



MSE *news*



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Dear Alumni and Friends:



The year 2016 marked the 5th year anniversary of Materials Genome Initiative (MGI), a major federal initiative launched by President Obama to spark a paradigm shift in how new materials are discovered, developed, and deployed. Over

the past five years, federal agencies, including DOE, DoD, NSF, NIST, and NASA, have invested more than \$500 million in resources and infrastructure in support of this initiative. This highlights the impact of materials research in shaping the national economy in the 21st century. The White House press release on MGI's 5th anniversary featured a selection of accomplishments and technical successes that included DoD's [Lightweight Innovations for Tomorrow](#) (LIFT) Manufacturing Innovation Institute for metals processing and structural design to provide lighter weight products, systems, and vehicles directed by Professor Alan Taub; DOE's *Center for Predictive Integrated Structural Materials Science (PRISMS)*, directed by Professor John Allison, NSF's *Summer School for Integrated Computational Materials Education* directed by Professor Katsuyo Thornton. These are some examples of the national research leadership by U-M's MSE faculty.

In the academic year 2015-2016, Associate Professor Emmanuelle Marquis was appointed the Director of the new Michigan Center for Materials Characterization, (MC)², located in the North Campus Research Complex (NCRC). The new facility (MC)² is managed directly by the Associate Dean of Research of the College of Engineering and it replaces MSE's old

Electron Microbeam Analysis Lab (EMAL) that is now closed. In Fall 2016, Associate Professor Anish Tuteja took over as the Chair of MSE's Graduate Program replacing Professor Jinsang Kim who completed his term as Graduate Chair, and Associate Professor Pierre Ferdinand Poudeu became the new Chair of MSE's Master's program. Finally, this year, Associate Professor Max Shtein was renewed for another term as faculty co-director of the College of Engineering's Center for Entrepreneurship. Professor Rachel Goldman was re-appointed as Associate Director of Applied Physics. Congratulations to all these faculty members in their new or continuing leadership roles on campus!

This year MSE initiated several new events to enhance student experience in the department. The MSE undergraduate committee, chaired by Professor Joanna Millunchick, organized the inaugural MSE Career fair inviting companies seeking MSE graduates, and several outreach and open house events on campus. The graduate committee initiated a MSE graduate student symposium recognizing the research accomplishments of MSE PhD students through oral and poster presentation competition and several prizes were awarded.

The MSE External Advisory Board

comprising of department alumni was reconstituted this year with a kick-off meeting in Fall 2016 homecoming. Earlier in the year, MSE hosted the inaugural MSE Distinguished Alum Lecture presented by Professor Elizabeth A. Holm from CMU. The lecture was presented as a graduate seminar in the department and the awardee was the department's invited guest of honor at the annual MSE graduation dinner. The annual CoE alumni merit award was presented in Fall 2016 to Dr. Aaron Crumm. The department website features a new page dedicated to alumni (<http://www.mse.engin.umich.edu/alumni>) and I invite the alumni to send us news and updates.

In the calendar year 2016, MSE welcomed two new Assistant Professors: John Heron and Ashwin Shahani. John works in the area of growth and device fabrication of multifunctional complex oxides while Ashwin works in solidification science and 4D X-ray tomography.

With the University gearing up for the bicentennial celebrations (<http://bicentennial.umich.edu>), 2017 promises to be an action-packed year on campus. I look forward to interacting with many more of the MSE alumni next year.

Go Blue!

Anish Tuteja

Introducing New Staff



Cassandra Ware, HR Assistant. Joined MSE as HR Assistant in September 2016. She is working in a new position shared with Chemical Engineering. Cassandra provides support to Department in areas of Human Resources. Responsibilities include processing staffing and personnel records, as well as handling compensation, benefits and training. She provides assistance with visa, I-9 and other employment documentation processing.



MATERIALS SCIENCE and ENGINEERING
University of Michigan
3062 H.H. Dow Building
2300 Hayward Street
Ann Arbor, MI 48109-2136
(734) 763-2445
(734) 763-4788 fax

mse.engin.umich.edu

Department Chair
Amit Misra

Contributing Writers
Kate McAlpine
Gabe Cherry

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Regents of the University of Michigan: Michael J. Behm, Mark J. Bernstein, Laurence B. Deitch, Shauna Ryder Diggs, Denise Ilitch, Andrea Fischer Newman, Andrew C. Richner, Katherine E. White, Mark S. Schlissel *ex officio*.

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Heron and Shahani join MSE as Assistant Professors



John Heron joined the Department of Materials Science and Engineering as an Assistant Professor in Winter 2016.

John studied Physics as an undergraduate at the University of California, Santa Barbara. His undergraduate research was performed under the mentorship of Professor David Awschalom. He used magnetotransport and magnetometry studies to investigate the evolution of magnetic properties of the magnetic semiconductor $\text{Ga}_{1-x}\text{Mn}_x\text{As}$ as a function of Mn alloying.

As a graduate student he was awarded the NDSEG graduate fellowship and worked in the thin film complex oxide group of Professor Ramamoorthy Ramesh at the University of California, Berkeley. During this time his research focused on investigating magnetoelectric multiferroics for low-power switching of a magnetization at room temperature. A variety of deposition and measurement techniques and several device designs were employed to study the mechanisms of ferroelectric and magnetoelectric switching in the model multiferroic BiFeO_3 . Additionally, John has studied the interface coupling mechanisms in functional heterointerfaces between a multiferroic oxides and ferromagnetic metals. Some of this work is highlighted and summarized in [1] and [2]. In 2013 John was awarded Ross N. Tucker Memorial Award for superior work and scholarship in the characterization, development and/or use of semiconductor, magnetic, optical or electronic materials by a graduate student or students pursuing such areas of inquiry at the University of California, Berkeley.

After earning his masters (2011)

and doctoral (2013) degrees from the University of California Berkeley he began postdoctoral research at Cornell University under the co-mentorship of Professors Darrell Schlom and Dan Ralph. During this period, his research focused on the deposition and characterization of fully epitaxial composite multiferroics consisting of a large magnetostriction metals, galfenol ($\text{Fe}_{1-x}\text{Ga}_x$), or metamagnetic materials, ($\text{Fe}_{1-x}\text{Rh}_x$), on ferroelectric thin films (BaTiO_3) and substrates (PMN-PT). He then focused on the design and measurement of ferroic and magnetoelectric properties of these systems in prototype device architectures to push towards the goal of ultra-low energy consumption spintronics.

At U-M, John will develop a research group that will explore the epitaxial deposition and properties of new oxide materials and heterostructures in the pursuit of finding undiscovered material functionalities for hybrid magnetoelectrics-spintronics applications. Particular emphasis is placed in interface, spin, structure, and charge effects that occur in layered structures with ferroic (and anti-ferroic) materials, such as (anti) ferromagnets, (anti)ferroelectrics, and multiferroics.

More about John can be found at: <http://www.mse.engin.umich.edu/people/jtheron>

[1] M. Fiebig, "Zigzag polarization straightens magnetization out," Physics 4, 95 (2011).

[2] K. Dörr, "Two steps for a magnetoelectric switch," Nature 516, 337-338 (2014).



In September 2016, the Department of Materials Science and Engineering will welcome Ashwin Shahani to the faculty as an assistant professor.

Shahani says that patterns in nature have always fascinated him. "We see beautiful structures falling from the sky, and yet we cannot explain how they came to be. How do molecules in the disordered gaseous state organize themselves into ice crystals? This is a fundamental question that remains to be answered."

Snowflakes are but one example from a large class of complex patterns. Other examples include dendritic and faceted structures. Shahani believes that the problem of pattern formation in such systems not only has scientific merit but also technological importance.

"What we learn from studying the growth of these remarkable patterns can then be used to process advanced materials for aerospace or automotive applications. The insights gained will allow us to better tune the as-grown structures to technological demands."

Shahani spent many of his formative years in Chicago. He joins UM MSE from Northwestern University, where he earned

his doctoral degree in Materials Science and Engineering. During this time, his research focused on the crystallization behaviors of highly faceted systems from a liquid phase. Some of his work is highlighted in [1].

"I studied alloys of aluminum (Al) and silicon (Si). The Al-Si alloy is used in 90% of the total Al cast parts produced. The highly directional covalent bonds of the Si phase have a profound impact on the chemical and mechanical properties of the material."

For his work, Shahani was awarded the National Science Foundation (NSF) graduate research fellowship as well as the first place award at the John E. Hilliard symposium.

At UM, Shahani will develop a research group at the forefront of solidification science. His group will explore a wide range of unanswered questions in the community, with particular emphasis on the growth of eutectics, semiconductors, and quasicrystals.

"I am excited to collaborate with members within my department as well as from other disciplines to solve these problems. A multidisciplinary approach is critical to understand the physical phenomena occurring at the different temporal and spatial scales."

[1] A. J. Shahani et al., Scientific Reports 6, 28651 (2016). <http://dx.doi.org/10.1038/srep28651>

Welcome to our Courtesy Faculty



In 2016, Materials Science and Engineering offered a courtesy appointment to Fei Gao.

In Fall 2016, Fei Gao became Professor of MSE through courtesy appointment. He joined University of Michigan in 2014 as Professor of Nuclear Engineering. His Ph.D. is in Materials Science from University of Liverpool in 1995. Prior to joining U-M, he was Chief Scientist at Pacific Northwest National Laboratory. His expertise is in multi-scale computer simulations of microstructure evolution of solids under irradiation employing various methods, including density functional theory (DFT), ab initio molecular dynamics, time-dependent DFT, and tight-binding calculations, molecular dynamics simulations, long-time dynamics, kinetic Monte Carlo, and cluster dynamics.



(MC)² Celebrates its First Year

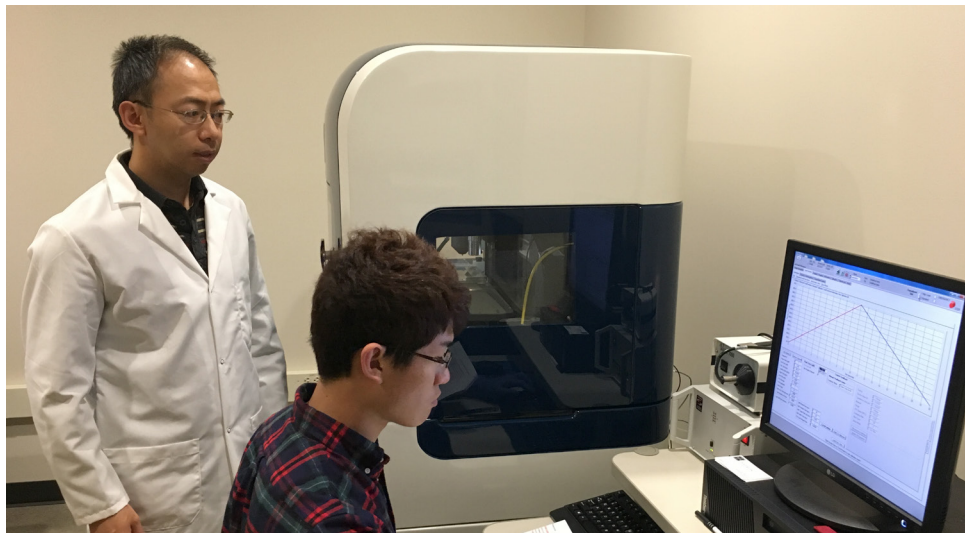
By Emmanuelle Marquis, Director of (MC)²

It is only one year since its creation and the Michigan

Center for Materials Characterization (formerly EMAL) continues on its successful path to provide state of the art instruments, professional training, and in-depth education for students and researchers.

Two new members joined the Center in early March. Bobby Kerns is our new Center Manager, and Dr. Allen Hunter completes our team as Instrument Scientist. Together, Bobby and Allen bring unique expertise in facility management, instrument maintenance, and advanced SEM and FIB operation. We are very proud to have them on our team!

We introduced a couple of new instruments, adding new capabilities and upgrading existing techniques. The Hysitron TI950 triboindenter enables mechanical and tribological characterization from the nano to microscale for a wide range of materials and structures. It is complemented



Haiping Sun (MC)² and Chen Li (ME graduate student) using the triboindenter.

by the Hysitron PI 95 Pico-indenter, a specialty holder for direct observations of nanomechanical testing inside a transmission electron microscope. A new Tescan scanning electron microscope with X-ray energy dispersive spectrometry and electron backscattered diffraction capabilities joined our series of existing electron columns. (MC)² helped the MSE department secure funding for a new

XRD instrument earlier this year. Another big achievement came from the award of a grant from the National Science Foundation – Major Instrumentation Program to acquire a new scanning electron microscope for real-time studies of materials behavior. The microscope will be equipped with a unique set of complementary imaging and analysis modalities: secondary electron and back-scattered electron diffraction in low and

high vacuum modes, X-ray energy dispersive spectrometry, Raman spectroscopy, monochromated cathodoluminescence, and a heating stage (up to 1000°C).

Education and training remain a top priority for our staff. Weekly seminars are offered to introduce users to our techniques and provide the necessary background information before individual hands-on training on the instruments. We have also changed some of our access requirements to make it easier for students and researchers from local universities to access the Center, and we've welcome users from Wayne State University, Michigan State University, Central, Eastern, and Western Michigan Universities.

Looking forward, we will continue to update and replace some of our microscopes as they reach end of life, develop new techniques, and

Photo:
Bobby Kerns,
(MC)² Manager.



CONTINUED ON PAGE 5



Allen Hunter (MC)² and Ellen Solomon (MSE graduate student) using the new scanning electron microscope.



John Mansfield teaches weekly seminars introducing techniques to new users.

find innovative ways to bring in new capabilities, all of which we will share with you in next year's newsletter! Current information regarding access, training, instruments, seminars and other events is posted on our website: <http://mc2.engin.umich.edu>. Don't miss our New Year Best Photo Competition.

Finally, should you need materials analyses, want to use our instruments, want to be involved in the acquisition of instrument, attend our seminars, or share ideas, contact us!

Contact information at:

<http://mc2.engin.umich.edu>

Emmanuelle Marquis, Director of (MC)²

Lightweight Innovations for Tomorrow

By Alan Taub, CTO

We are nearing the end of the third year operating LIFT (Lightweight Innovations for Tomorrow), which was established by the University of Michigan in partnership with Ohio State University and EWI. LIFT, as part of a new national network of manufacturing innovation institutes, is focused on developing advanced approaches for manufacturing lightweight metal components for the machines that move people and goods on land, sea and air. Over 100 companies, universities and non-profit organizations are supporting the institute. A number of University of Michigan faculty are playing leadership roles in LIFT including Vice President for Research Jack Hu as a board member and Professor Alan Taub as Chief Technology Officer.

University of Michigan faculty are involved in almost every LIFT project and have been awarded over \$12.5M in contracts. The various projects are already delivering results on projects being executed with several industry partners. This includes microstructure and texture development of incrementally formed aluminum sheet, optimized welding procedures for steel

plate and development of Integrated Computational Materials Engineering (ICME) capabilities for linear friction welded titanium alloy components and advanced aluminum alloy castings and forgings. In addition, MSE has agreed to house the institute's ICME staff under the leadership of Professor John Allison.

LIFT is headquartered in downtown Detroit and is in the process of installing a range of pilot scale metals processing equipment including a linear friction welder, a forming press designed for local temperature control, a hot isostatic press, and a robotic welding station capable of handling components as large as ship plate. The Michigan Economic Development Center provided \$8.5 million dollars to procure the equipment. In September, graduate students from MSE and ME performed the first experiments conducted at the LIFT facility. They used the new state-of-art coordinate measuring machine to analyze an incrementally formed part made at the university as part of a LIFT project being conducted with Boeing.

In addition to the equipment being installed at LIFT, the University of Michigan allocated \$3M to procure advanced manufacturing equipment that is being installed in the Wu Manufacturing Center in the H.H. Dow building. A Gleeble elevated temperature, thermo-mechanical simulator is already fully operational. In addition, a formability press and a friction stir welder are expected to be delivered later this year.

"I am proud to have been a part of establishing a new research organization dedicated to improving U.S. manufacturing competitiveness. Working together with our company members on key advanced metals technology is already producing results including state-of-the-art thin wall castings and low distortion welding of high strength steel plates for naval vessels" said Alan Taub, U-M professor of materials science and engineering and chief technology officer of the new institute.

From left to right: Caleb Reese (MSE graduate student), Maya Nath (MSE graduate student), Xun Liu (MSE/ME post-doc), Zongtai Luo (ME graduate student), Sherkoh Abbas (Director of Technology Operations for LIFT), and Erika Salem (MSE graduate student).



Materials Genome Initiative - PRISMS Center

Center for PRedictive Integrated Structural Materials Science

By John Allison, Director

The Materials Genome Initiative (MGI) celebrated its fifth anniversary in August 2016 at the White House. The UM PRISMS Center was highlighted at that event and acknowledged for its significant contributions to this important national effort. The PRISMS Center is one of five national MGI Software Innovation Centers established in 2012 to accelerate the pace of materials developments. To make this possible, the center is developing and demonstrating a suite of advanced software tools for predicting the behavior of metals. These computational tools are open source and being made available to the global materials community.

Experimentalists are also actively engaged and critical to the success of the Center, developing new experimental methods and using them to quantify precipitate characteristics, micro-scale strain distributions and detailed properties such as the initiation and growth of small fatigue cracks.

This year the PRISMS Center released major upgrades of all of our software tools. These tools include an advanced statistical mechanics code (CASM) for calculating the energetics of phases

and phase diagrams, a major new phase field code (PRISMS-PF) for simulating how precipitates evolve and an efficient finite element software method (PRISMS-Plasticity) for predicting how microstructure affects properties such as strength and fatigue (PRISMS-Plasticity).

We are using these simulation tools in conjunction with advanced experiments to demonstrate the power of working together in new ways using new tools. Magnesium alloys are our test bed for this demonstration and by working in this

way, we have uncovered new insights in how the nano-scale phases that are essential for strengthening advanced magnesium alloys evolve. We are using these insights to quantify and predict how alloying and heat

treatment affect the strength and fatigue resistance of these new alloys.

An important thrust of our center is the development of new methods for sharing our scientific information and making it available to the broader community. To accomplish this, we have been developing the Materials Commons. The Materials Commons is a unique web-based information repository and collaboration platform - and it also was made available to the public this year.

The PRISMS Center hosts an annual workshop for training and technical exchange. Over 90 people have attended our workshops over the past two years. To get additional information or sign-up for future events please visit our website at: <http://prisms-center.org>.

The PRISMS Center involves faculty, research staff and students from across the university, including MSE faculty John Allison, Vikram Gavini, Wayne Jones, Emmanuelle Marquis, Amit Misra and Katsuyo Thornton and MSE Research Staff Brian Puchala, Stephen DeWitt and Terry Weymouth. John Allison serves as the Center Director.



Prof. Liang Qi discusses the latest results from Anirudh Natarajahn a PRISMS PhD student with Prof. Van der Ven (UCSB) working on precipitates in Mg-rare earth alloys.



The poster session with PRISMS workshop attendees, faculty, staff and students.

The Kim Group Finds the Roles of Molecular Motions in Room Temperature Phosphorescence

By Jinsang Kim

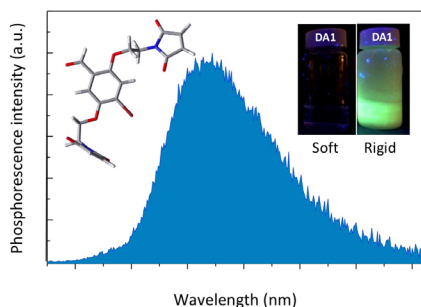


Fig. 1 - Bright emission of purely organic phosphor DA1 in a rigid environment

organic phosphors that could be the key to phosphorescent LEDs.

Today's LEDs emit light in what's called a singlet energy state, which only converts about 25% of the electricity that's consumed into light. But phosphors convert energy into a triplet state, which in theory enables them to emit nearly 100% of consumed energy as light. The trouble is, getting bright light has traditionally required makers to dope the phosphors with heavy metals. These organo-metallic phosphors are expensive and sometimes toxic. And blue phosphors--which are essential in the production of white light--don't last long enough to be viable for use in commercial devices.

The Kim group introduced bright, metal-free, purely organic phosphors that could be tuned to any color in 2011, using a rational molecular design. But their efficiency was still much less than that of their organo-metallic counterparts because vibration at the molecular level caused them to waste much of their energy as heat.

In a development that could hasten the advent of low-cost, high-efficiency LEDs and solid-state lighting, a group of University of Michigan researchers has developed a new process that can improve the efficiency of the of metal-free

Now, the group has used a different approach to create a new, phosphor-doped polymer with a more rigid molecular structure. They used rational chemical design to covalently link metal-free purely organic phosphors and paired polymer matrixes. The self-assembling, metal-free polymers waste far less energy as heat through vibration, dramatically increasing their efficiency compared to the same phosphors-doped polymers without the covalent linkage.

The team's phosphor-doped polymer achieved a phosphorescence efficiency of 28 percent. While this figure is only slightly better than today's widely-used fluorescent LEDs, the developed strategy and thorough understanding of the correlation between molecular motions and emission intensity could be readily applicable to further development of organic phosphors and variety of polymers, potentially leading to big efficiency gains in future all-organic phosphorescent LEDs. The technology is also useful in bio-imaging and sensing applications.

The team's findings are detailed in a new paper published in the journal *Nature Communications* entitled "[Suppressing Molecular Motions for Enhanced Room Temperature Phosphorescence \(RTP\) of Metal-free Organic Materials.](#)" Funding was provided by the National Science Foundation, a Samsung GRO grant and the Spanish Science Ministry.

Acknowledgement goes to the team: Min Sang Kwon, Youngchang Yu, Caleb Coburn, Andrew W. Phillips, Kyeongwoon Chung, Apoorv Shanker, Jaehun Jung, Gunho Kim, Kevin Pipe, Stephen R. Forrest, Ji Ho Youk, Johannes Gierschner, Jinsang Kim "Suppressing Molecular Motions for Enhanced Room Temperature Phosphorescence (RTP) of Metal-free Organic Materials" *Nature Commun.* 2015, 6, 8947

ASM Teacher's Camp

By Timothy Chambers

experiments to bring to their own students, and to sharpen their pedagogical skills. The camp was led by ASM Master Teachers Andy Nydam, Debra Goodwin, and Gissel McDonald, with a large support crew including Keith McIntyre and Tim Chambers from our department.

Attendees spent five days performing experiments, enjoying presentations, and holding discussions in MSE classrooms and the Van Vlack laboratory. Some highlights included building mechanical testers, growing copper crystals from solution, drawing fiber optic cables, and creating pottery. Meanwhile, classroom sessions helped teachers develop their understanding of the principles behind the experiments.

Additionally, many of the teachers were second-year attendees preparing to launch materials science classes at their own schools. For these teachers, UM-MSE faculty and staff were able to provide insight on the nature of Materials Science and Engineering as an academic discipline and career path that ties together many fields of science and engineering. It is our hope that these teachers will bring this understanding to their students, preparing them to continue exploring and appreciating the world of materials well beyond their high school years.

This July, UM-MSE hosted the annual ASM Teacher's Camp located in Ann Arbor. High school and college teachers came from across the country and around the world – as far as Brazil - to develop their knowledge of MSE content, to learn about new lessons and

Spray-on Coating Could Ice-proof Airplanes, Power Lines, Windshields

By Gabe Cherry (Tuteja Research Group)



Fig. 1 - Icy conditions applied to a license plate – the left side is uncoated; the right side is coated with new icephobic substance being researched by Anish Tuteja's group.

On your car windshield, ice is a nuisance. But on an airplane, a wind turbine, an oil rig or power line, it can be downright dangerous. And removing it with the methods that are available today—usually chemical melting agents or labor-intensive scrapers and hammers—is difficult and expensive work.

That could soon change thanks to a durable, inexpensive ice repellent coating developed by University of Michigan researchers. Thin, clear and slightly rubbery to the touch, the spray-on formula could make ice slide off equipment, airplanes and car windshields with only the force of gravity or a gentle breeze. This could have major implications in industries like energy, shipping and transportation, where ice is a constant problem in cold climates.

The new coating could also lead to big energy savings in freezers, which today rely on complex and energy-hungry defrosting systems to stay frost-free. An ice-repelling coating could do the same job with zero energy consumption, making household and industrial

freezers up to 20 percent more efficient. The coating is detailed in a new paper published in the journal *Science Advances*.

Made of a blend of common synthetic rubbers, the new formula marks a departure from earlier approaches to icephobic coatings, which relied on making surfaces either very water repellent or very slippery.

“Researchers had been trying for years to dial down ice adhesion strength with chemistry, making more and more water-repellent surfaces,” said Materials Science and Engineering graduate student Kevin Golovin. “We’ve discovered a new knob to turn, using physics to change the mechanics of how ice breaks free from a surface.”

Led by U-M Materials Science and Engineering associate professor Anish Tuteja, the team initially experimented with water-repelling surfaces as well, but found that they weren’t effective at shedding ice.

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But during their experiments, they noticed something unexpected: rubbery coatings worked best for repelling ice, even when they weren't water repellent. Eventually, they discovered that the ability to shed water wasn't important at all. The rubbery coatings repelled ice because of a different phenomenon, called "interfacial cavitation."

Golovin explains that two rigid surfaces—say, ice and your car windshield—can stick tightly together, requiring a great deal of force to break the bond between them. But because of interfacial cavitation, a solid material stuck to a rubbery surface behaves differently. Even a small amount of force can deform the rubbery surface, breaking the solid free.

"Nobody had explored the idea that rubberiness can reduce ice adhesion," Tuteja said. "Ice is frozen water, so people assumed that ice repelling surfaces had to also repel water. That was very limiting."

The new approach makes it possible to dramatically improve durability compared to previous icephobic coatings, which relied on fragile materials that lost their ice-shedding abilities after just a few freeze-thaw cycles. The new coatings stood up to a variety of lab tests including peel tests, salt spray corrosion, high temperatures, mechanical abrasion and hundreds of freeze-thaw cycles.

The team has also found that by slightly altering the smoothness and rubberiness of the coating, they can fine-tune its degree of ice repellency and durability. Softer surfaces tend to be more ice repellent but less durable, while the opposite is true for harder coatings. Golovin believes that that flexibility will enable them to create coatings for a huge variety of applications.

"An airplane coating, for example, would need to be extremely durable, but it could be less ice-repellent because of high winds and vibration that would help push ice off," Golovin said. "A freezer coating, on the other hand, could be less durable, but would need to shed ice with just the force of gravity and slight vibrations. The great thing about our approach is that it's easy to fine-tune it for any given application."

In fact, the team has already designed hundreds of ice-repelling formulas. Some are rough to the touch, some smooth; some shed water while others don't. But they all have one thing in common: ice slides off easily.

University of Michigan researchers demonstrate a durable ice-repellent coating that could help keep everything from airplanes to ships, power lines and windshields ice-free.

"I think the first commercial application will be in linings for commercial frozen food packaging, where sticking is often a problem. We'll probably see that within the next year," Tuteja said. "Using this technology in places like cars and airplanes will be very complex because of the stringent durability and safety requirements, but we're working on it."

The team received funding and assistance from the U-M MTRAC program, created to support new innovations that demonstrate high commercial potential. MTRAC is funded in partnership with the Michigan Economic Development Corporation's Entrepreneur and Innovation initiative, which focuses on establishing Michigan as the place to create and grow a business by providing high-tech start-up companies with access to a variety of resources.

The paper is titled "Designing durable icephobic surfaces." Funding was provided by the Office of Naval Research, the Air Force Office of Scientific Research, the National Science Foundation and the Nanomanufacturing Program (grant number 1351412).



Fig 2. - New ice repelling substance being studied in Tuteja lab

The Kim Group Developed Stimuli-Sensitive Polymers for Efficient Capture and Release of Circulating Tumor Cells

By Kate McAlpine (Kim Research Group)

A new device developed at the University of Michigan could provide a non-invasive way to monitor the progress of an advanced cancer treatment. It can pick cancer cells out of a blood sample and let them go later thanks to a new stimuli responsive polymer developed by the Kim research group, enabling further tests that can show whether the therapy is successfully ridding the patient of the most dangerous cancer cells.

Cells released into the bloodstream by tumors could be used to monitor cancer treatment, but they are very

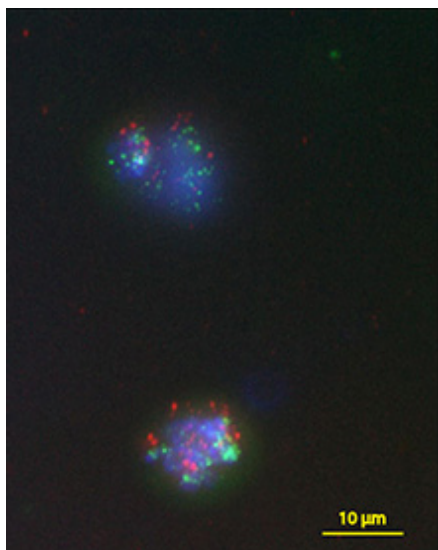


Fig. 1 - Fluorescence probes in two breast cancer cells give information about which genes are present. The green dots show that both cells have multiple copies of the HER2 gene, suggesting that the cancer is aggressive. Credit: Nallasivam Palanisamy)

difficult to capture, accounting for roughly one in a billion cells.

Sunitha Nagrath, an assistant professor of chemical engineering, and her collaborators pioneered technologies for capturing these cells from blood samples. Their devices trapped the cells on chips made with graphene oxide, a single layer of carbon and

oxygen atoms. But all analysis had to be done on the chip because the cells were firmly stuck.

“We could grow the cells on the chip or analyze them all together, but research has shown that cancer cells are not all the same. Hence it is important to study cells individually, and our new device makes this possible,” said Nagrath.

The stem cell theory of cancer holds that relapses occur because chemotherapy and radiation therapy

are not very effective at killing cancer stem cells, which make up between

about one and ten percent of a tumor. As a result, the cancer stem cells left behind are able to regrow the tumor or spread to other areas of the body.

New treatments in clinical trials attack the stem cells, but killing this smaller population does not immediately shrink the tumor. Doctors need a good way to monitor whether the cancer stem cells are on the decline. This may be possible through blood tests, but clinicians need to study captured cells individually, and that means removing them from the chip.

“How can we release the cell without damaging it—that’s the name of the game,” said Jinsang Kim, a professor of materials science and engineering, who co-led the project with Nagrath.

Kim works on design principles for creating chain-like molecules with particular capabilities, and his team devised a solution. His group developed a polymer that is solid at room temperature but falls apart at a temperature that can be set anywhere between about 40 and 68 degrees Fahrenheit.

The polymer dissolves in water when it interacts with water molecules. At higher temperatures, heat breaks up the interactions, so the polymer doesn’t dissolve. Apoorv Shanker, a graduate student in macromolecular science and engineering, set the polymer to dissolve at temperatures below 54 degrees. The team mixed the tiny cell-catching graphene oxide flakes into the polymer and built the chip into a device to guide the blood sample over it.

“It’s very gentle for the cells,” said Nagrath, contrasting the slight dip in temperature with other designs that rely on heating or enzyme-induced chemical reactions to release the cells.

Still, it wasn’t easy to make the device work at first.

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“We had to solve various issues such as incorporating polymer-GO film in a microfluidic device, leaking and cells sticking to the device,” said Apoorv. The team expected the cancer cells to flow out of the device as the polymer dissolved, but instead, they latched onto the uncovered glass surface.

“We patterned the polymer-GO composite film into the device via selective chemical surface modification,” said Apoorv. “And we prevented cells from attaching onto glass by adding another layer of very non-adhesive molecules between glass slide and release polymer,” added Molly Kozminsky, a doctoral student in chemical engineering.

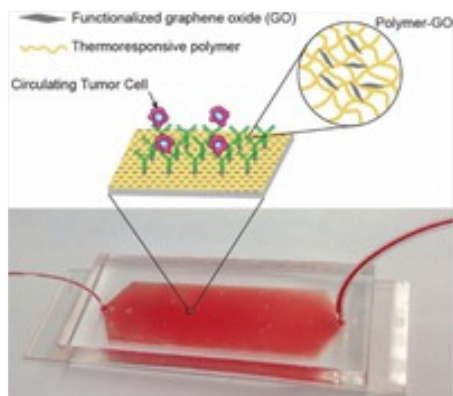


Fig. 2 - The device captures cancer cells from a blood sample. When a cold solution runs through the device, it releases the cancer cells for further study. Credit: Hyeun Joong Yoon, Apoorv Shanker, Angela Yang Wang, and Molly Kozminsky University of Michigan.

The device can capture and live-release up to 80 percent of the cancer cells in the initial blood sample. Then, the clinicians could collect the cells into a tissue-like sample for conventional analysis, which can reveal the

proportion of captured cancer cells that are stem cells. Alternatively, they could identify single cells for more

detailed study, such as full genetic sequencing or tests that identify which drugs would be most effective.

“Because the device is easy and cost-effective to make, large-scale clinical studies are possible,” said Kim.

This study was done in collaboration with the group of Max Wicha, a professor of oncology, and the group of Diane Simeone, a professor of surgery and molecular & integrative physiology. Other collaborators in this study, Hyeun Joong Yoon+, Apoorv Shanker+, Yang Wang, Molly Kozminsky, Qu Jin, Nallasivam Palanisamy, Monika L. Burness, and Ebrahim Azizi.

It is described in a paper titled, “Tunable Thermal-Sensitive Polymer-Graphene Oxide Composite for Efficient Capture and Release of Viable Circulating Tumor Cells,” which recently appeared in *Advanced Materials* 2016, 28, 4891.

The project was conceived of at a workshop held by the U-M Biointerfaces Institute, of which Nagrath and Kim are both members. The research was supported by the US National Institutes of Health, the Republic of Korea's Ministry of Science, ICT and Future Planning, and the US National Science Foundation.

The university is pursuing patent protection for this technology and is seeking partners to bring it to market.

Journal Paper: <http://onlinelibrary.wiley.com/doi/10.1002/adma.201600658/full>

2016 Van Vlack lectures were presented by Professor William L. Johnson, Ruben F. and Donna Mettler Professor of Engineering and Applied Science, California Institute of Technology. Bill Johnson is internationally recognized for his pioneering work on metallic glasses.

His public lecture was titled “*What are Glasses?: Atomic Organization and the Price of Non-Conformity*”, and his second lecture presented as part of the graduate seminar series was titled “*Science and Technology of Metallic Glasses*”. Michael Atzmon, MSE professor by courtesy, is a former PhD student of Bill Johnson.

The Van Vlack Lecture Series was established in honor of L. H. Van Vlack, to provide a distinguished lecture series from the outstanding leaders in the field of Materials Science and Engineering and is hosted by the current Van Vlack Chair Professor John Halloran.

Update on Van Vlack Lectures



2016 Van Vlack Lecturer Professor Bill Johnson from Caltech with Van Vlack family members; Nancy Van Vlack and her father Bruce Van Vlack who is Professor Larry Van Vlack's son.

Graduate Committee Update – November 2016

By Prof. Anish Tuteja - Graduate Committee Chair

The Graduate Committee has continued its focus on providing a high quality graduate education, and training our graduate students to build an outstanding career after graduation.

Our graduate students have excelled in numerous research, development, and leadership roles in the past year. Many of our graduate students have also received prestigious fellowships and awards including the National Science Foundation Graduate Student Fellowships, National Defense Science and Engineering Graduate Fellowship, Vietnam Education Foundation Fellowship, Rickover fellowship, College of Engineering Beyster Fellowship, College of Engineering Distinguished Leadership Award and the Rackham Barbour Scholarship.

Our students were also awarded a number of external awards including the Patagonia Eco Innovation Case Competition (1st place grand prize - \$10,000), Microscopy and Microanalysis Student, Willie Hobb Moore Trailblazer, Sweetland Graduate

Fellowship, Gore Fellows Award, Best Paper Award in Journal of Electronic Materials, MLK Spirit Award, Marian Sarah Parker Prize, DOE Office of Science Graduate Student Research (SCGSR) program award, and the American Chemical Society Colloid and Surface Chemistry Division Outstanding Student Poster Award, amongst many others. Awardees listed in Student External Awards section.

22 new Ph.D. students and 13 MS students having record high GPA and GRE scores joined the department in Fall 2016. There were selected and admitted from among more than 400 applications from top US universities and renowned schools from all over the world. Fellowships were awarded to all admitted Ph.D. students from the department to fully cover at least the first term. A fellowship and / or a graduate student research assistantship, a graduate student instructorship, or some combination of these will be provided to all students for the following years.

The inaugural MSE Graduate Students' Symposium was held on October 28th. The symposium highlighted the best graduate student research within the department. 25 students made either oral (5) or poster (20) presentations. All oral presentation received either the gold or the silver award. One gold award, and two silver awards were also given to the best posters. Winners will also be recognized at the annual MSE graduate dinner in April 2017.

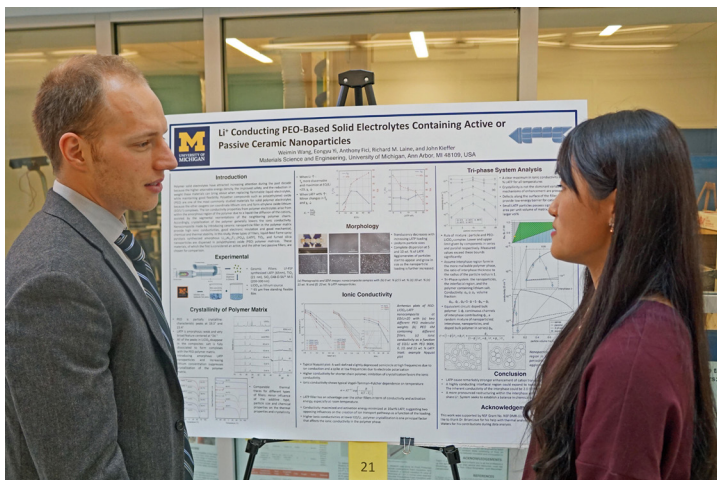
Twenty seven Ph.D. students have either successfully defended, or are in the process of defending their dissertations, between January – December 2016. Congratulations to those that have successfully defended: Matthew Dejarld, Olga Shalev, Alexander Chang, Eric Irrgang, Sunyeol Jeon, Andrea Jokisaari, Jake Jokisaari, Anton Li, Tapiwa Mushove, Terry Shyu, Kale Stephenson, Guln Vardar, Michael Waters, Bradley Wing, and Junnan Zhao.

These students have accepted positions at various academic, national lab, and industrial employers such as Samsung, Dow Chemical, General Motors, Applied Materials, Exponent, SpaceX, Oak Ridge National Laboratory, NIST, Argonne National Laboratory, Northwestern University and UCSB.

The graduate committee aims to continue recruiting top quality students for our graduate program, and will particularly focus on enhancing diversity within our program. We also plan on an annual career workshop for our graduate students, starting in April 2017. The workshop will feature multiple speakers from academia, industry, and national labs. The goal of the workshop will be to educate our students on the best practices for obtaining a position after graduation in these three distinct fields, transitioning from the classroom to the active workforce, and having a successful career in each of these fields.



Finalists for Oral Symposium left to right, Eric Harper, Kevin Golovin (1st place), Ellen Solomon, Wesley Chapkin, Peng-Wei Chu



Wesley Chapkin reviews poster with Weimin Wang

Undergraduate Committee Report

By Prof. Joanna Millunchick (Undergraduate Committee Chair)

The undergraduate program continues to be recognized as among the best Materials Science undergraduate programs in the Nation, and is currently ranked #4 according to U. S. News and World Report (2016).

A major effort this past year has been in increasing the number of students who declare in Materials Science. The department hosted several recruiting events for undeclared students, including a pizza dinner and a pumpkin-casting event on the new Gerstaker Grove (see sidebar). Over the summer, we will also contact incoming freshmen with information about the department, and opportunities for students who major in Materials Science.

In order to serve our existing majors, the department held our first Materials Science centered career fair last January. Six companies from a number of companies in southeast Michigan took part, and approximately 60 students attended looking for internships and permanent position. The second

Materials Science career will take place this January, with an even larger slate of companies in attendance.

The department also continues to innovate in the realm of education. **Dr. Wynarsky** developed a new version of the Intro to Materials Science course (MSE 220) focused on Aerospace engineering. **Prof. Shtein** serves as Faculty Co-Director for the Undergraduate Program in Entrepreneurship on North Campus, and developed and taught several courses in the Center for Entrepreneurship in entrepreneurial design. **Prof. Thornton** founded and continues to organize a Summer School for Integrated Computational Materials Education that hosts faculty and students from other universities to broaden the reach of computational materials science education. Finally, **Prof. Millunchick** is working with a student startup called Gwydion to develop an augmented reality app for viewing crystal structures to be used in learning modules across the curriculum.



HOW DOES A MATERIALS SCIENTIST COOK A PUMPKIN?

With molten aluminum, of course!

The day was sunny and crisp. The scene was the newly renovated Eda U. Gerstaker Grove on North Campus. Approximately 50 students looked on as Dr. Tim Chambers lopped the tops off of pumpkins, and filled their innards with liquid aluminum. The event was both a celebration of autumn and a demonstration of one of the important topics in Materials Science: metals casting. Check out a video of the event: <https://www.youtube.com/watch?v=btbKh1h5u3o>



Writing to Learn in Introductory Materials Science

By Prof. Rachel Goldman

The latest pedagogical innovation in the Department of Materials Science and Engineering had its debut during the spring term of 2016, with the first offering of “M-Write MSE 250”, in which “writing to learn” pedagogies were infused into introductory materials science and engineering. Students in MSE 250 wrote about several key concepts including the interpretation of phase diagrams, polymer recycling and its impact on mechanical properties, and corrosion as it relates to the recent Flint water crisis. The course was taught by Rachel Goldman, Prof. of Materials Science and Engineering, who is a co-PI of M-Write, a project funded by the University’s Third Century Fund, with project directors Ginger Shultz from Chemistry and Anne Ruggles Gere, Director of the Sweetland Writing Center.

M-Write aims to transform the teaching and learning in large enrollment gateway courses so that there is more opportunity for student engagement and transformative learning. The key innovations of this approach include the development of concept-based writing prompts and rubrics and their incorporation via automated peer review. Prof. Goldman was the first to implement all the elements of M-Write into a gateway UM course. Prior to and during the spring term offering of MSE 250, Prof. Goldman worked with M-Write staff to identify key concepts, focusing on the ones that students typically find most difficult, and to develop prompts that address these concepts.

Overall, MSE 250 student response to M-Write was very positive. Comments such as: “The writing helped me understand difficult concepts,” “I didn’t realize what I didn’t know until I started writing the prompt about phase diagrams,” and “I learned a lot from reading what other students wrote about polymers,” were typical, and they validate the M-Write premise that writing fosters learning. M-Write is currently being incorporated into several gateway courses campus-wide, ranging from introductory economics and statistics to organic chemistry. In addition, Goldman is currently introducing M-Write approaches into the intermediate-level electronic materials course, MSE 400, with plans to develop an M-Write Electronic Materials Science sequence, in collaboration with John Heron, Assistant Professor of MSE, Manos Kioupakis, Assistant Professor of MSE, and Timothy Chambers, Engineering Technician. For all of these courses, the approach consists of developing prompts based on key concepts to which students respond with a draft, then students participate in automated peer review, and write a revision to solidify their learning.

Following the pilot of M-Write MSE 250, M-Write’s software developer improved upon the automated peer review that is

part of Canvas, the University’s course management system, so students are able to write in response to a given prompt, upload it, and receive drafts from several other students to review and comment upon. In turn, they receive comments from other students, and these, along with what students glean from reading the drafts of others, enable them to revise their drafts. In other words, M-Write makes it possible for students in very large (several hundred or even a couple thousand students) gateway classes to write and receive feedback on their work.

Of course the technology is only part of the story. Every M-Write course has a cadre of advanced undergraduates who support and monitor the work of students in the course. These Writing Fellows, as the advanced undergraduates are called, have already taken the gateway course and have been nominated by their professors. For example, Jack Hu and Emily Rizzi, exceptional students from the senior and junior MSE class, served as Writing Fellows during the first offering of M-Write MSE 250. New Writing Fellows take a course from the Sweetland Writing Center that prepares them to help students with everything from the technology of the peer review system to strategies for using feedback to revise a draft.

During Winter Semester, M-Write will add courses in biology and take on expanded versions of Economics 101 and Materials Science Engineering. Plans are in place to add additional courses in the fall and to initiate a Sweetland Seminar for Engaged Learning that will bring together experienced and new faculty interested in incorporating M-Write into their courses. For further information about M-Write, go to <https://lsa.umich.edu/sweetland/m-write.html>

Prof. Goldman (center) with MWrite MSE 250 students, Saiful B. Roslin (left) and Nuramani S. Ramli (right).



Faculty Awards

Internal Awards



Emmanuelle Marquis is the recipient of the 2016 MSE Outstanding Achievement Award. This award is presented annually to a faculty member for

their stellar performance in materials research and teaching and service to the department. The winner is recognized at the annual CoE faculty honors dinner dance.



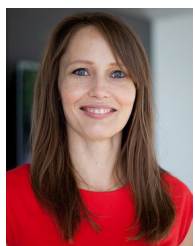
Manos Kioupakis is the recipient of the 2016 Jon R. and Beverly S. Holt Award for Excellence in Teaching. The award is presented annually by College

of Engineering to one faculty member in Materials Science and Engineering and one in Industrial and Operations Engineering to recognize outstanding teaching. This is Professor Kioupakis's second Holt award.



Rachel Goldman is recipient of the 2016 University of Michigan Distinguished Faculty Achievement Award that honors senior faculty who consistently

have demonstrated outstanding achievements in the areas of scholarly research or creative endeavors, teaching and mentoring of students and junior faculty, service, and a variety of other activities. Professor Goldman was also named Senior Fellow of The Michigan Society of Fellows.



Joanna Millunchick was named Arthur F. Thurnau Professor. Criteria for Thurnau professorships include a strong commitment to students and to

teaching and learning, excellence in teaching, innovations in teaching and learning, a strong commitment to working effectively with a diverse student body, a demonstrable impact on students' intellectual or artistic development, and contributions to undergraduate education beyond the classroom, studio or lab.

Several MSE faculty members were honored with the 2016 CoE faculty awards:



Ron Gibala, Edward Law Emeritus Faculty Award. This award recognizes an emeritus or emerita faculty member who has

continued to provide valuable service, which may include teaching and research to the College of Engineering after retirement.



John Kieffer, Monroe-Brown Foundation Service Excellence Award. Demonstrated significant service contribution at the College and/or University levels, including the

development of new extracurricular programs; advising student societies and student groups with major projects; program advisor; visiting high schools, junior colleges, and other groups to inform them about the College or University; contributions to the functioning of the College as exemplified by service on major committees, leadership roles, and interfacing between the College and the outside communities (city, state, nation, world).



Jinsang Kim, Monroe-Brown Foundation Research Excellence Award. Demonstrated sustained excellence in research and related scholarly activities.



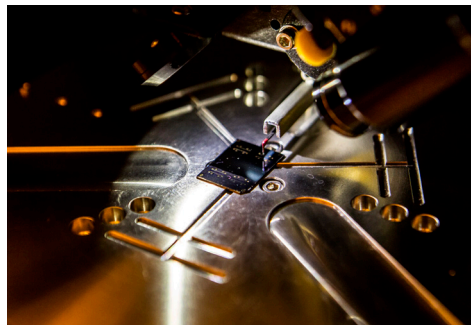
Steve Yalisove, Monroe-Brown Foundation Education Excellence Award. Demonstrated sustained excellence in curricular

development, instruction and guidance at both the undergraduate and graduate levels. This includes demonstrated excellence in graduate student supervision; the development of new courses, teaching laboratories, teaching techniques, textbooks, and software; bringing research into the classroom (leading to skills required for graduate study and research careers); and emphasizing contextual learning (the broader public impact or interdisciplinary implications).



Nick Kotov (MSE Professor, by courtesy), Innovation Excellence Award. The award recognizes any of the following accomplishments:

a) developed a breakthrough technology and demonstrated its transformational potential in engineering practice or the market; b) taken significant innovation developed, in part, within the College through to market readiness, either through partnership with a commercial enterprise or by starting a company; c) taken significant innovations developed, in part, within the College and deployed them towards societal good. This award is intended to recognize entrepreneurial aspects of innovation that fall outside the scope of innovation in basic research, education, and service.



CONTINUED ON PAGE 17

External Awards

Rachel Goldman was named 50th Anniversary Distinguished Lecturer, Department of Electrical and Computer Engineering, UC-San Diego, Feb. 26, 2016

Amit Misra was named Materials Research Society Fellow, 2016

Alan Taub was Elected to Council for National Academy of Engineering.

Nicholas Kotov has received a recognition and awards with the following organizations:

- 2017 - Colloid Chemistry Award (American Chemical Society, ACS)
- 2016 - Stephanie Kwolek Award (Royal Society of Chemistry, RSC)
- 2016 - August T Larssons Scholar (Sveriges Lantbruksuniversitet)
- 2016 - Fulbright Scholar (Fulbright Foundation and Commission)
- 2016 - UNESCO Medal for Development of Nanoscience and Nanotechnologies

Professional Service

John Allison

- TMS Materials Genome Initiative Ambassador
- TMS Materials Innovation Committee, Chair
- TMS Nominations Committee
- TMS ICME Committee
- Integrating Materials and Manufacturing Innovation, Editorial Board
- International Journal of Fatigue, Editorial Board (2015)
- ASM Gold Award Committee
- ASM Bronze Award (Mid-Career) Committee
- Madrid Institute for Advanced Materials Studies – Scientific Board

Michael Atzmon

- Past President, International Mechanochemical Union (member society of the International Union of Pure and Applied Chemistry)

- Steering Committee, International Symposium on Metastable, Mechanically Alloyed and Nanocrystalline Materials
- TMS Chemistry and Physics of Materials Committee
- U.S. Advisory Committee, Bulk Metallic Glass International Conference (BMG XI)

Stephen Forrest

- Distinguished Visiting Professor of Electrical Engineering, Technion Israel Institute of Technology (2015-present)
- National Academy of Sciences Flexible Electronics Committee (2010-present)
- ChemSusChem, Editorial Board (2007-present)
- ACS Nano, Editorial Board (2007-present)
- The Technion, Israel Institute of Technology Board of Governors (2012-present)
- Physical Review Applied, Editorial Board (2014-present)

Vikram Gavini

- Chair, USACM technical thrust area on Nanotechnology and lower scale phenomena (2015-present)
- Co-organizer, USACM workshop on "Recent Advances in Computational Methods for Nanoscale Phenomena" held in Ann Arbor, August 29-31, 2016
- Management committee, Michigan Institute for Computational Discovery in Engineering (2016-present)
- Steering Committee, Center for Data-driven Computational Physics (2016-present)

Sharon Glotzer

- ACS Nano, Associate Editor
- APS Division of Condensed Matter Physics, Chair
- National Academy of Sciences Board on Chemical Sciences and Technology (2015-2018)
- DOE Advanced Scientific Computing Advisory Committee
- DOE Basic Energy Sciences Grand Challenges Committee
- Unifying Concepts in Glass Physics, January 2015, Co-chair

Rachel Goldman

- MRS News, Editorial Board (2012-present)
- Swedish Academy of Sciences, Goran Gustafson Prize Award Committee (2016)
- National Academies of Sciences, Engineering, and Medicine's Report: "Assessment of Solid-State Lighting, Phase 2", Reviewer (2016)
- Electronic Materials Committee, Member (2016-2019)
- NSF Designing Materials to Revolutionize and Engineering our Future Panel (2016)
- Journal of Electronic Materials, Associate Editor (2002-present)

Peter Green

- Co-PI and co-organizer of NSF funded Workshop JUAMI 2016: Materials for Sustainable Energy, Nelson Mandela African Inst. for Science and Tech. in Arusha, Tanzania, May 29 - June 10, 2016. The Joint Undertaking for an African Materials Institute (JUAMI) aims to build materials science research and collaborations between the United States and Africa, with an initial focus on East Africa, and to develop ties between young materials researchers in both regions in schools taught by leading materials science researchers. Sossina Haile (Northwestern) and Simon Billinge (Columbia Univ. Were PIs and organizers of the meeting).
- Member, the Massachusetts Institute of Technology Corporation Visiting Committee for the Department of Chemical Engineering
- MRS Communications, Editor-in-Chief
- External Review Board for Materials Research, Sandia National Laboratories
- Advisory Board, ACS Petroleum Research Fund

Jinsang Kim

- Associate Editor, Macromolecular Research (Springer)
- Advisory Board, Hanwha Advanced Materials Faculty Award

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Emmanouil Kioupakis

- Co-organizer and Session Chair, "Focus Session: Theory and simulation of excited-state phenomena in semiconductors and nanostructures," American Physical Society March Meeting 2015
- Steering Committee, Michigan Institute for Computational Discovery and Engineering (MICDE).
- J. Robert Beyster Computational Innovation Graduate Fellowship Selection Committee (2015)

Richard Laine

- Polymer Division of the American Chemical Society, Board Member, and chief organizer of new ACS approved test in Polymer Science and Engineering
- Director, Macromolecular Science and Engineering Program, University of Michigan (2006-2015)
- Editorial Board, Polymer International
- Organizer, Symposium on Hybrid Materials, Pacific Polymer Conference (2015)

Peter Ma

- Chair, Tissue Engineering and Regenerative Medicine International Society, Americas Dental and Craniofacial TWIG
- Board Member, International Chinese Musculoskeletal Research Society
- Distinguished Scientist Award Committee Member, International Association for Dental Research
- Advisory Board Member, Chinese Association for Biomaterials
- Grant Reviewer for NSF, NIH and National Research Foundation of Korea

John Mansfield

- Member of the Executive Committee of the International Federation of Societies for Microscopy (2015–2019)
- Journal Microscopy and Microanalysis, Microanalysis Editor

Amit Misra

- MRS Bulletin, Editorial Board,
- MRS Broader Impacts Program Development Subcommittee
- Materials Research Letters, Editor

Pierre Ferdinand Poudeu-Poudeu

- Co-Chair of the DOE 2015 Synthesis and Processing Science Principal Investigators' Meeting, Gaithersburg, Maryland, November 2-4, 2015

Donald Siegel

- Member, Executive Committee, American Physical Society (APS) Group on Energy Research and Applications
- Review Panelist, U.S. Department of Energy Hydrogen Program and Vehicle technologies Program Annual Merit Review
- Review Panelist, National Science Foundation Division of Chemical, Bioengineering, environmental, and Transport Systems
- Affiliate Member, U.S. DRIVE Hydrogen Storage Technical Team
- Faculty Advisor, University of Michigan Society of Automotive Engineers Student Chapter
- Member of the Directorate, Joint Center for Energy Storage Research

Alan Taub

- NAE Committee on Membership
- Member DOE USDrive Review Committee
- MIT Corporation Visiting Committee

for Materials Science and Engineering

- Dean's Advisory Council, University of California Davis
- Panel Session for U.S. Senate Competes Act
- Keynote Panel Michigan Minority Procurement Conference

Katsuyo Thornton

- Member, Advisory Board, MRS Communications
- Technical Advisory Board, Center for Hierarchical Materials Design (CHi-MaD), a NIST Advanced Materials Center of Excellence (2014-present)
- TMS Materials Innovations Committee (2012-present)
- TMS Education Committee (2012-present)
- Chair, Education Subcommittee, TMS ICME Technical Committee (2014-present)
- Computational Materials Science, Editorial Board (2014-present)
- IMMI, Editorial Review Board, (2013-present)

Steven Yalisove

- MRS Bulletin, Member, Editorial Board
- MRS Bulletin, Energy Quarterly, Member, Core Editorial Board
- MRS Academic Affairs
- Chair, MRS Education Subcommittee Academic Affairs
- TMS Accreditation Committee
- ABET Volunteer
- Program Committee for "Laser Applications in Microelectronic and Opto- electronic Manufacturing" at Photonics West, February 2016
- Co-Organized Symposium on "Ultra- fast Bandap Photonics" at the SPIE Defense + Security Meeting in Baltimore, April 2016

STAFF SERVICE

2016 staff service awards were presented at the staff/faculty holiday luncheon in December 2016 to the following staff:



Tim Chambers – for excellent service in teaching in the Van Vlack lab and conducting demonstrations for outreach programs. Tim's has provided outstanding service which has led to successful events in M-Xplore, ASM Teacher's camp and the pumpkin casting demonstration.



Keith McIntyre – for his excellent service in overseeing lab renovations, moves and department facilities. Keith has instrumental in preparing and launching labs for two new professors as well as hosting a tour our building for leadership from the College and Provost office.

Alumni News

Aaron Crumm received the 2016 CoE Alumni Merit Award for MSE



Aaron Crumm's PhD work at the University of Michigan, supervised by Professor John Halloran, led to his founding of Adaptive Materials, Inc. (AMI), an alternative energy market leader. Aaron's simple, yet radical, business proposition was to develop a portable solid oxide fuel cell system that ran off of readily available fuel. Aaron's work has attracted

more than \$50 million in contracts to support the growth of AMI. His success in leveraging research grants as part of AMI's business acceleration strategy was integral to the company's ability to remain privately-held and focused on fuel cell product development. The company was acquired by defense industry giant Ultra Electronics in 2010. AMI has been recognized for its dynamic growth with Ann Arbor SPARK FastTrack, Inc. 5,000, and Inc. 100 Energy Company awards. Aaron has also been individually recognized as an entrepreneur with multiple awards including Executive of the Year in 2011.

Elizabeth A. Holm presented the Inaugural Distinguished Alumni Lecture

In 2016, MSE started a new award (Distinguished Alumni Lecture) to recognize alumni who have made seminal contribution to materials research, as evident by published scholarship, patents/technology transfer, mentoring of early career materials researchers and service to the materials profession. The inaugural lecture, delivered as a graduate seminar, was presented by Liz Holm who was also the department's invited guest of honor at the annual graduation dinner. Liz Holm is a Professor of Materials Science and Engineering at Carnegie Mellon University. Prior to joining CMU in 2012, she spent 20 years as a computational



materials scientist at Sandia National Laboratories. Liz obtained her B.S.E in Materials Science and Engineering from the University of Michigan, S.M in Ceramics from MIT, and dual Ph.D. in Materials Science and Engineering and Scientific Computing from the University of Michigan, supervised by Professor David Srolovitz.



Photo: MSE EAB at homecoming (from L to R): Ray Decker, Jason Hertzberg (EAB Chair), John R. (Chip) Keough, Jon Madison, Jerry W. Hoffman, Aaron Crumm, Sue Hartfield-Wünsch, Jeffrey Carbeck. Not in the photo: Gerald I. Madden, Liz Holm, Keith Bowman, Jody N. Hall.

2016 EAB meeting

MSE External Advisory Board (EAB) comprising of MSE alumni was reconstituted this year with a kick-off meeting on homecoming Friday in Fall 2016. The mission of EAB is to enhance MSE department's position as a premier research and higher education program by advising the MSE Chair on matters such as strategic planning, curriculum feedback, alumni engagement, talent acquisition and retention, and enhancing diversity, equity and inclusion in engineering. Jason Hertzberg is the current Chair of EAB.

Dr. Paul Krajewski (BSE '89, MSE '91, PhD '94)

Dr. Paul Krajewski, is a globally recognized expert in lightweight materials, automobile lightweighting, and innovation. He was recognized in 2014 with the MSE Department Alumni Award and he continues to accomplish new feats. He has taken his expertise and published a children's book on Material Science.

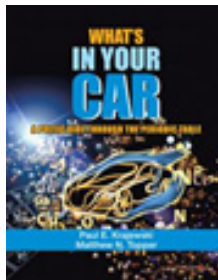


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What's In Your Car

Paul E. Krajewski, Ph.D., FASM Director
Vehicle Systems Research Lab General Motors Global
Research and Development

- Published children's book on Materials Science



What's in Your Car uses a combination of catchy poems and interesting pictures to explore how elements of the periodic table are used to make a car. Thirty-one different elements are shown with captivating pictures of the raw materials and their application in the vehicle. The uses of these materials are explained with simple

poems that can serve as a starting point for deeper exploration into the world of materials and automobiles. What's in Your Car appeals to children of all ages as they understand how different materials come together to create awesome automobiles.

Marcus Collins, BSE '02



Senior vice president and executive director of social engagement, Doner Co.

Marcus Collins was just named to Crain's Detroit 40 under 40. Marcus received his BSE in

Materials Science Engineering in 2002. Marcus has taken his foundation in Materials Science Engineering, with an MBA from The University of Michigan, and made an impact in Brand Marketing. His strategies and creative contributions have led to the successful launch of Budweiser's "Made In America" music festival, Bud Light Platinum, the Brooklyn Nets (Hello Brooklyn!), and State Farm's "Cliff Paul" campaign. He is an AACSB certified clinical instructor and faculty member at Stephen M. Ross School of Business.

<http://www.crainsdetroit.com/article/20161007/AWARDS4016/161009877/marcus-collins>

Xplore Engineering *By Timothy Chambers*

Every summer, the Xplore Engineering outreach event brings the children and families of College of Engineering alumni to North Campus for two days. Each department in CoE hosts sessions where participants can get hands-on experience with what it might be like to be an engineer when they grow up. Here in the UM-MSE department, we shared our love of the world of materials with nearly fifty families during the two-day event.

This year's MSE session, eXtraordinary Materials, was designed and planned by staff member Tim Chambers, and delivered by graduate students Evan Anderson and Erica Chen. Participants started by puzzling out the identities of mystery objects using optical and electron microscopes, and went on from there to experience such material mysteries as a piece of foam that protected them from a blowtorch and a putty that can stretch, bounce, or crack under different forces. The final demonstration, preparing maize and blue ice cream using liquid nitrogen, sent everyone away with some edible excitement.

We are proud to share that 90% of participating families gave our session the highest possible rating – Very Satisfied. Many of them even said that the MSE session was their favorite part of the whole event! We look forward to strengthening our relationships with alumni and community members with an even better session at next year's Xplore Engineering.



Undergrad – MMS

MMS has started off the year strong with our weekly luncheons every Friday. We've had speakers present for us from General Mills, Joyworks, Steel Market Development Institute and more. Our annual ASM Professional/Student Mixer at Conor O'Neill's was a big success and great opportunity for students to meet professionals! We also had our first MMS picnic of the year, which was held on October 9th in Island Park. Finally, earlier this week we had a pumpkin casting/MSE Q and A event in the North Campus Gerstacker Grove to give interested prospective students more information about the MSE department.

The 2016-2017 MMS Board

- President - Rachel Shifman
- Vice President - Megan Liu
- Treasurers - Melissa Cadel & Bryce Kriegman
- Secretary - Elyse Fleck
- Social Chair - Clare Hyde
- Undergraduate Representative - Catherine Haslam
- Graduate Representative - Eleanor Coyle
- Undergraduate Committee Representatives - Ron Hobson & Larissa Woryk
- Undergraduate Student Advisory Board Representatives - Nicole Chiu and Xiaoer Hu

Grad – GSC

The school year was an exciting year for the Graduate Student Council. The group kicked the year off with the annual Graduate Student Chili and Cornbread Cookoff. Next they planned a Holiday Party with the Chemical Engineering Graduate Student Council. The party consisted of a dinner, cookie decorating station and an ugly sweater contest. To help graduate students looking for a job in Industry, the group hosted a "How To Turn Your CV To A Resume" workshop where students could get live feedback on their resumes from an expert. The group ended the school year with an annual meeting with Department Head, Professor Amit Misra to discuss issues and concerns in the graduate student community in MSE. For the upcoming school year the group will continue to hosts events that unite the graduate student community through professional and social through professional and social interactions.

Photos: Ugly Christmas sweaters and cookie decorating at the holiday party.



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Students Abroad

Two Materials Science and Engineering undergraduate students, Megan Liu and Allison Ward, participated in Honors Global Outreach. The program was created by the Engineering Honors Program with the goal to challenge students beyond the scope of traditional curricula and provide an opportunity to enrich their community.

Megan and Allison volunteered with the International Volunteer Headquarters on a jungle conservation project in Peru. They spent two weeks volunteering in the Amazon rainforest. This reforestation project (fig. 1) allowed them to assist with a community garden (see fig. 2). The community garden at the reserve is where seeds of endangered trees were planted. They remained here until they grew and were developed enough to be moved into specified areas of the jungle. The garden also grew fruits and vegetables for meals at the reserve.

Making a difference globally in service by our students and supported by the MSE Department. In addition to the work, they were able to go on hikes in the jungle, visit local communities to experience their culture and lifestyles, and learn about the many medicinal plants in the Amazon.



Fig. 1 - Reforestation project in Amazon Rainforest.

Fig. 2 - Left to right, Allison Ward and Megan Liu at the Community garden at the reserve where seeds of endangered trees were planted. They remained here until they grew and were developed enough to be moved into specified areas of the jungle.



Student Honors

Department Awards and Recognition for MSE Graduate Students

MSE Graduate Student Council

- President, Ariel Murphy
- Ellen Solomon
- Erica Salem
- Eleanor Coyle
- Alan Olvera
- Alexander Chadwick
- Jill Wenderott
- Benjamin Derby

MSE Graduate Service Award for Recruiting

- Benjamin Derby
- Kelsey Mengle
- Lydia Mensah
- Benjamin Swerdlow
- Bryan VanSaders

Best Overall Graduate Student Instructor

- Erica Chen

CoE Distinguished Academic Achievement

- Juan Lopez

CoE Marian Sarah Parker Prize

- Ariel Murphy

CoE Distinguished Leadership

- Juan Lopez

Rackham Predoctoral Award

- Alan Olvera

National Science Foundation Graduate Fellowship

- Christian Greenhill
- Lydia Mensah

Microscopy and Microanalysis Student Award, 2016 M&M Conference

- Kevin Fisher
- Linze Li

Wilie Hobb Moore Trailblazer Award (awarded by WISE)

- Christian Greenhill

Sweetland Graduate Fellowship (awarded by LSA)

- Christian Greenhill

Patagonia Eco Innovation Case Competition (1st place grand prize)

- Kevin Golovin
- Sarah Snyder

Gore Fellows Award (2nd place)

- Kevin Golovin

MRS Science as Art (finalist)

- Kevin Golovin

MLK Spirit Award – 2016

- Ariel Murphy

Marian Sarah Parker Prize – 2016

- Ariel Murphy

TMS ReX and GG Conference Student Research Award – 2016

- Ariel Murphy

DOE Office of Science Graduate Student Research (SCGSR) Program

- Jordan Occena

American Chemical Society Colloid and Surface Chemistry Division Outstanding Poster Award

- Ji Young Kim

63rd American Vacuum Society Symposium Art Zone Contest (2nd place)

- Davide Del Gaudio

Undergraduate Student Awards

Richard A. Flinn Scholarship

- Rebecca Cohn
- Jack Hu
- Ron Keinan
- Bryce Kriegman
- Erica Siismets

Fontana-Leslie Scholarship Fund

- Xiaoer Hu

James W. Freeman Memorial Scholarship

- Catherine Haslam
- Alissa Recker
- Allison Ward

John Grennan Scholarship

- Dylan Jennings
- Jeremy Lipshaw

Jack J. Heller Memorial Engineering Scholarship Fund

- Andrew Burek
- Colette Verch

William F. Hosford Scholarship

- Daniel Nara
- Connor Saukas
- Ashlynn Stanley
- Yixiang Tang
- Tyler Zhang

MSE Graduate Service Award for Recruiting.
Left to right: Jinsang Kim, Benjamin Derby, Kelsey Mengle, Lydia Mensah, Benjamin Swerdlow, Bryan VanSaders



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Dow Chemical	MGA Research
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