

FRONTIERS IN MATERIALS RESEARCH

MATERIALS DAY



MIT
MATERIALS
RESEARCH
LABORATORY

Materials Resources

The Materials Research Laboratory (MRL) MRL serves interdisciplinary groups of faculty, staff and students, supported by industry, foundations and government agencies to carry out fundamental engineering research on materials. Research topics include energy conversion and storage; quantum materials; spintronics; photonics; metals; integrated microsystems; materials sustainability; solid-state ionics; complex oxide electronic properties; biogels; and functional fibers.
<https://mrl.mit.edu>

The Crystal Physics and Electroceramics Laboratory is devoted to the modeling, processing, characterization and optimization of energy related devices (sensors, batteries, fuel cells, solar/photolysis cells) and the integration of sensor, actuator and photonic materials into microelectromechanical (MEMS) systems.
<http://electroceramics.scripts.mit.edu/>

Microphotonics Center @ MIT builds interdisciplinary teams, focused on collaborative research for the advancement of basic science and emerging technology pertaining to integrated photonic systems.
<https://mphotronics.mit.edu>

The Communications Technology Roadmap (CTR) is a project under the Microphotonics Industry Consortium, and is a part of the MIT Microphotonics Center. The purpose of this Roadmap is to understand the interaction between technology, industry, and policy dynamics and from there, formulate a vision for the future of the microphotonics industry.
<http://mph-roadmap.mit.edu/>

The AIM Photonics Academy launched in 2016 as the education, workforce development, and roadmapping arm of AIM Photonics, one of 14 public-private manufacturing innovation institutes launched as part of the 2014 Revitalize American Manufacturing Innovation Act. The AIM Photonics Academy's mission is to educate the current and future workforce in integrated photonics – technologies that will lead to the next generation of faster and more power-efficient chips.
<https://aimphotonics.academy/>

The Skoltech Center for Electrochemical Energy Storage (CEES) is an inter-university/interdepartmental center with three major goals; development of advanced lithium ion and multivalent ion batteries, the development of rechargeable metal-air batteries, and the development of reversible low and elevated temperature fuel cells.
<https://cees-www.mit.edu/>

Department of Materials Science & Engineering is known as the world-wide leader in its field, pioneering advances in engineering sciences and technologies.
<https://dmse.mit.edu>

MATERIALS DAY AT MIT

Frontiers in Materials Research

October 11, 2017

Hosted annually, Materials Day includes a topical symposium followed by a student poster session. This year the symposium will be broad in scope and will involve primarily speakers from MIT. The theme will be Frontiers in Materials Research. Presentations will be given by speakers who represent MIT's new generation of leaders in material research. Subjects covered will include: additive technologies for manufacturing, high temperature materials extraction and processing, probing and interrogation of neural function in mammals with fibers, utilizing optical phase change materials new high performance communication circuits and systems.

New for this year, Materials Day will include a panel discussion involving four distinguished leaders of MIT's materials research community addressing the challenges and opportunities of materials research. The poster session immediately follows the symposium and showcases students research and it's applications. About seventy-five posters are presented each year, on a full range of research topics.

Materials Research Laboratory
Massachusetts Institute of Technology
77 Massachusetts Avenue
Room 13-2106
Cambridge, MA 02139
<https://mrl.mit.edu>
email: mit-mrl@mit.edu

Materials Day Agenda

8:00am

Registration

8:30 - 8:45am

Welcome and Overview

Carl V. Thompson, Professor, Department of Materials Science & Engineering
Director, Materials Research Laboratory, MIT

Session I:

8:45 - 9:15am

Materials Research: From Vision to Reality

Dr. Julia Phillips
Executive Emeritus
Sandia National Laboratories

9:15 - 9:45am

Additive Manufacturing Across Length Scales

A. John Hart, Associate Professor
Department of Mechanical Engineering, MIT

9:45 - 10:15am

Engineering Ceramic and Glass-Materials for Energy Storage, Sensing and Computing

Jennifer Rupp, Assistant Professor
Department of Materials Science and Engineering, MIT

10:15 - 11:00am

BREAK

Session II:

11:00 - 11:30am

Quantum Transport and Optoelectronics with van der Waals Heterostructures

Pablo Jarillo-Herrero, Associate Professor
Department of Physics, MIT

11:30 - 12:00pm

Harnessing High Temperature Materials for Extraction and Processing

Antoine Allanore, Associate Professor
Department of Materials Science and Engineering, MIT

12:00 - 1:00pm

LUNCH

Stratton Student Center, 3rd Floor
Twenty Chimneys/Mezzanine Lounge (Building W20)

Agenda cont'd

Session III:

1:00 - 1:30pm

Electronic, Optical and Magnetic Materials for Probing and Interrogation of Neural Function

Polina Anikeeva, Associate Professor
Department of Materials Science and Engineering, MIT

1:30 - 2:00pm

Optical Phase Change Materials: The Altering Face of a Chameleon

Juejun Hu, Associate Professor
Department of Materials Science and Engineering, MIT

2:00 - 2:15pm

BREAK

2:15 - 3:15pm

Panel Discussion:

Vladimir Bulovic, Professor
Founding Director of MIT.nano

Karen Gleason, Professor
Associate Provost, Office of the Provost, MIT

Caroline Ross, Professor
Associate Department Head, Department of Materials Science and Engineering, MIT

Timothy Swager, Professor
Director of the Deshpande Center for Technological Innovation, MIT

3:15 - 4:00pm

Poster Preview: 2 minute talks by selected poster presenters

4:15 - 6:00pm

Poster Session and Social

La Sala de Puerto Rico,
2nd Floor, Stratton Student Center (Building W20)

6:00pm

Poster Awards

6:15pm

Adjourn

Professor Carl V. Thompson
Director
Materials Research Laboratory
Stavros Salapatas Professor of Materials
Science and Engineering
Department of Materials Science and
Engineering, MIT



Welcome and Overview

Biography:

Professor Thompson received his S.B. in Materials Science and Engineering from MIT, and his S.M. and Ph.D. in Applied Physics from Harvard University. He was an IBM postdoctoral Fellow in the Research Laboratory of Electronics at MIT before joining the faculty of the Department of Materials Science and Engineering in 1983. Professor Thompson spent the 1990-91 academic year at Cambridge University, the 1997-98 academic year at the Max Planck Institut fur Metallforschung, and 2012 at the Karlsruhe Institute of Technology. He has been active in MIT's programs with Singapore, including twelve years leading the program for Advanced Materials for Micro- and Nano-Systems of the Singapore-MIT Alliance. He served as the President of the Materials Research Society in 1996. He served as the director of the Materials Processing Center (MPC) for 8 years and is now the director of the Materials Research Laboratory (MRL) and Co-Director of the Skoltech Center for Electrochemical Energy Storage. Professor Thompson has been a consultant with over thirty companies, including Intel, IBM, DEC, and a number of start-ups involved in development of microelectromechanical devices and systems.

Professor Thompson's research interests include processing of thin films and nanostructures; the mechanical and electrical properties of nanostructures; and the incorporation of thin films and nanostructures in electronic, electromechanical, and electrochemical devices and systems.

Materials Research: From Vision to Reality

Abstract: Materials research came into its own in the second half of the twentieth century. As an inherently interdisciplinary endeavor, it broke down traditional boundaries between fields. The result has been nothing short of transformational, as advances in materials research have provided an essential foundation for revolutionary technologies ranging from information processing to medical implants. As we enter the heart of the 21st Century, we face existential challenges as we seek to steward the finite resources of our planet, reduce vulnerability to human and natural threats, and ensure that all of the world's people have sufficient resources for healthy, productive lives. Materials research will play a critical role in addressing these challenges. As practitioners of an inherently interdisciplinary field, materials researchers already know how to attack problems whose solution requires multiple fields to collaborate. As such, they will be catalysts for many of the efforts to address these challenges. New technologies to address the challenges will be built of materials with new functionalities, composed of environmentally sustainable base materials, and processed in energy-efficient ways. At the end of the century, our children and grandchildren will observe that their lives have been profoundly improved by the advances in materials research we are pursuing today.

Biography: Julia M. Phillips retired in 2015 from Sandia National Laboratories after nearly 20 years. She culminated her Sandia career by serving as Vice President and Chief Technology Officer, when she led the Laboratory's internally funded research and development program, research strategy, and intellectual property protection and deployment. Other positions at Sandia included Director of Nuclear Weapons Science and Technology Programs; Director of the Physical, Chemical, and Nano Sciences Center; and Director of the U.S. Department of Energy's (DOE) Center for Integrated Nanotechnologies (CINT) at Sandia and Los Alamos national laboratories. Prior to her time at Sandia, she spent 14 years at AT&T Bell Laboratories where she performed research in thin film epitaxial electronic materials and complex oxides.

Phillips is a member of the National Science Board, member and Home Secretary of the National Academy of Engineering (NAE) and fellow of the American Academy of Arts and Sciences, Materials Research Society (MRS), American Association for the Advancement of Science (AAAS), and the American Physical Society (APS). She has served on the NAE Council and AAAS Board of Directors, and has chaired the APS Panel on Public Affairs, the APS Topical Group on Energy Research and Applications, and the APS Division of Condensed Matter Physics. She also served as President of the MRS.

In 2008 Phillips received the George E. Pake Prize from the American Physical Society "for her leadership and pioneering research in materials physics for industrial and national security applications." She has served on the editorial boards of the Journal of Materials Research, Journal of Applied Physics, and Applied Physics Reviews.

Dr. Julia M. Phillips
Vice President and Chief Technology
Officer - retired
Executive Emeritus
Sandia National Laboratories



Additive Manufacturing Across Length Scales

Abstract: Throughout history, innovations in manufacturing processes—such as movable type printing, and low-cost conversion of iron to steel—have catalyzed industrial growth and improved our standard of living. Now, additive manufacturing (AM) technologies, ranging from printing of low-cost electronics to automated assembly of large structures, promise to accelerate the scale-up of new products and reshape the constraints of supply chains. Toward this vision, I will describe selected recent work from my group including: realization of a high-speed desktop 3D printer that can produce handheld polymer and composite parts in 5-10 minutes, and fabrication of macroscale nanostructured solids via direct-write colloidal assembly. I will conclude with my perspective on the challenges and opportunities that AM provides for materials research and commercial development in the coming years.

Biography: John Hart is Associate Professor of Mechanical Engineering and Director of the Laboratory for Manufacturing and Productivity at MIT. John's research group, the Mechanosynthesis Group (<http://mechanosynthesis.mit.edu>), aims to accelerate the science and technology of advanced manufacturing in areas including additive manufacturing, nanostructured materials, and the integration of computation and automation in process discovery. He has also co-founded three advanced manufacturing startup companies, and launched the world's first massive open online course on manufacturing processes (MIT 2.008x on edX). John has been recognized by prestigious awards from NSF, ONR, AFOSR, DARPA, ASME, and SME, by two R&D 100 awards, by several best paper awards, and most recently by the MIT Ruth and Joel Spira Award for Distinguished Teaching in Mechanical Engineering.

A. John Hart
Associate Professor
Department of Mechanical
Engineering, MIT



Engineering Ceramic & Glass-Materials for Energy Storage, Sensing & Computing

Abstract: The next generation of energy storage, sensors and neuromorphic computer logics in electronics rely largely on solving fundamental questions of mass and charge transport of ionic carriers and defects in materials and their structures. Here, understanding the defect kinetics in the solid state material building blocks and their interfaces with respect to lattice, charge carrier types and interfacial strains are the prerequisite to design novel energy storage, sensing and computing functions. Through this presentation basic theory and model experiments for solid state oxides their impedances and memristance, electro-chemo-mechanics and lattice strain modulations is being discussed as a new route for engineering material and properties on the examples of solid state batteries, environmental CO₂ sensors and memristors for memory and neuromorphic computing chips. Central are the making of new oxide film materials components, and manipulation of the charge carrier transfer and defect chemistry (based on ionic and electronic carriers), which alter directly the device performances and new operation metrics.

Biography: Prof. Jennifer Rupp is an Assistant Professor of Electrochemical Materials in the Department of Materials Science and Engineering at MIT. Previously she was a non-tenure track assistant professor at ETH Zurich Switzerland where she was holding two prestigious externally funded career grants, namely an ERC Starting Grant (SNSF) and Swiss National Science Foundation (SNF) professorship from 2012 on. She previously was affiliated as a visiting and senior scientist at the MIT (2012-2011), the National Institute of Materials Science (NIMS) in Tsukuba Japan (2011), and was working as a postdoc at ETH Zurich (2010-2006).

Rupp team's current research interests are on solid state material design and tuning of structure-property relations for novel energy and information devices and operation schemes. This ranges from alternative energy storage via batteries or catalytic convertor systems processing by smart material design solar light and CO₂ to renewables synthetic fuels, or novel types of neuromorphic memories and computing logic entities for data storage and transfer beyond transistors. Here, her team goes the whole way from material design, novel processing techniques to make ceramics, cermets or glassy-type ceramic structures up to device prototypes, their operation and characteristics.

She has published more than 70 papers, holds 4 patents, and enjoys discussing material tech trends on the theme of energy with the public, economists and policy makers. She is a frequent speaker and member of the World Economic Forum (2015-2017), or contributes to CNN and other television movies. Rupp and her team received several honors and awards such as keynote lecture at Nature Energy conference 2016, "Top 40 international scientist under the age of 40" by World Economic Forum 2015, Spark Award for the most innovative and economically important invention of the year 2014 at ETH Zurich, Gordon Research lecture 2014, the Kepler award "new materials in energy technology" by the European Academy of Science 2012 or Young Scientist Award by the Solid State Ionic Society.

Jennifer Rupp
Assistant Professor
Department of Materials Science
and Engineering, MIT



Quantum Transport and Optoelectronics with van der Waals Heterostructures

Abstract: Over the past decade, a revolution in materials science has taken place with the advent of atomically-thin layered materials. These materials exhibit unique physical properties, different from their bulk counterparts, as exemplified by graphene's ultra-relativistic electronic properties. Moreover, the possibility to stack different layered materials arbitrarily on top of each other to form what are known as van der Waals heterostructures, has paved the way for an even richer variety of electronic, optical, chemical and mechanical behaviors, which the physics, chemistry and engineering communities are just beginning to explore. In this talk I will describe my group's efforts in the area of quantum electronic transport and optoelectronics with van der Waals heterostructures, with examples ranging from the opening of a band gap in graphene to the thinnest photodetectors, solar cells, and LEDs based on transition metal dichalcogenides.

Biography: Pablo Jarillo-Herrero is an associate professor in the MIT physics department. Jarillo-Herrero's group explores quantum transport and optoelectronics in novel condensed matter systems such as graphene, transition metal dichalcogenides, and topological insulators. In recent work, he has demonstrated the presence of a bandgap in graphene-based van der Waals heterostructures, novel quantum spin Hall and photothermoelectric effects in graphene, as well as light-emitting diodes, photodetectors, and solar cells in the atomically thin tungsten diselenide system. He has also made advances in characterizing and manipulating the properties of other ultrathin materials, such as ultra-thin graphite and molybdenum disulphide, which lack graphene's ultrarelativistic properties, but possess other unusual electronic and electronic properties. Jarillo-Herrero has co-authored over 60 journal publications and directed four PhD thesis.

After earning an M.Sc. at the University of Valencia, Spain in 1999 and another at the University of California, San Diego in 2001, Jarillo-Herrero earned his PhD at the Delft University of Technology in 2005. He remained at Delft for a year as a postdoctoral researcher and then worked as a NanoResearch Initiative Fellow at Columbia University until he joined the MIT faculty in 2008. Jarillo-Herrero's awards include an NSF Career Award (2008), an Alfred P. Sloan Fellowship (2009), the IUPAP Young Scientist Prize in Semiconductor Physics (2010), a DOE Early Career Award (2011), a Presidential Early Career Award for Scientists and Engineers (PECASE, 2012), an ONR Young Investigator Award (2013), and a Moore Foundation Investigator Award (2014).

Pablo Jarillo-Herrero
Associate Professor
Department of Physics, MIT



Harnessing High Temperature Materials for Extraction & Processing

Abstract: The demand for materials, particularly minerals and metals, has experienced an exceptional growth in the last decades. In parallel, the costs of the corresponding processing technologies have reached levels that are unsustainable for most countries. Increasing access to cost effective and clean electricity sets the stage for novel processes that can match new expectations from society. In this context, recent research and development results pertinent to materials processing are presented, in particular for oxides and sulfides. In parallel, novel experimental methods and predictive capacity for high temperature systems are shown, paving the way to transformative processes and materials.

Biography: Antoine Allanore is currently Associate Professor of Metallurgy in the Department of Materials Science and Engineering at MIT. He received his higher education in Nancy (France) where he earned a chemical process engineer diploma from Ecole Nationale Supérieure des Industries Chimiques and a M.Sc and PhD from Lorraine University. Dr. Allanore joined MIT in 2012 as a faculty, leading a research group that develops sustainable materials extraction and manufacturing processes. He has developed numerous alternative approaches for metals and minerals extraction and processing. With an emphasis on electrochemical methods for both analytical and processing purposes, his group combines experimental and modeling approaches to promptly investigate the ultimate state of condensed matter, the molten state. He teaches thermodynamics and sustainable chemical metallurgy at both the undergraduate and graduate level. He received the Vittorio de Nora Award from TMS in 2012, and the TMS Early Career Faculty Fellow Award in 2015.

Antoine Allanore
Associate Professor
Department of Materials Science
and Engineering, MIT



Electronic, Optical and Magnetic Materials for Probing and Interrogation of Neural Function

Abstract: Mammalian nervous system contains billions of neurons that exchange a diversity of signals. Our ability to study this complexity is limited by the lack of technologies available for interfacing with neural circuits without inducing a foreign-body reaction. My talk will describe strategies pursued in my group to mimic the materials properties and signaling modalities of the nervous system. I will discuss how fiber-based fabrication methods can be applied to polymers, metals and composites to deliver flexible and stretchable optoelectronic probes for multifunctional interfaces with the brain and spinal cord circuits. These fiber based probes enable simultaneous electrophysiological recording and optical modulation of neural activity as well as local delivery of drugs and genetic constructs into the nervous system of freely moving subjects. In addition, I will describe how synergistic action of magnetic nanomaterials and alternating or slow-varying magnetic fields can be applied to deliver thermal and mechanical stimuli for minimally invasive control of neural activity.

Biography: Polina Anikeeva received her BS in Physics from St. Petersburg State Polytechnic University in 2003. After graduation she spent a year at Los Alamos National Lab where she worked on developing photovoltaic cells based on quantum dots. She then enrolled in a PhD program in Materials Science at MIT and graduated in January 2009 with her thesis dedicated to the design of light emitting devices based on organic materials and nanoparticles. She completed her postdoctoral training at Stanford University, where she created devices for optical stimulation and electrical recording from neural circuits. Polina joined the faculty of the Department of Materials Science and Engineering at MIT in July 2011, where she is now a Class of 1942 Career Development Associate Professor. Her lab focuses on the development of flexible and minimally invasive materials and devices for neural recording, stimulation, and repair. Polina is also a recipient of NSF CAREER Award, DARPA Young Faculty Award, and the TR35 among others.

Polina Anikeeva
Associate Professor
Department of Materials Science
and Engineering, MIT



Optical Phase Change Materials: The Altering Face of a Chameleon

Abstract: Optical phase change materials (O-PCMs) are a unique class of materials which exhibit extraordinarily large optical property change (e.g. refractive index change $\Delta n > 1$) when undergoing a solid-state phase transition. These materials, exemplified by Mott insulators such as VO₂ and chalcogenide compounds, have been exploited for a plethora of emerging applications including optical switching, photonic memories, reconfigurable metasurfaces, and non-volatile display. These traditional phase change materials, however, generally suffer from large optical losses even in their dielectric states, which fundamentally limits the performance of optical devices based on traditional O-PCMs. In this talk, we will discuss our progress in developing O-PCMs with unprecedented broadband low optical loss and their applications in novel photonic systems, such as high-contrast switches and routers towards a reconfigurable optical chip – the optical analog of electronic field-programmable gate arrays (FPGAs).

Biography: Juejun (JJ) Hu received the B.S. degree from Tsinghua University, China, in 2004, and the Ph.D. degree from Massachusetts Institute of Technology, Cambridge, MA, USA, in 2009, both in materials science and engineering. He is currently the Merton C. Flemings Career Development Associate Professor at MIT's Department of Materials Science and Engineering. His primary research interest is enhanced photon-matter interactions in nanophotonic structures. Prior to joining MIT, he was an Assistant Professor at the University of Delaware from 2010 to 2014. Hu has authored and coauthored more than 70 refereed journal publications since 2006 and has been awarded six U.S. patents. He has been recognized with the National Science Foundation Faculty Early Career Development award, the Robert L. Coble Award from the American Ceramic Society, the Gerard J. Mangone Young Scholars Award, the University of Delaware College of Engineering Outstanding Junior Faculty Member, the University of Delaware Excellence in Teaching Award, among others.

Juejun Hu
Associate Professor
Department of Materials Science
and Engineering, MIT



Panel Discussion

Vladimir Bulović

Professor and Associate Dean for Innovation
Founding Director of MIT.nano
School of Engineering, MIT



Biography:

Vladimir Bulović is the Associate Dean for Innovation in MIT's School of Engineering, overseeing a broad portfolio of efforts that support innovation and entrepreneurship. He co-directs the campus-wide MIT Innovation Initiative and is the Founding Director of MIT.nano, leading the design and construction of MIT's new nano-fabrication, nano-characterization, and prototyping facility.

Bulović is a Professor of Electrical Engineering, holding the Fariborz Maseeh Chair in Emerging Technology. His research interests include studies of physical properties of organic and organic/inorganic nanocrystal composite thin films and structures, and development of novel nanostructured optoelectronic devices. He is an author of over 250 research articles (cited over 30,000 times) and an inventor of over 90 U.S. patents in areas of light emitting diodes, lasers, photovoltaics, photodetectors, chemical sensors, programmable memories, and micro-electro machines, majority of which have been licensed and utilized by both start-up and multinational companies. The three start-up companies Bulović and his students co-founded jointly employ over 350 people, and include QD Vision, Inc. of Lexington MA, producing quantum dot optoelectronic components (acquired by Samsung in 2016); Kateeva, Inc. of Newark CA, focused on development of printed organic electronics; and Ubiquitous Energy, Inc., developing nanostructured solar technologies. Bulović received his Ph.D. from Princeton University, where his academic work and patents contributed to the launch of the Universal Display Corporation and the Global Photonics Energy Corporation (presently NanoFlex Power Corporation). Among his awards, in 2012 he shared the SEMI Award for North America in recognition of his contribution to commercialization of quantum dot technology, and in 2017 his solar technology was recognized as the winner of the Katerva Award, in the materials, resources and water category. In 2009 Bulović was awarded the Margaret MacVicar Faculty Fellowship, MIT's highest teaching honor, and in 2011 he was named the Faculty Research Innovation Fellow for excellence in research and international recognition. Recently, Bulović was named the Xerox Distinguished Lecturer in recognition for his continued contribution to innovation of practical applied nanotechnologies.

Panel Discussion

Karen Gleason

Professor and Associate Provost
Office of the Provost,
Department of Chemical
Engineering, MIT



Biography:

Karen K. Gleason is the Alexander and I. Michael Kasser Professor of Chemical Engineering at MIT. She has been a member of the MIT faculty since 1987 and previously served as MIT's Associate Provost, Associate Dean of Engineering for Research, Associate Dean of Engineering, Associate Director for the Institute of Soldier Nanotechnologies, and Executive Officer of the Chemical Engineering Department. Prof. Gleason is a member of the National Academy of Engineering and a fellow of the American Institute of Chemical Engineering (AIChE). She has authored >300 publications and holds >20 issued US Patents. Gleason is also a co-founder of GVD Corporation and DropWise Technology Corporation. Gleason received her PhD from the University of California at Berkeley. Her BS and MS degrees are from MIT, where she also won All-American honors in swimming.

Panel Discussion

Caroline Ross

Professor and Associate Department Head, Department of Materials Science and Engineering, MIT



Biography:

Ross has been a professor at MIT since 1997, and she is currently Associate Department Head in the Department of Materials Science and Engineering. Prior to MIT, she spent six years working in Research and Development at Komag, Inc. in San Jose, CA, which was then the world's largest independent supplier of computer hard disks. This was preceded by two years as a Postdoctoral Fellow at Harvard University. She has a Bachelors degree and a Ph.D. from Cambridge University in England. She is a Fellow of the APS, the MRS, the UK Institute of Physics and the IEEE. She was the Chair of the 2011 Magnetism and Magnetic Materials Conference, and co-chaired the 1998 MRS Spring Conference. She has published over 370 papers and 21 patents. Her area of research is in magnetic materials and spintronics, primarily for data storage and data processing applications; magneto-optical thin film materials for integrated photonic devices and multiferroics, and the self-assembly of block copolymers, oxide nanocomposites and other systems for nanoscale lithography and fabrication.

Panel Discussion

Timothy Swager

Professor and Director
Deshpande Center for Technological
Innovation,
Department of Chemistry, MIT



Biography:

Timothy M. Swager is the John D. MacArthur Professor of Chemistry and the Director, Deshpande Center for Technological Innovation at the Massachusetts Institute of Technology. A native of Montana, he received a BS from Montana State University in 1983 and a Ph.D. from the California Institute of Technology in 1988. After a postdoctoral appointment at MIT he was on the chemistry faculty at the University of Pennsylvania 1990-1996 and returned to MIT in 1996 as a Professor of Chemistry and served as the Head of Chemistry from 2005-2010. He has published more than 400 peer-reviewed papers and more than 70 issued/pending patents. Swager's honors include: Election to the National Academy of Sciences, an Honorary Doctorate from Montana State University, The Pauling Medal, The Lemelson-MIT Award for Invention and Innovation, Election to the American Academy of Arts and Sciences, The American Chemical Society Award for Creative Invention, The Christopher Columbus Foundation Homeland Security Award, and The Carl S. Marvel Creative Polymer Chemistry Award (ACS).

Swager's research interests are in design, synthesis, and study of organic-based electronic, sensory, energy harvesting, membrane, high-strength, liquid crystalline, and colloid materials. His liquid crystal designs demonstrated shape complementarity to generate specific interactions between molecules and includes fundamental mechanisms for increasing liquid crystal order by a new mechanism referred to as minimization of free volume. Swager's research in electronic polymers has been mainly directed at the demonstration of new conceptual approaches to the construction of sensory materials. These methods are the basis of the Fido™ explosives detectors (FLIR Systems Inc), which have the highest sensitivity of any explosives sensor. Other areas actively investigated by the Swager group include radicals for dynamic nuclear polarization, applications of nano-carbon materials, organic photovoltaic materials, polymer actuators, membranes, and luminescent molecular probes for medical diagnostics. He has founded four companies (DyNuPol, Iptyx, PolyJoule, and C-2 Sense) and has served on a number of corporate and government boards.

Kresge Auditorium - W16 Stratton Student Center - W20



Front & back cover image credit

Silicates ore in thin section observed with cross polarized light, prove to be of remarkable Potash content, making them a possible new source to produce K fertilizer.

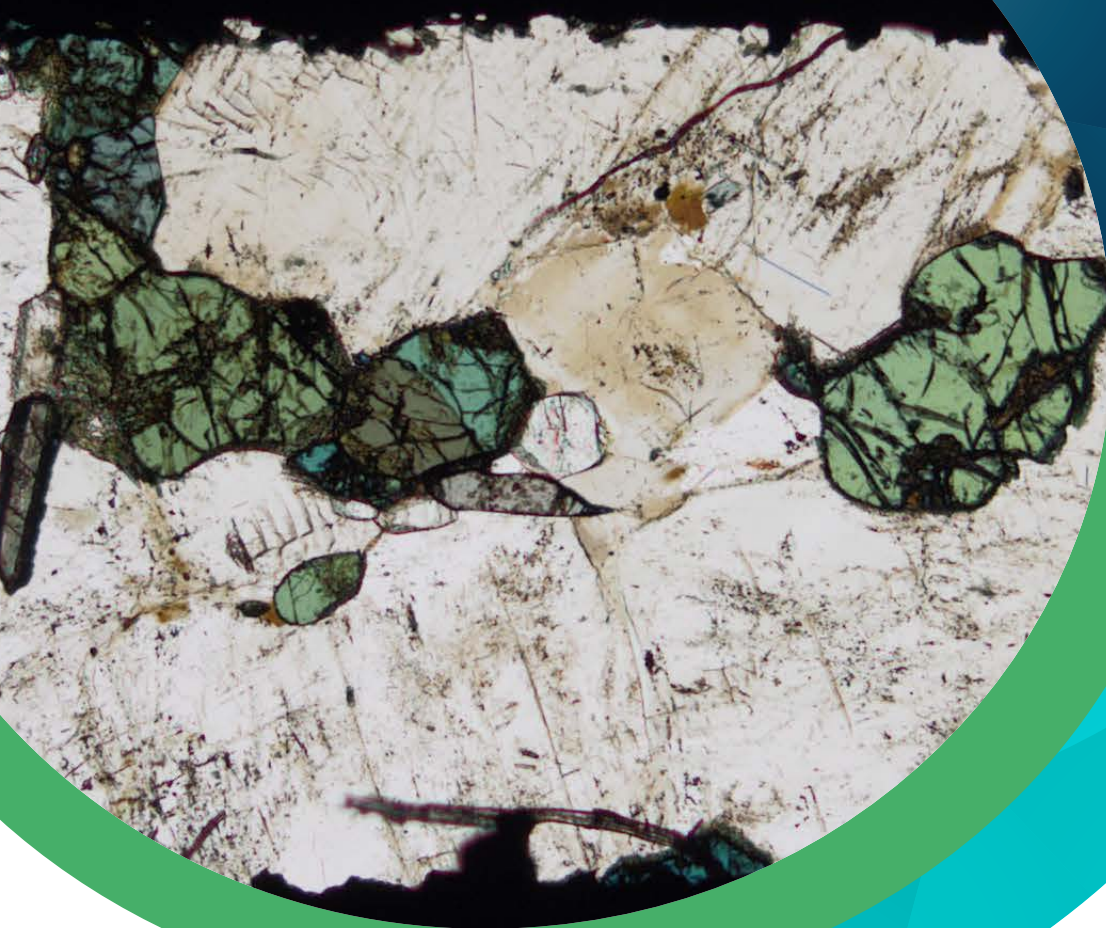
Image provided by the Allanore research group.

Professor Antoine Allanore
<http://allanore.mit.edu>

Dates for future Materials Day events:

October 10, 2018

October 9, 2019



MIT Materials Research Laboratory
77 Massachusetts Avenue, 13-2106
Cambridge, MA 02139
617-253-5179
<https://mrl.mit.edu>
email: mit-mrl@mit.edu

