- Advances in processing of bio-based materials—including additive manufacturing, injection molding, thermoforming, blow molding, extrusion, etc.
- Material life cycle and carbon footprint analyses and considerations for end-of-life/waste management
- High performance and functional bio-based polymers and composites
- Demonstration and emerging applications of bio-based polymers and composites
- Bio-based materials in advanced applications such as energy, batteries, biomedical, etc.
- Circular economy, recycling, and upcycling

Joint sessions are being considered with **EN03 - Biodegradable, Resorbable and Sustainable Materials**.

Invited speakers include:

Zhiyong Cai	U.S. Department of Agriculture, USA
Eric Cochran	Iowa State University, USA
Habib Dagher	University of Maine System, USA
Mitra Ganewatta	Ingevity, USA
Olli Kahkonen	Nordic Bioproducts Group, Finland
Soledad Peresin	Auburn University, USA
Nicholas Rorrer	National Renewable Energy Laboratory, USA
Liesl Schindler	Trillium Renewable Chemicals, USA
Katariina Torvinen	VTT Technical Research Centre of Finland Ltd., Finland
Ferrie van Hattum	Saxion University, Netherlands
Deepak Venkatraman	NatureWorks LLC, USA
Dean Webster	North Dakota State University, USA
Vikram Yadama	Washington State University, USA

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Symposium SB09: Biomaterials for Regenerative Engineering

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

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

Topics will include:

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

Invited speakers include:

Nenad Bursac	Duke University, USA
Rebecca Carrier	Northeastern University, USA
Eun Ji Chung	University of Southern California, USA
Jeanine Coburn	Worcester Polytechnic Institute, USA
Elizabeth Cosgriff-Hernandez	The University of Texas at Austin, USA
Akhilesh Gaharwar	Texas A&M University, USA
Riccardo Gottardi	University of Pennsylvania, USA
Brendan Harley	University of Illinois at Urbana-Champaign, USA
David Kaplan	Tufts University, USA
Kent Leach	University of California, Davis, USA
Helen Lu	Columbia University, USA
Georgia Papavasiliou	Illinois Institute of Technology, USA
Murugan Ramalingam	Vellore Institute of Technology, India
Julie Renner	Case Western Reserve University, USA
Monica Serban	University of Montana, USA
Ramille Shah	Dimension Inx, USA
Anita Shukla	Brown University, USA
Jian Yang	The Pennsylvania State University, USA

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Symposium SB10: From Soft Hydrogel Materials to Hard Materials for Sports Equipment—Bridging the Gap with Additive Manufacturing

The purpose of the symposium is to bring (i) together the distinctive research communities working on soft materials such as hydrogels and hard materials such as sport equipment, and (ii) to identify synergies and strategies to use soft materials and additive manufacturing approaches (such as 3D printing) to bridge the gap in properties. Equipment improvement in sports such as surfing has seen an increase in the use of materials science and engineering methodologies. This ranges from understanding the mechanical flex in surfboards, the kinesiology of paddling, and the biomechanics of aerial landings to the use of new manufacturing techniques (such as additive manufacturing / 3D printing) and incorporation of computational fluid dynamics in the design of surfboards, fins and even wave pools. One of the key issues in sports is the mechanical mismatch between “hard” sports equipment and “softer” human operators. This mismatch is responsible for most of the sports injuries, when, for example, surfers collide with surfboards or surfboard fins. A particular focus will be the use of soft materials (such as hydrogels and thermoplastic polymers), which has attracted much attention during the last decades because of their wide range of applications in various fields. Better understanding of the behavior of soft materials will make it possible to identify the mechanisms that govern the lubricity and frictional response under dynamic sliding conditions such as those encountered in sports such as surfing, skiing, snowboarding and skating. The invited presentations will be given by leading researchers from academia, government laboratories, and industry. An important goal of the symposium is to promote collaboration across different disciplines such as materials science, physics, chemistry and engineering.

Topics will include:

- 3D/4D printing (additive manufacturing)
- Self-healing hydrogels and other soft materials
- Neutral, polyelectrolyte and responsive gels
- Structure property relationship in polymer networks
- Transport and dynamic properties (including modelling and simulation of networks)
- Materials for injury prevention and medicine in sports (e.g. surfing)
- Fluid dynamics, including Computational Fluid Dynamics (CFD)
- Biomechanics, kinesiology and bioenergetics in sports (e.g. surfing)
- Surfing equipment including surfboards, foils, fins, wetsuits and measurement devices

Joint sessions are being considered with **SB04 - Conducting and Functional Hydrogels—From Materials to Devices**.

Invited speakers include:

Tom Allen	Manchester Metropolitan University, United Kingdom
Tracie Barber	University of New South Wales, Australia
Namita Choudhury	Royal Melbourne Institute of Technology, Australia
Jack Douglas	National Institute of Standards and Technology, USA
Stevin Gehrke	The University of Kansas, USA
Alan Grodzinsky	Massachusetts Institute of Technology, USA
Paul Janmey	University of Pennsylvania, USA
Nir Kampf	Weizmann Institute of Science, Israel
Ogi Markovic	Strategic Materials, Inc., USA
Luca Oggiano	Nabla Flow, Norway
Michelle Oyen	Washington University in St. Louis, USA
Gaio Paradossi	Università degli Studi di Roma-Tor Vergata, Italy
Nicholas Peppas	The University of Texas at Austin, USA
Clara Usma-Mansfield	Deakin University, Australia
Sandra van Vlierberghe	Ghent University, Belgium
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Symposium SB11: Wearable and Implantable Neuro- and Bio-Electronics with 2D Materials

Bioelectronics with two-dimensional materials is a distinctly new and rapidly expanding field of applied science. Graphene's progression from applications in nanoelectronics and fundamental science has now reached the fields of biomedical engineering and applied electronics. Other 2D materials have emerged and now also find unique applications in the vast area of wearable, implantable, neuronal, and neuromorphic bioelectronics. In this symposium, we will cover the topics on the merge of these impactful scientific fields with the core thesis on the use of 2D materials for the production of new bioelectronics. Symposium content will include, but not limited to, the application of 2D materials for neuroelectronic interfaces, novel biosensors and bioelectronics architectures, wearable and implantable functional devices, neuromorphic systems, and hybrid multimodal integrated devices. The symposium will also include contributions addressing the fundamental principles of 2D materials and their interaction with biological matter. Present trends in the biocompatibility and cytotoxicity of 2D materials will be explored, through formal presentations and discursive forums. The symposium will provide a portal to attendees on the present state-of-the-art in research on 2D-material-based devices, including the production, operation, and integration of 2D material based transistors, electrodes, biosensors, neuromorphic, artificially synaptic devices, in vivo probes, etc. The symposium will consider and endorse contributions of works that utilize novel materials beyond graphene, including the emerging TMDs and related 2D materials (MXenes, germanene, silicene, MoS_2, $MoSe_2$, hBN, WS_2, WSe_2, $PtSe_2$, $PtTe_2$, $PtSe_2$, etc.) and their heterostructures. This timely symposium will disseminate this findings in the vogue research field to a broad audience. It will enable and stimulate the wider academic community to explore the development of 2D-material based bioelectronics towards supporting future on-body, real-time healthcare monitoring in times of urgently required growth in remote, user-specific healthcare monitoring of the elderly and vulnerable groups.

Topics will include:

- Wearable electronics based on 2D materials
- 2D nanoscale implantable and neurosurgical tools
- 2D materials for detection and diagnostics of virus infections
- 2D materials for cellular electrophysiology
- 2D biosensors
- Optobioelectronics enabled by 2D materials
- Biophysics of graphene and related 2D materials interfacing with cells
- Graphene and related 2D materials for brain-computer-interface technologies
- Biocompatibility and toxicity of 2D materials
- 2D materials for drug delivery cancer research
- Large-scale 2D integrated systems for healthcare applications
- Tissue-like 2D Bioelectronics

Invited speakers include:

Jong-Hyun Ahn	Yonsei University, Republic of Korea
Deji Akinwande	The University of Texas at Austin, USA
Kiana Aran	Keck Graduate Institute, USA
Tzahi Cohen-Karni	Carnegie Mellon University, USA
Monica Craciun	University of Exeter, United Kingdom
Ertugrul Cubukcu	University of California, San Diego, USA
Lucia Gemma Delogu	Università degli Studi di Padova, Italy
Wei Gao	California Institute of Technology, USA
Jose Garrido	Catalan Institute of Nanoscience and Nanotechnology, Spain
Sahika Inal	King Abdullah University of Science and Technology, Saudi Arabia
Pawan Jolly	Harvard University, USA
Shideh Kabiri	Queen's University, Canada
Tomas Palacios	Massachusetts Institute of Technology, USA
Maurizio Prato	CIC biomaGUNE, Spain
Martin Pumera	University of Chemistry and Technology, Prague, Czech Republic
Paolo Samori	Université de Strasbourg, France
Takao Someya	University of Tokyo, Japan
He Tian	Tsinghua University, China
Flavia Vitale	University of Pennsylvania, USA
Yingying Zhang	Tsinghua University, China
Amaia Zurutuza	Graphenea Inc., Spain

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Symposium SF01: Additive Manufacturing—From Material Design to Emerging Applications

The recent advances and successes in additive manufacturing (AM) have propelled the field into a new era of design and manufacturing possibilities. AM offers a transformative approach that enables the creation of complex architectures with unprecedented precision and efficiency. This technology has revolutionized various industries, such as aerospace, automotive, healthcare, defense, and consumer products. In addition to the advancements in AM processes and material innovation, the integration of data-driven material design and process modeling with AM techniques paves the way for accelerated material development, improved process control, and enhanced material performance. This multidisciplinary approach fosters innovation, reduces development cycles, and promotes the adoption of AM across various industries.

Building upon the prior Fall 2021 symposium on this topic, this symposium provides a forum to present research progress based on experimental and/or computational approaches. We invite researchers, practitioners and industry professionals to submit their original and unpublished contributions.

Topics will include:

- Novel materials development by/for AM
- AM technology and process development (e.g., powder bed fusion, projection stereolithography, direct ink writing, drop-on-demand ink jetting, cold spray, directed energy deposition, binder jetting)
- AM process control (e.g., defect mitigation)
- Design and optimization: Design for AM, topology optimization, architected materials, design automation
- Standards, metrology, and quality control: Standardization efforts, metrology techniques, real-time monitoring, inspection, material characterization, quality assurance
- Multi-physics computational modeling, data analytics, and machine learning for AM
- Applications and case studies: AM in aerospace, automotive, healthcare, tooling, and other industries. Case studies demonstrating the practical implementation and success stories are particularly encouraged.

Invited speakers include:

Nesma Aboulkhair	University of Nottingham, United Kingdom	**Manyalibo Matthew**	Lawrence Livermore National Laboratory, USA
Susmita Bose	Washington State University, USA	**Amy Peterson**	University of Massachusetts Lowell, USA
Jian Cao	Northwestern University, USA	**Minh-Son Pham**	Imperial College London, United Kingdom
Shih-Chi Chen	Chinese University of Hong Kong, Hong Kong	**Dierk Raabe**	Max-Planck-Institut für Eisenforschung GmbH, Germany
Amy Clarke	Colorado Schools of Mines, USA	**Anthony Rollett**	Carnegie Mellon University, USA
Zachary Cordero	Massachusetts Institute of Technology, USA	**Julie Schoenung**	University of California, Irvine, USA
Tarasankar DebRoy	The Pennsylvania State University, USA	**Christopher Schuh**	Massachusetts Institute of Technology, USA
David Dunand	Northwestern University, USA	**Matteo Seita**	University of Cambridge, United Kingdom
Randall Erb	Northeastern University, USA	**Christopher Spadaccini**	Lawrence Livermore National Laboratory, USA
Wendy Gu	Stanford University, USA	**Hayden Taylor**	University of California Berkeley, USA
Christopher Hutchinson	Monash University, Australia	**Iain Todd**	Sheffield University, United Kingdom
Jitae Kim	The University of Hong Kong, Hong Kong	**Lorenzo Valdevit**	University of California, Irvine, USA
Jae-Hwang Lee	University of Massachusetts Amherst, USA	**Yinmin Wang**	University of California, Los Angeles, USA
Christian Leinenbach	Swiss Federal Laboratories for Materials Science and Technology, Switzerland	**Xiaoyu Zheng**	University of California, Berkeley, USA
Jennifer Lewis	Harvard University, USA	**Ting Zhu**	Georgia Institute of Technology, USA

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Symposium SF02: Crystallization and Assembly at Interfaces—Fundamental Breakthroughs Enabled by Data-Centric Analysis and *In Situ/Operando* Techniques

This symposium will cover recent advances in the crystallization and assembly of atoms, molecules, and particles at interfaces, with a particular focus on mechanistic approaches developed to understand the underlying pathways for materials design and development. In almost all branches of materials research, these processes play a crucial role in defining the structure and morphology of synthetic materials, conversion and performance of energy storage devices, texture and properties of surfaces and substrates, and more. These processes include both crystal formation on an existing surface or substrate and phase transformation occurring at a phase boundary (e.g., solid-liquid and liquid-gas interfaces). The emergence of new research tools, including *in situ* and *operando* microscopy, spectroscopy, and scattering/diffraction techniques; computer vision-aided data analysis programs; and simulations have led to key breakthroughs in the fundamental understanding of interfacial phase transformation. This symposium will consist of two parts. The first part is focused on the crystallization of atoms, ions, and small molecules at interfaces and surfaces. Specifically, contributions that study surface-bound growth of nano- and micro-crystals, formation of epitaxial layers, 2D materials growth, synthesis of heterojunctions and core-shell structures, and phase transformation in batteries and devices are warmly welcomed. The second part is dedicated to the assembly of larger building blocks, including (surface-functionalized) nano/microparticles, biological macromolecules (e.g., proteins and their derivatives), polymers, and higher-order complex structures. In both parts, new results in the thermodynamics, kinetics, and evolution pathways will be encouraged. In particular, attention will be paid to *in situ/operando* techniques and new data analysis methods, while fundamental studies based on *ex situ* observations and other approaches are also welcomed.

Topics will include:

- *In situ* microscopy for interfacial transformation studies
- *In situ/operando* spectroscopy, diffraction, and scattering methods
- New data processing, analysis, and mining methods for large in-situ datasets
- Surface-bound crystal growth and epitaxy
- Growth of 2D materials on substrates
- Synthesis of heterojunctions and core-shell nanostructures
- Phase transformation of battery materials
- Formation pathways and stability of colloidal crystals
- Biomimetic self-assembly
- Colloidal phase transformation
- Pre-nucleation events and dynamics
- Mass transport near interfaces
- Kinetics, thermodynamics, and pathways of interfacial processes
- Crystal growth models and theories
- Simulations of interfacial crystal growth or assembly pathways

Joint sessions are being considered with **CH02 - Advances in *In Situ* TEM Characterization of Dynamic Processes in Materials**, and **EN10 - From Single Atom to Device—Interfaces Under Electrochemical Conditions**.

Invited speakers include:

Qian Chen	University of Illinois at Urbana-Champaign, USA	**Frieder Mugele**	University of Twente, Netherlands
Peter Crozier	Arizona State University, USA	**Eiichi Nakamura**	University of Tokyo, Japan
James De Yoreo	Pacific Northwest National Laboratory, USA	**Paul Nealey**	The University of Chicago, USA
Mingdong Dong	Aarhus University, Denmark	**Jungwon Park**	Seoul National University, Republic of Korea
Oleg Gang	Columbia University, USA	**Harley Pyles**	University of Washington, USA
Ricardo Garcia	Spanish National Research Council, Spain	**Caroline Ross**	Massachusetts Institute of Technology, USA
Song Jin	University of Wisconsin–Madison, USA	**Frances Ross**	Massachusetts Institute of Technology, USA
Ute Kaiser	Ulm University, Germany	**Andreas Stierle**	Deutsches Elektronen-Synchrotron, Germany
Sergei Kalinin	The University of Tennessee, Knoxville, USA	**Niklas Thompson**	Argonne National Laboratory, USA
Won Chul Lee	Hanyang University, Republic of Korea	**Ulrich Wiesner**	Cornell University, USA
Jun Liu	University of Washington, USA	**Claire Xiong**	Boise State University, USA
Jianwei Miao	University of California, Los Angeles, USA	**Xiao-Ying Yu**	Oak Ridge National Laboratory, USA
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Symposium SF03: Inorganic Materials to Overcome the Challenges of Tomorrow

Chemistry plays a central role in the development and characterization of new inorganic materials. From developing synthetic techniques that make new families of materials available to elucidating correlations between the crystal structure and functionality, solid state chemistry unifies researchers across several disciplines. This symposium will provide a forum for discussing the underpinning science of synthesis of new materials and exploring how the structure of a phase dictates its physical properties. Presentations on advanced characterization methods to elucidate the fundamental mechanisms for how materials assemble at the atomic level. Talks on new characterization techniques potentially incorporating AI/ML techniques for experimental control and data analysis and the characterization of novel materials for magnetic, dielectric, and porous materials are also encouraged. This symposium offers the opportunity for experimental and computational materials chemists to discuss the current state-of-the-art in materials design and characterization. Contributions that use detailed structure and property characterization are encouraged, particularly when supported by electronic structure calculations.

Topics will include:

- Photocatalysis
- Solid state lighting
- Porous materials
- Energy storage
- Dielectrics, ferroelectrics, and multiferroics
- New compositions and materials
- Thermoelectrics
- Crystal chemistry
- X-ray and neutron scattering

Invited speakers include:

Phoebe Allen	University of Birmingham, United Kingdom
Sabarjit Banerjee	Texas A&M University, USA
Megan Butala	University of Florida, USA
Jean-Noël Chotard	Université de Picardie Jules Verne, France
Raphaële Clément	University of California, Santa Barbara, USA
Matt Cliffe	University of Nottingham, United Kingdom
Sabine Devautour-Vinot	Université Montpellier, France
Omar Farah	Northwestern University, USA
Daniel Fredrickson	University of Wisconsin–Madison, USA
Aiko Fukazawa	Kyoto University, Japan
Jeremiah Gassensmith	The University of Texas at Dallas, USA
Andrew Goodwin	University of Oxford, United Kingdom
Becky Greenaway	Imperial College London, United Kingdom
Claire Hobday	The University of Edinburgh, United Kingdom
Geneva Laurita	Bates College, USA
Dae-Woon Lim	Yonsei University, Republic of Korea
Adam Michalchuk	University of Birmingham, United Kingdom
Jayakanth Ravichandran	University of Southern California, USA
Tomce Runcevski	Southern Methodist University, USA
Alina Schimpf	University of California, San Diego, USA
Daniel Shoemaker	University of Illinois at Urbana-Champaign, USA
Mizuki Tada	Nagoya University, Japan
Shinya Takaishi	Tohoku University, Japan
Mercedes Taylor	University of Maryland, USA
Hui Wu	National Institute of Standards and Technology, USA
Dianne Xiao	University of Washington, USA
Yusuke Yamauchi	The University of Queensland, Australia
Sihai Yang	University of Manchester, United Kingdom
Hamish Yeung	University of Birmingham, United Kingdom

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Symposium SF04: Expanding the Frontiers of Plasma Technology in Materials Science and Engineering

Plasma technology has achieved great advances for a vast range of applications in materials science and engineering, from industrial settings to cutting-edge laboratory investigations. Because of the unique energy coupling, plasmas enable reactions and interactions in the gas phase and near interfaces that are otherwise impossible to achieve with conventional methods (e.g., thermal). Plasma-based techniques offer a wide range of experimental conditions, varying from low- to high-pressure and including diverging degrees of equilibrium (from thermal equilibrium to non-equilibrium). These features are key to develop next-generation material processes, which include many plasma-enhanced techniques (e.g., plasma-assisted 3D printing, atomic layer deposition and etching) as well as rapidly emerging approaches (e.g., flow-through nucleation, hybrid plasma-liquid processes, plasma catalysis). This symposium aims to bring together experts in different areas of plasma-based synthesis, processing and applications. Specifically, the symposium will highlight how plasmas can greatly contribute to the development and synthesis of functional nanomaterials and quantum materials, innovative 3D printing, next-generation electronics and communication technologies, biosensors and biomaterials, lightweight and high-strength composites. It will cover recent advances and emerging opportunities in the synthesis of materials with unique and tailored properties for energy and catalysis applications, materials for extreme conditions, structural composites, flexible/textile and other non-conventional surfaces. Further, the complexity of plasmas lends itself to data-driven materials research. Therefore, the symposium will also include topics that relate to artificial intelligence, machine learning and in situ and operando characterization, allowing the optimization of materials synthesis and processing, while opening new avenues to control plasma-material interactions down to the atomic scale.

Topics will include:

- Plasma surface and interface engineering
- Plasma synthesis and processing of nanomaterials and quantum materials
- Plasmas for (multi-)functional and smart materials
- Plasma processes for biosensors and biomaterials
- Plasmas for 3D printing, bioprinting and additive manufacturing
- Plasmas for e-textiles, flexible electronics and other non-conventional surfaces
- Plasmas for lightweight and high-strength composites
- Plasma synthesis and processing of materials for energy harvesting and storage
- Plasma catalysis and plasma synthesis of materials for catalysis
- Plasma synthesis and processing of materials for extreme conditions
- Machine Learning, artificial intelligence etc. for plasma processes
- Diagnostics and fundamental plasma science for materials processes

Invited speakers include:

Sumit Agarwal	Colorado School of Mines, USA
Behnam Akhavan	University of Newcastle, Australia
Eray Aydil	New York University, USA
Jan Benedikt	Kiel University, Germany
Jane Chang	University of California, Los Angeles, USA
Wei-Hung Chiang	National Taiwan University of Science and Technology, Taiwan
Anna Maria Coclite	Graz University of Technology, Austria
Mariadriana Creatore	Eindhoven University of Technology, Netherlands
Davide Mariotti	Ulster University, United Kingdom
Matthias Muehle	Fraunhofer USA, USA
Kentaro Shinoda	National Institute of Advanced Industrial Science and Technology, Japan
Luc Stafford	University of Montreal, Canada
Lea Winter	Yale University, USA
Chi-Chin Wu	U.S. Army Research Laboratory, USA
Hideaki Yamada	National Institute of Advanced Industrial Science and Technology, Japan
Shurik Yatom	Princeton Plasma Physics Laboratory, USA
Lenka Zajíčková	Masaryk University, Czech Republic

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Symposium SF05: Infrared Materials and Devices for Thermal Radiation Control

This symposium will broadly cover current and emerging infrared photonic materials and devices for thermal applications. A key focus will be on recent advances in fundamentals, new concepts, and technologies of using infrared materials and devices to control radiative photonic transport for various applications. Traditionally, thermal radiation is featured by its broad bandwidth, omnidirectional angular emissive pattern, reciprocity, and heat flux bounded by the blackbody limit. However, recent advances, including infrared materials, thermal metasurfaces and structures, magnetooptical materials, nonequilibrium emission, both for far- and near-field technologies, have provided tremendous opportunities in controlling thermal radiation beyond the traditional regimes. Such controlling abilities represent key enablers in a broad range of applications including thermal management, infrared spectroscopy, optoelectronics, thermal energy conversion, material/surface characterization and information processing. This symposium will highlight recent advances in materials, nanostructures, concepts, devices, and systems that involve thermal photon transport. The goal is to bring together scientists from various disciplines and inspire discussions from different perspectives on infrared materials and devices for fundamental science as well as applications.

Topics will include:

- Metamaterials for radiative heat transfer
- Near-field heat transfer and energy conversion
- Plasmons and phonon-polaritons in the infrared
- Spectroscopy of infrared materials and nanostructures
- Coherent thermal emission
- Photonic refrigeration and energy conversion
- Radiative cooling and thermal management
- Thermal circuits and logics
- Radiative lithography and data processing
- Fundamentals of radiative properties
- Electromagnetic theory for thermal radiation control

Joint sessions are being considered with **EL06 - Metamaterials Innovation in Photonics, Acoustics, Fluidics and Thermal Sciences**, and **EL08 - Emerging Material Platforms and Fundamental Approaches for Plasmonics, Nanophotonics and Metasurfaces**.
Also, a **tutorial** complementing this symposium is tentatively planned. Further information will be included in the MRS Program that will be available online in September.

Invited speakers include:

Harry Atwater	California Institute of Technology, USA
Koray Aydin	Northwestern University, USA
Michael Barako	Northrop Grumman, USA
Peter Bermel	Purdue University, USA
Svend-Age Biehs	Oldenburg University, Germany
Joshua Caldwell	Vanderbilt University, USA
Gang Chen	Massachusetts Institute of Technology, USA
Sheila Edalatpour	University of Maine, USA
Mathieu Francoeur	McGill University, Canada
Jean-Jacques Greffet	Institut d'Optique, France
Zubin Jacob	Purdue University, USA
Alejandro Manjavacas	Spanish National Research Council, Spain
Jeremy Munday	University of California, Davis, USA
Alirezah Nojeh	University of British Columbia, Canada
Michelle Povinelli	University of Southern California, USA
Cheng-Wei Qiu	National University of Singapore, Singapore
Aaswath Raman	University of California, Los Angeles, USA
Pramod Reddy	University of Michigan, USA
Alejandro Rodriguez	Princeton University, USA
Sheng Shen	Carnegie Mellon University, USA
Liping Wang	Arizona State University, USA
Yannick De Wilde	École Supérieure de Physique et de Chimie Industrielles, France
Zhuomin Zhang	Georgia Institute of Technology, USA
Yi Zheng	Northeastern University, USA
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Symposium SF06: From Robotic Towards Autonomous Materials

Over the last twenty years, progress in soft robotics has motivated the materialization of physical intelligence through new forms of soft actuators, sensors, and control strategies. But the challenges of power, performance, and control in soft robotics remain limited by available materials. The natural world is inspiring a new generation of materials design paradigms, where multifunctionality not only tightly integrates multiple robotic capabilities, but enables truly autonomous behaviors. The next-generation of autonomous agents should be indistinguishable from materials, as they must truly integrate distributed actuation, perception, control, and energy capabilities. To enable this interdisciplinary vision, this symposium aims to bring several communities together – from materials science and soft robotics to chemistry and mechanics – to build beyond visions of robotic materials to truly autonomous ones.

Our symposium is structured around three core tracks. The first – robotic materials – will feature new materials for actuators, sensors, controllers, and energy. Research themes of interest are electrically-driven and chemically powered actuators, new soft material sensing and control strategies, and materials for robotic power. The second track – design and fabrication – will highlight innovations in multifunctional material fabrication, directed assembly of materials across multiple lengths scales, and modeling. The third track – autonomous materials – will explore the emergence of autonomous, self-regulatory, and intelligence in material systems, while exploring emerging areas of embodied energy, and distributed sensorimotor capabilities. Overall, the three tracks will collectively explore new applications for robotic or autonomous materials, including devices for wearables and biomedicine, untethered bioinspired robots, food security, environmental monitoring, and beyond.

Topics will include:

- Stimuli-responsive hydrogels, liquid crystalline materials, and composites
- Materials with distributed sensorimotor behaviors
- Soft material logic, memory, and computation
- Multifunctional materials for programmed shape-change, adaptability, and embodied intelligence
- Self-healing, self-regulatory, and homeostatic materials
- Biohybrid, autonomous materials
- Application- and data-driven design of robotic and autonomous materials
- Materials for energy scavenging and embodied energy
- Autonomous soft, bioinspired, and/or microscale robots
- Additive and digital fabrication of autonomous materials
- Architected materials for robots
- Modeling, simulation, and control of autonomous materials

Invited speakers include:

Joanna Aizenberg	Harvard University, USA	**Markus Nemitz**	Worcester Polytechnic Institute, USA
Hyeon Seok An	Cornell University, USA	**Monica Olvera De La Cruz**	Northwestern University, USA
Thomas Angelini	University of Florida, USA	**Jang-Ung Park**	Yonsei University, Republic of Korea
Bilge Baytekin	Bilkent University, Turkey	**Kirstin Petersen**	Cornell University, USA
Lucia Beccai	Istituto Italiano di Tecnologia, Italy	**James Pikul**	University of Pennsylvania, USA
Philip Buskohl	Air Force Research Laboratory, USA	**Jordan Raney**	University of Pennsylvania, USA
Kyujin Cho	Seoul National University, Republic of Korea	**Metin Sitti**	Max Planck Institute for Intelligent Systems, Germany
Amir Gat	Technion–Israel Institute of Technology ology, Israel	**Nancy Sottos**	University of Illinois at Urbana-Champaign, USA
Daniel Goldman	Georgia Institute of Technology, USA	**Jeong-Yun Sun**	Seoul National University, Republic of Korea
Ryan Hayward	University of Colorado Boulder, USA	**Zeynep Temel**	Carnegie Mellon University, USA
Mirko Kovac	Imperial College London, United Kingdom	**Michael Tolley**	University of California, San Diego, USA
Jennifer Lewis	Harvard University, USA	**Zhong Lin Wang**	Georgia Institute of Technology, USA
Shlomo Magdassi	The Hebrew University of Jerusalem, Israel	**Timothy J. White**	University of Colorado Boulder, USA
Barbara Mazzolai	Istituto Italiano di Tecnologia, Italy	**Xuanhe Zhao**	Massachusetts Institute of Technology, USA
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Symposium SF07: Advances in Reactive Materials Engineering

Reactive materials are composites or physical mixtures that exhibit self-sustaining exothermic reactions upon receiving an initial energy input. These materials are a unique subset of energetic materials that differ from explosives in that the reaction fronts propagate subsonically and reactivity can be engineered over many orders of magnitude by controlling the reactant length scales. Approaches to exercising this control include additive manufacturing, mechanical milling, thin film deposition, and particle size engineering. Reactive materials have been used in diverse fields including defense, joining/welding, pyrotechnics, transient electronics, and medicine, and new materials and advanced manufacturing methods are opening up new applications. Additionally, new diagnostics have been developed that are providing insights into reaction mechanisms that are particularly useful for validating atomistic and highly-resolved continuum-level simulations of thermal and mass transport in these materials. New approaches like machine-based learning may pave the way toward a mechanistic understanding of complex phenomena like particle combustion and aid in the development of new reactive materials for targeted applications. This symposium will focus on the latest research on processing, characterization, and modeling of reactive materials, with emphasis on (1) advanced manufacturing and diagnostic techniques, (2) fundamental materials science issues that must be tackled to develop advanced materials for next-generation pyrotechnic applications, and (3) new computational methodologies and tools for the simulation of the combustion of reactive materials. This field is constantly advancing, and this symposium will serve as a platform for the contributors to collectively consider upcoming challenges and research directions.

Topics will include:

- Applications of reactive materials (joining, agent defeat, munitions, pyrotechnics, transient electronics, military flares, medical)
- New materials for thermite or intermetallic reactions
- Continuum and atomistic modeling of reactive material ignition and propagation
- *In situ* and *in operando* characterization of reactive materials
- Advanced manufacturing to expand the functionality of reactive materials
- Modeling and AI for new materials discovery and development
- The role of microstructure and edge effects on ignition and propagation
- High throughput experimental techniques for generating machine learning training data
- Scientific questions about reactive materials that can be answered with AI
- Bridging the gap between atomic, micro-, and meso-scale phenomena
- Safety and aging mechanisms in reactive materials

Invited speakers include:

Shane Arlington	Draper Labs, USA
Santanu Chaudhuri	University of Illinois at Chicago, USA
Sili Deng	Massachusetts Institute of Technology, USA
Dana Dlott	University of Illinois at Urbana-Champaign, USA
Edward Dreizin	New Jersey Institute of Technology, USA
Alain Esteve	French National Centre for Scientific Research, France
Jennifer Gottfried	U.S. Army Research Laboratory, USA
Lori Groven	South Dakota School of Mines, USA
David Kittell	Sandia National Laboratories, USA
Dylan Kline	Lawrence Livermore National Laboratory, USA
Ernst-Christian Koch	Lutradyn, Germany
Steven Son	Purdue University, USA
Alejandro Strachan	Purdue University, USA
Katharine Tibbetts	Virginia Commonwealth University, USA
Timothy Weihs	Johns Hopkins University, USA
John Wen	University of Waterloo, Canada
Gregory Young	Virginia Tech, USA
Michael Zachariah	University of California, Riverside, USA
Xiaolin Zheng	Stanford University, USA

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Symposium SF08: Design and Behavior of Architectured Materials for Extreme Environments

The operating conditions of modern materials and devices are progressing towards more extreme aerodynamic, mechanical, radiation, and corrosive environments. These conditions narrow material selection to a small subset, necessitating the development for next-generation material solutions with highly tailored structures. These materials are defined as architectured because they exploit specific design of microstructure (e.g., homo/hetero interfaces), meso-structure (e.g., 3D topologies), phase-structure (e.g., laminated composites), and combinations thereof. With recent advances in fabrication techniques, it is now possible to improve material performance by controlling architectures across nano- and micro-meter length scales. However, the service lifetimes of these materials are often unknown or fall short when compared to industry standards.

The ultimate implementation of architectured materials requires a mechanistic understanding of how they behave and evolve when subjected to extreme environments. This symposium will bring together different communities to identify key mechanisms to understand and predict how materials behave when subjected to a diversity of extreme conditions. Symposium contributions should address basic science regarding the performance, stability, and evolution of emerging architectured materials in extreme environments. Discussion of material design principles, fabrication techniques, and novel testing methods are also welcomed.

Topics will include:

- Shock and Behavior at Mechanical Extremes
- Aqueous Corrosion and High-Temperature Oxidation
- Damage Accumulation and Microstructural Evolution under Irradiation
- Extreme Aerodynamic and High-Enthalpy Environments
- Design & Synthesis of Materials for Extreme Conditions
- Advanced Characterization and Testing Methods

Joint sessions are being considered with **SF01 - Additive Manufacturing—From Material Design to Emerging Applications**.

Invited speakers include:

Pascal Bellon	University of Illinois at Urbana-Champaign, USA	**Keith Nelson**	Massachusetts Institute of Technology, USA
Dana Dattelbaum	Los Alamos National Laboratory, USA	**Suman Pokhrel**	Universität Bremen, Germany
Jürgen Eckert	University of Leoben, Austria	**K.G. Prashanth**	Tallinn University of Technology, Estonia
Ibrahim Karaman	Texas A&M University, USA	**John Scully**	University of Virginia, USA
Hidemi Kato	Tohoku University, Japan	**Mitra Taheri**	Johns Hopkins University, USA
Mukul Kumar	Lawrence Livermore National Laboratory, USA	**Jason Trelewicz**	Stony Brook University, The State University of New York, USA
Sviatlana Lamaka	Helmholtz-Zentrum Hereon, Germany	**Rodney Trice**	Purdue University, USA
Jeffrey Lloyd	U.S. Army Research Laboratory, USA	**Janelle Wharry**	Purdue University, USA
Nadiia Mameka	Helmholtz-Zentrum Hereon, Germany		

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