

MSEN News

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2013 Spring Graduation Dinner

Dear Alums and Friends:



Let me begin with an interesting observation about our field. It is noteworthy that with intellectually more diverse research portfolios, increased student enrollments, and a rise in the number of departments and programs, the field of Materials Science and Engineering (MSE) has undergone significant growth during the last decade. The popularity of the field during this period has largely been due to emerging opportunities at the intersections between materials and computing, materials

and chemistry, and materials and biology. Many of us are aware that from the early- to the mid-20th century, the field of physics had a significant influence on the development of MSE, with the invention of techniques that include x-ray scattering, electron microscopy, and neutron scattering. The use of these techniques enabled an understanding of the structure-property relations of materials. The impact of our interdisciplinary field on societal challenges, from energy and the environment to security, is unmistakable. My intent here is to provide a context for how we think about the future of our department and its contributions to the overall field of materials, as well as to society.

Exciting developments in our department include the invention of new characterization tools and the design and synthesis of new functional advanced materials for different applications. One example involves ceramic materials. The real-time ferroelectric domain switching, with applications for computer memories, was demonstrated for the first time by MSE researchers. MSE faculty also designed and synthesized novel inorganic oxides for thermoelectric applications (interconversion between heat and electricity). Collaborations between MSE computational and experimental researchers led to the computational design and chemical synthesis of molecules that were fabricated into materials for efficient solar energy conversion. Novel organic materials for influenza virus and nerve gas sensing were designed and developed by MSE researchers. They were also responsible for the world's first efficient organic phosphorescent material for display applications. Another success story is the development of superomniphobic surfaces that repel virtually any liquids. These discoveries are the result of basic scientific research, funded by the government. To this end, it is important to mention that approximately 25 percent of MSE faculty have founded start-up companies.

Now a word about the MSE students. Our graduate program increased in size by 75 percent since 2008, to its current cohort of 140 students. As of April, there were 181 sophomores, juniors, and seniors in our department, in contrast to the 62 students enrolled in 2001. Fifty students graduated from our department with bachelor's degrees in 2011 and 2012. The number of U-M MSE graduates compares favorably with those of the largest MSE departments in the country. Our students are actively engaged in entrepreneurial activities, helped in this effort by the curriculum, which has evolved to include entrepreneurship

as part of the educational experience. The senior capstone design course is now undergoing a remarkable revolution, as MSE seniors work on joint projects with undergrads from different departments. Continuously improving the undergraduate experience remains a key emphasis of our department.

In recent years, our junior faculty have routinely won young investigator awards. Assistant Professor Geeta Mehta, whose research is in the area of biomaterials, was the recipient of a Department of Defense Young Scientist Investigator Award. In addition, Assistant Professor Emmanouil Kioupakis won an NSF CAREER award, entitled "First-principles calculations of quantum processes in bulk and nanostructured semiconductors." Our Assistant Professors have all proven to be excellent teachers. For example, Assistant Professor Emmanuelle Marquis is the latest assistant professor to receive the John R. and Beverly S. Holt award for Excellence in Teaching. Input from the undergraduates is the primary factor that determines the recipient of this award, established by the Holt family, to recognize excellent teaching in MSE.

The senior faculty hires, professors Taub and Allison, with their vast industrial experience, are making an important difference in the way we teach our Introduction to Materials and senior capstone design courses. They have been successful at broadening and strengthening the department's expertise in structural materials (metals) and manufacturing. Additionally, we hired two new Research Assistant professors who also work in the area of metals. In the coming year we anticipate hiring one, or potentially two, new tenure-track faculty members in the area of metals.

I had an ulterior motive for describing a brief history of the field and some of our recent accomplishments. Our department faces some obvious challenges. The current facilities in the Dow building were designed for a much smaller number of students and researchers working in different—and narrower—areas of research. New facilities with new features (including ultra-low vibration capabilities to enable us to study phenomena at the nanoscale, and chemical and bio hoods that enable the synthesis of new materials) will make a significant difference in our ability to remain one of the premier MSE departments in the country. We will continue to effectively educate the next generation of students to compete effectively for the very best positions in academia, industry, and elsewhere. New facilities will enable us to realize our vision of being at the leading edge in education and materials discovery; they will also enhance interdisciplinary campus collaboration and partnerships with industry, as we to continue to discover new materials for current and future technologies. The University and the College of Engineering have just announced a new development campaign. It is our hope that you will help us to make a positive impact on societal challenges, globally.

Go Blue,

Peter F. Green

New Faculty



Geeta Mehta joined MSE as an assistant professor in Fall 2013. She also holds a joint appointment in the Department of Biomedical Engineering. Mehta earned her PhD in Biomedical Engineering at U-M, working with professors Shuichi Takayama and Jennifer Linderman on microfluidic niches for hematopoietic stem cells. Her postdoctoral research in the area of liver tissue engineering and regenerative medicine was conducted at the Massachusetts

Institute of Technology, in the labs of professors Linda Griffith and Roger Kamm.

“I’m looking forward to interactions with undergraduate and graduate students, as well as establishing collaborations with our highly productive faculty members.”

Mehta holds a bachelor’s degree in chemical engineering (Honors) from Panjab University in India, and a master’s degree in chemical engineering from Michigan State University. Most recently, she was an assistant research scientist in the Department of Biomedical Engineering at the U-M. She uses biomaterials and microtechnology as tools to create engineered microenvironments in order to study biological problems in the areas of ovarian cancer, breast cancer, and bone marrow stem cells. Her research focus includes cancer microenvironments, stem cell engineering, tissue regeneration, microfluidics, biomechanics, biomaterials, tissue engineering, and regenerative medicine.

As an assistant professor at MSE, she plans to leverage these strengths to develop strong collaborations with her colleagues who are working on various facets of materials science, and together make significant contributions in the fields of tissue engineering, regenerative medicine, and drug development and delivery. She is building a research group that emphasizes both fundamental as well as applied research, and involves extensive multidisciplinary and interdepartmental collaboration.

Q&A with Alan Taub



Alan Taub joined the faculty as Professor of Materials Science and Engineering in September of 2012. He will be pursuing research in advanced materials and processing, and will also be leading an initiative to establish a new center within the College that will focus on advanced manufacturing of lightweight material structures for automotive and aerospace applications.

MSE News sat down with Taub recently.

Q: What’s different about being in the industrial sector as opposed to moving upstream within the academic realm now?

Taub: In general, there’s a lot more in common than one might imagine between how academic and industrial research is conducted. For example, in developing new materials you will find that the researchers employ the same types of characterization and modeling tools, and you often find industry/university collaborations taking advantage of their respective capabilities. In fact, at a technical conference, it is often difficult to determine whether the speaker comes from industry or academia unless you look at the program. At the same time, I find that there is a major difference in what types of research activities are undertaken. In an industrial laboratory, there is always an application in mind when a project is undertaken. That is true for both downstream work as well as for early exploratory activities. While not always the case, I find that in academia, often there is an interesting research topic identified and a new insight developed, and only then will the search begin for an application that might benefit from the invention.

Q: What has the change been like for you personally?

Taub: I am working to create a new institute for lightweight materials manufacturing. This initiative will be led by the U-M and will involve the research capabilities of a number of universities and government laboratories in the midwest. The goal is to develop advanced manufacturing technologies, as defined by our industry partners, that can increase US manufacturing competitiveness. This role utilizes many of the skills used in industrial leadership—defining and developing a strategic roadmap, organizing a portfolio of projects coordinated across a number of organizations while promoting interdisciplinary innovation, etc.

At the same time, my other roles are proving to be quite a different challenge than my industrial leadership career. It has been almost 20 years since I was in the laboratory defining and executing experiments, and I find myself having to re-learn those skills along with my new grad students. I have also chosen to get involved with the Center for Entrepreneurship. Having worked in three Fortune 10 companies, it is interesting to get exposed to the world of start-ups.

Q: What is your take on MSE and engineering education overall?

Taub: I am truly enjoying interacting with the students. Professor Shtein and I are co-teaching the Capstone Design Class MSE 480 this semester and we took the opportunity to rework the curriculum to have the students execute their projects using the discipline of systems engineering while encouraging innovative approaches to the projects. I was pleased to find that the students appear motivated to learn new things as compared to just getting a good grade. It is very satisfying to be part of training the next generation of engineers. I suspect that like many new faculty, I underestimated the work required to prepare for a class. I only wish that the rule of 10 hours of preparation for every hour of lecture was true—maybe I will get that efficient over time.

Q: What's been your funniest experience so far since arriving here?

Taub: I haven't quite figured out yet how professors handle the deep cultural divide between their research and teaching environments without developing a split personality. On the research front, the "free agent" professor can seek out funding for a wide range of technologies from a broad set of sponsors on topics that can change on a fast pace. On the academic front, the "teaching" professor is part of a large organization and needs to coordinate activities with the other professors within their department and with other departments within the college. Still trying to learn the academic rules of the game, including mastering "Michigan time": I am still finding myself showing up for meetings 10 minutes before everyone else.

Q: Students can participate in a "Take your professor to lunch program." If you had such a voucher, who would be on your list (dead or alive) to invite?

Taub: No question—Leonardo Da Vinci. I've always been impressed by the Renaissance heroes, those people with the unique balance of left- and right-brain strength. How the same person who could paint the "Mona Lisa" could also have his track record of inventions is humbling to lesser mortals.



Alan Taub (left), professor of materials science and engineering, testifies in Washington, D.C., before the House Science, Space and Technology's Research Subcommittee, about federal advanced manufacturing programs and ways to increase the ability of small and medium-size companies to tap into cutting-edge technologies. Also testifying were Thomas Baer of Stanford University (center) and Mark Muro of the Brookings Institution. (Photo by Mike Waring, Washington Office. Reprinted with permission from *The University Record*.)

Research

\$12.3M center aims to ramp up design of advanced materials

by Nicole Casal Moore

It takes between 10 and 20 years to develop a new material — an advanced metal alloy, for example, that can be used in lighter cars, trucks and airplanes. That's too long, says John Allison, professor of materials science and engineering.

With an \$11 million, five-year grant from the U.S. Department of Energy (DoE), Allison is leading a project that aims to drastically shorten that time. The funding comes from the Materials Genome Initiative, President Obama's plan to double the speed with which American scientists and engineers discover, develop, and manufacture new materials. In addition to the DoE grant, the university is providing \$1.3 million toward the effort.

The grants establish a DoE Software Innovation Center called the PRedictive Integrated Structural Materials Science Center, or PRISMS.

"Materials have been a defining technology for humans since the beginning — the Stone Age, the Bronze Age, and now we have the Silicon Age," Allison says. "Going forward, we need new materials to solve enormous engineering challenges around critical issues such as global warming. We don't have as much time as we used to."

Researchers at the center will build a set of integrated, open-source computational tools that materials researchers in academia and industry can use to simulate how proposed materials might behave in the real world. The software tools will provide a radical change from the traditional trial-and-error approach, Allison says. Trial and error managed to double the strength of aluminum alloys since the Wright brothers' time, but it took 80 years.

"PRISMS will give us a quantitative means to figure out which materials knob we should be turning," Allison says. "If I were studying fatigue of metals, for example, and I wanted

to understand how to improve that property, I'd want to quantify or simulate how a certain microstructural feature might affect it."

More than 160,000 engineering materials exist today, and most are mixes of between six and 10 different elements. These materials can have different properties at various scales, from that of the atom, up to the microstructure, to the end product, whether that's a laptop battery, solar cell or car door. It's challenging for the field to predict how each different combination of elements will behave at each of these levels, and that's why Allison says materials science hasn't kept pace with industry needs.

"We're starting to fall behind because the product development and manufacturing fields now have computational tools to design new aircraft components and manufacturing approaches in days, but for materials it still takes much longer. We're losing opportunities to really advance new products," he says.

"The country and the companies that figure this out will have a major competitive advantage."

Allison says the materials field is at a tipping point.

"The ability to integrate knowledge across length scales and different technical domains has been a major challenge but the needs for this are now very clear. We believe that the integrated computational tools our team will be developing will serve as a scientific core for a transformational new approach to materials development."

The PRISMS team of 11 faculty members from across the College of Engineering and the School of Information will demonstrate their new approach on magnesium, the lightest-weight metal, which has applications in the auto, aerospace and electronics industries.

In addition to Allison, faculty members involved in the PRISMS Center are:

- Samantha Daly, assistant professor of mechanical engineering.
- Krishna Garikipati, professor of mechanical engineering.
- Vikram Gavini, assistant professor of mechanical engineering.
- Margaret Hedstrom, professor and associate dean for academic programs at the School of Information.
- H.V. Jagadish, the Bernard A. Galler Collegiate Professor of Electrical Engineering and Computer Science.
- J. Wayne Jones, professor of materials science and engineering.
- Emmanuelle Marquis, assistant professor of materials science and engineering.
- Veera Sundararaghavan, assistant professor of aerospace engineering.
- Katsuyo Thornton, associate professor of materials science and engineering.
- Anton Van der Ven, associate professor of materials science and engineering.

Article courtesy of Michigan Engineering

Paint-on plastic electronics: aligning polymers for high performance

by Kate McAlpine

Semiconducting polymers are an unruly bunch, but University of Michigan engineers have developed a new method for getting them in line that could pave the way for cheaper, greener, “paint-on” plastic electronics.

“This is for the first time a thin-layer, conducting, highly aligned film for high-performance, paintable, directly writeable plastic electronics,” said Jinsang Kim, U-M professor of materials science and engineering, who led the research published in *Nature Materials*.

Semiconductors are the key ingredient for computer processors, solar cells and LED displays, but they are expensive. Inorganic semiconductors like silicon require high temperatures in excess of 2,000 degrees Fahrenheit and costly vacuum systems for processing into electronics, but organic and plastic semiconductors can be prepared on a basic lab bench.

The trouble is that charge carriers, like electrons, can’t move through plastics nearly as easily as they can move through inorganic semiconductors, Kim said. Part of the reason for this is because each semiconducting polymer molecule is like a short wire, and these wires are randomly arranged.

“Charge mobility along the polymer chains is much faster than between the polymers,” Kim said.

To take advantage of the good conduction along the polymers, research groups have been trying to align them into a charge-carrying freeway, but it’s a bit like trying to arrange nanoscopic linguine.

Kim’s group approached the problem by making smarter semiconducting polymers. They wanted a liquid polymer solution they could brush over a surface, and the molecules would automatically align with one another in the direction of the stroke, assembling into high-performance semiconducting thin-layer films.

First, they designed the polymers to be slippery—ordinary polymersglom together like flat noodles left in the fridge, Kim said. By choosing polymers with a natural twist, the team kept them from sticking to one another in the solution. But in order to align during the brushstroke, the polymers needed to subtly attract one another. Flat surfaces would do that, so the team designed their polymer to untwist as the solvent dried up. (The feature 1 in the chemical structure of the figure.)

They stopped the unaligned polymers from forming large chunks by adding flexible arms that extended off to the sides of the flat, wire-like polymer. These arms prevented too much close contact among the polymers while the bulkiness of the arms kept them from snagging on one another (The features 2 and 3 in the chemical structure). Polymers with these properties will line up in the direction of an applied force, such as the tug of a paintbrush.

“It’s a big breakthrough,” Kim said. “We established a complete molecular design principle of semiconducting polymers with directed alignment capability.”

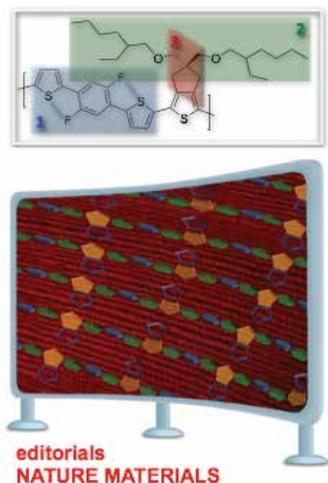
The team made molecules that matched their design and built a device for spreading the polymer solution over surfaces such as glass or a flexible plastic film. The force from the silicon blade, moving at a constant speed across the liquid polymer, was enough to align the molecules.

The team then built the semiconducting film into a simple transistor, a version of the electronic components that make up computer processors. The device demonstrated the importance of the polymer alignment by showing that charge carriers moved 1,600 times faster in the direction parallel to the silicon blade’s brushstroke than they did when crossing the direction of the stroke.

“By combining the established molecular design principle with a polymer that has a very good intrinsic charge carrier mobility, we believe it will make a huge difference in organic electronics,” he said. “We are currently developing a versatile fabrication method in order to realize high-performance and paintable plastic electronics in various length scales from nanometers to meters.” (B.-G. Kim, E. J. Jeong, J. W. Chung, S. Seo, B. Koo and J. Kim, *Nature Materials* 2013, 12, 659.)

The paper is titled “A molecular design principle of lyotropic liquid-crystalline conjugated polymers with directed alignment capability for plastic electronics.”

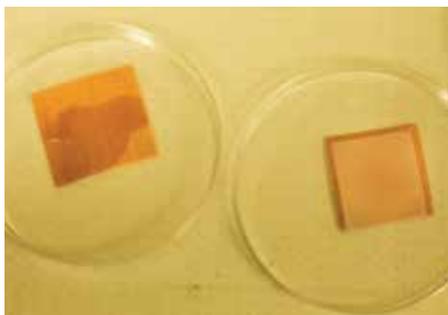
The work is funded by the U.S. Department of Energy. The university is pursuing patent protection for the intellectual property and is seeking commercialization partners to help bring the technology to market.



Article courtesy of U-M News Service

Nanoscale Coating Makes Fabrics Stain-, Water-Resistant

by Nicole Casal Moore



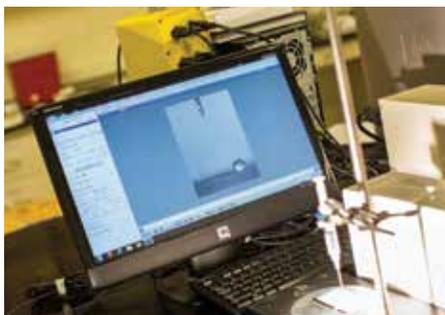
An uncoated tile of screen is wetted by liquids, but a treated piece remains dry. MSE researchers have developed a “superomniphobic” surface that can repel virtually any liquid. Image credit: Joseph Xu

A nanoscale coating that’s at least 95 percent air repels the broadest range of liquids of any material in its class, causing them to bounce off the treated surface, according to MSE researchers who developed it. In addition to super stain-resistant clothes, the coating could potentially lead to breathable garments that can protect soldiers and scientists from chemicals, and advanced waterproof paints that dramatically reduce drag on ships. The origin of the response arises as droplets of solutions that would normally damage either your shirt or your skin recoil when they touch the new “superomniphobic surface.”

“Virtually any liquid you throw on it bounces right off without wetting it,” said Anish Tuteja, assistant professor of MSE, chemical engineering and macromolecular science and engineering. “For many of the other similar coatings, very low surface tension liquids such as oils, alcohols, organic acids, organic bases and solvents stick to them and they could start to diffuse through and that’s not what you want.”

Tuteja is the corresponding author of a paper on the coating published in the January issue of the *Journal of the American Chemical Society*.

Tuteja and his colleagues have tested more than 100 liquids, and found only two



A high-speed camera captures a droplet resting on the surface of a new super-repellant surface developed MSE. Image credit: Joseph Xu

that could penetrate the coating. Those were chlorofluorocarbons—chemicals used in refrigerators and air conditioners. In a demonstration in Tuteja’s lab, the surface repelled coffee, soy sauce and vegetable oil, as well as toxic hydrochloric and sulfuric acids. Tuteja says it’s also resistant to gasoline and various alcohols.

The deposition procedure uses electrospinning that creates an electric charge to agglomerate fine particles of solid from a liquid solution. So far, they’ve coated small tiles of screen and postage-stamp-sized swaths of fabric.

The coating is a mixture of rubbery plastic particles of “polydimethylsiloxane,” or PDMS, and liquid-resisting nanoscale cubes developed by the Air Force, that contain carbon, fluorine, silicon and oxygen. The material’s chemistry is important, but so is its texture. The coating hugs the pore structure of whatever surface it’s being applied to, and it also creates a finer web within those pores. Between 95 and 99 percent of the coating is actually air pockets, so any liquid that contacts the coating is barely touching a solid surface.

Because the liquid touches mere filaments of the solid surface, as opposed to

a greater area, the developed coating can dramatically reduce the intermolecular forces that normally draw the two states of matter together. These Van der Waals interaction forces are kept at a minimum.

“Normally, when the two materials get close, they imbue a small positive or negative charge on each other, and as soon as the liquid comes in contact with the solid surface it will start to spread,” Tuteja said. “We’ve drastically reduced the interaction between the surface and the droplet.”

With almost no incentive to spread, the droplets stay intact, interact only with molecules of themselves, maintain a spherical shape, and literally bounce off the coating.

The coatings repel a range of non-Newtonian fluids, including, among others, shampoos, custards, blood, paints, clays and printer inks. They differ from the Newtonian fluids (such as water and most other liquids), whose viscosity stays the same no matter the force applied. Viscosity is a measure of a liquid’s resistance to flow on the application of force, and it’s sometimes thought of as its thickness. “No one’s ever demonstrated the bouncing of low-surface tension non-Newtonian liquids,” Tuteja said.

The paper is titled “Superomniphobic Surfaces for Effective Chemical Shielding.” Doctoral student Shuaijun Pan and postdoctoral researcher Arun Kota, both in MSE, are authors of the paper. Also contributing is Joseph Mabry, in the rocket propulsion division of the Air Force Research Laboratory. The work is funded by the Air Force Office of Scientific Research.

Article courtesy of U-M News Service

MSE Department increases its worldwide digital engagement through Mconnex



Individual MSE alumni, faculty, and students have been showcased through Mconnex (engin.umich.edu/mconnex/about), Michigan Engineering's most ambitious effort to engage and connect with a worldwide audience in terms of packaged content for distribution.

The notion behind Mconnex is simple. The College is creating video content to

more effectively publicize the remarkable contributions of its students, faculty and alumni, both during their time in Ann Arbor and after graduation. These vignettes are then uploaded to the MConnex website. Professional videographers have been capturing the activities in laboratories, classrooms and beyond to produce video content that explains the impact of the work executed in the department. Sample content that has been created includes remarks from Jason Hertzberg, the recent 2012 Distinguished Alumni Award winner, who gave a lecture to the department when he visited Ann Arbor to receive his award. On the site now: Anish Tuteja discusses the research behind the development of omniphobic coatings that can be considered in next generation fabrics and clothing for soldiers of the future. And faculty and students connected to the Energy Frontiers Research

Center present a thoughtful justification for the need for advanced solar harvesting and storage media to help effect the transition from fossil fuels. Each of the vignettes runs a few minutes and more are soon to follow.

Federal agencies are increasingly interested in understanding the value of the work their grantees are undertaking. As the MConnex video portfolio grows, the full breadth of work executed in MSE can be seen. MConnex' availability to a wide audience provides our alumni and friends with a way to understand what we do within MSE. It is easy to see how content related to research and education conducted in MSE can be packaged for ultimately more viral distribution in the digital age.



Manos Kioupakis receives NSF CAREER Award

Assistant Professor Manos Kioupakis has been awarded the Early Faculty Career Development (CAREER) Award from the National Science Foundation for

his investigation of quantum processes in bulk and nanostructured semiconductors with first-principles calculations.

Quantum processes play a crucial role in the operation of modern electronic, optoelectronic, and thermoelectric devices. Theoretical studies can provide insight into the microscopic mechanisms that govern quantum processes in materials but are inaccessible to experiment. First-principles methods based on density functional theory enable

the predictive calculation of the electronic properties of materials entirely from theory, without empirical or adjustable parameters.

This CAREER award, supported by funds from the Division of Advanced Computing Infrastructure and the Division of Materials Research, will allow Kioupakis to develop an integrated research and educational program focused on quantum processes in technologically important bulk and nanostructured semiconductors. This study will provide valuable insight on the nature and significance of microscopic quantum processes in electronic and thermoelectric materials. Studies of optical absorption by free carriers and nonradiative Auger recombination will elucidate the microscopic nature of these parasitic quantum processes and their role in the operation and efficiency of optoelectronic devices.

The research program will be integrated with educational activities through the incorporation of numerical calculations and computer simulations in the classroom. Computer codes for the predictive theoretical calculation of quantum processes will be created and shared with the educational and research communities with the intent to contribute to software reuse and the software cyberinfrastructure of the materials research community.

Education

Undergraduate Program Update

Our undergraduate program now has approximately 170 declared students. The program is vibrant—strong teaching by first-rate professors, active undergraduate research and internships, a state-of-the-art undergraduate laboratory that prepares students for the design sequence, and integration of computation into the curriculum.

Last year, the Van Vlack Undergraduate Laboratory (VVUL) acquired a tabletop SEM as well as new imaging equipment and a high-precision heating stage for optical microscopes. We also replaced our aging Rikaku MiniFlex with the most recent model, which will provide us with excellent capabilities for powder diffraction experiments. These new capabilities provide undergraduate students

exposure to additional analytical techniques and reinforcement for essential concepts in materials science.

Computation has become an integral part of the curriculum; the enrollment in the senior-level course on computational approaches has grown to the degree that warrants expansion of the computational facility within the VVUL.

The Michigan Materials Society (MMS), under the guidance of Prof. Kioupakis, began holding panel sessions to discuss careers in materials science. These activities ensure that our students receive high-quality educational experience. In the coming year, our focus will be on recruiting, which supports the

departmental goal to further increase enrollment. Last year, our faculty, led by Prof. Yalisove, began generating videos to promote materials science and engineering as well as our undergraduate program. The videos that were generated for our introductory materials science courses can be found at www.mse.engin.umich.edu/about/videos. Many more are being produced and will be added as they're available.

Graduate Program Update

The Graduate Committee has continued focusing on providing high-quality graduate education and helping our grad students build an outstanding career development program.

Our graduate students have excelled in research development and leadership roles. Many of them received prestigious fellowships and awards including the National Science Foundation Graduate Student Fellowships, College of Engineering Beyster Fellowship, Rackham Barbour Fellowship, Rackham Predoctoral Fellowship, College of Engineering Distinguished Achievement Award, and College of Engineering Distinguished Leadership Award.

Fifteen new PhD students and 11 MS students joined the department in Fall 2013. All had record high GPA and GRE scores, and were selected from among 500 applications from

top US universities and renowned schools all over the world. The Rackham Merit Fellowship was given to four PhD students; one is an NSF Graduate Student Fellowship recipient. Two MS students received the newly established College of Engineering Masters Fellowship. Furthermore, fellowships were given to all admitted PhD students.

The committee will continue recruiting top-quality students for our graduate program and will particularly focus on enhancing diversity. We also aim to help our outstanding graduate students foster their interests in academic careers in coming years.

Faculty

Our outstanding faculty continues to be recognized with national, regional, and local awards:

John Allison

MSE Outstanding Faculty Award, 2012

Rachel S. Goldman

Fellow, AVS the Science and Technology Society (2012)

Fellow, American Physical Society (2012)

Peter F. Green

Fellow, Royal Society of Chemistry, (London, 2012)

Jinsang Kim

MSE Outstanding Accomplishment Award, College of Engineering, University of Michigan 2013

Nicholas Kotov

Stine Award for Materials Research (AIChE 2012)

Kennedy Family Research Team Award (2012)

Richard Laine

SPJS International Award, Society of Polymer Science, Japan (2013)

State Specially Recruited Expert Certificate, Ministry of Human Resources and Social Security of the P.R.C. (2013)

Emmanuelle Marquis

Jon R. and Beverly S. Holt Award for Excellence in Teaching 2013

Joanna Millunchick

University of Michigan Provost's Teaching Innovation Prize (2012)

Senior Fellow of the University of Michigan Society of Fellows (2012)

Xiaoqing Pan

Towner Professorship

Alan Taub

Cambridge University Anthony Kelly Lecture (2012)

York University, Chancellor Lecture (2012)

Michael Thouless

Fellow, Institute of Materials, Minerals and Mining (UK) 2012
U-M Distinguished Faculty Governance Award (2012)

PROFESSIONAL SERVICE

John Allison

Member, Editorial Board, *International Journal of Fatigue*

Member, Scientific Council, Madrid Institute for Advanced Study of Materials

Rachel S. Goldman

MRS News Editorial Board (2012–present)

Peter F. Green

Chair of Panel on Neutron Research, National Academy of Sciences

John Kieffer

American Ceramic Society
Program Chair, Glass and Optical Materials Divisional Program during the 2012 Materials Science and Technology Conference and 114th Annual Meeting of the American Ceramic Society, Pittsburgh, PA, October 7–11, 2012

Jinsang Kim

6th Int'l Conf on Materials for Advanced Technology (IUMRS-ICA) 2012
Abstract Review Committee, March–April 2012

Qatar National Research Fund, Proposal Review, March 2012

Emmanouil Kioupakis

Member, Proposal Study Panel, Molecular foundry, Lawrence Berkeley National Laboratory, February–August 2012
Proposal Reviewer, Department of Energy, Basic Energy Sciences Program

Joerg Lahann

Chair of session on “Nanoscale Manufacturing and Processing” at Annual Meetings of the American Institute of Chemical Engineers

Richard M. Laine

Executive Board, Polymer Division of the American Chemical Society

Joanna Millunchick

Participant–Committee for Assessing Foreign Technology Development in Human Performance Modification, The National Academies (since 2012)
User Executive Board for the Center of Integrated Nanotechnology (CINT) at Sandia National Laboratory and Los Alamos National Laboratory Program Committee–International Conference on Molecular Beam Epitaxy 2012, Nara, Japan

Professor Emeritus profile: Bill Hosford

Bill Hosford grew up in Maplewood, New Jersey, went to Lehigh (BS Metallurgical Engineering, 1950), Yale (ME in Metallurgy, 1951), and MIT (ScD in Metallurgy 1959). He taught at MIT for four years before coming to Michigan in 1963. In his words:

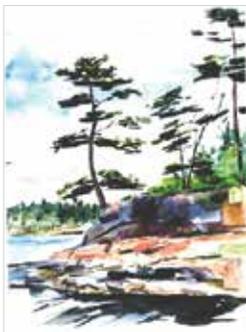
“Most of my research has involved bridging the gap between crystal plasticity and continuum plasticity. So what’s been up since I retired in 2003? Well, I’ve been busy writing books. I wrote one book called Reporting Results, a practical guide for engineers and scientists.

It’s a small effort linked with trying to explain how to convey research results convincingly. Later this year, ASM International will publish a high-school-level book on elementary materials science, a noted gap as everyone in high school seems to have a vague frame

Alumni

Bill Hosford (continued)

of reference for what chemists, physicists, and engineers do. But it's important to teach applied concepts in materials at the high-school level to explain more clearly the role



Pine Trees

materials processing has in producing tomorrow's vehicles, structures, and the like.

My book portfolio also includes wilderness canoe tripping. This book's aims were twofold. I'm still committed to providing numbers to an observational world, so I show the quantitative nature of a wilderness trip, from weather patterns and water currents to calorie intake and canoe specs. I couple that to my love of art and sketch observations of canoe-trip life. Each summer, I enjoy going canoeing in northern Canada. I have paddled over 6,700 miles and I enjoy places few others have seen. Recent trips include from Virginia Falls to Nahanni Butte in the Northwest Territories; Bonne Plume, in the Yukon; the Wakwayokastic in Ontario; North French in Ontario; Rupert (Quebec) Coppermine and Horton in the Northwest Territories; the Bloodvein in Ontario and Manitoba; and the Stikine in British Columbia and Alaska. I like to make watercolors while others fish—then I enjoy eating their catch! This last past summer I took a two-week raft trip on the Tashinini River from the Yukon, though British Columbia into Alaska.

Peg and I have four children, and we see them and their families as time allows. Our brood now includes three grandsons and two granddaughters. Peg and I also continue to love to play games and we play cards or dominoes every night before going to bed. We also continue to provide a location for the MMS-hosted picnics at our spread dating back to 1964. I think they like our large yard and perhaps our old farmhouse.

Jason Hertzberg receives our 2012 Alumni Merit Award



From left: Corey Brooker, Dean David Munson, Jason Hertzberg, and Peter Green at the 2012 Alumni society Awards Dinner, held on October 12, 2012. Photo courtesy of Dwight Cendrowski, College of Engineering Communications and Marketing

At Exponent, where he serves as Vice President, Director of Mechanical Engineering Practice and Principal Engineer, Jason Hertzberg applies his expertise to solving complex technical problems in a variety of industries, including medical devices, industrial equipment and systems, and technology product development.

His contributions on the consumer-product side are especially valuable. These include testing and analysis of new products, substantiation of product

performance claims, and failure analysis of field-returned products, to name just a few. In addition, he has led recall-related investigations for a wide range of products including medical diagnostic equipment and children's and infants' toys.

Hertzberg is the co-author of, *Deformation and Fracture Mechanics of Engineering Material*. The book combines continuum aspects of mechanical behavior and a materials science approach to problem solving.

Dr. Alex Lin (BSE 2001) is currently an academic staff member in the Department of Biomedical Electronics in the Republic Polytechnic School of Engineering, Singapore. He graduated from Rice University in 2006 with a PhD in Bioengineering, where he researched modeling and experimental elucidation of gold nanoshells as a light scattering contrast agent for early cancer optical diagnostics.

Tim Waxweiler (BSE '06) and **Alexis Goolik** (BSE '05 and MSE '06) were married in October. The couple met in Kinetics and Transport class with Professor Michael Falk in the Materials Science and Engineering department. Tim and Alexis are currently living and working in Denver.

Email updates to: mse-alumni-update@umich.edu

Achievements in 2012–13

MMS Activities during 2012–13

- **An increased presence in the professional societies.** MMS expanded its role this year with efforts to be more active in professional societies, particularly in the local ASM Detroit Chapter. And different outlets were explored through student representation at the ASM/AFS Management Night and the ASM Detroit Chapter Meetings. ASM Detroit has been supporting these efforts by organizing a professional mixer in Ann Arbor for students;
- **Continuing traditional weekly luncheons** during the academic year featuring an invited speaker on an array of technical topics of current interest to undergraduate and graduate students alike;



Student Faculty mixer sponsored by MMS

- **Offering younger students opportunities** to learn from older, more experienced students. While a majority of our speakers still came from outside companies, we also added events such as General Body Meetings, Graduate Student Panels, and Internship Panels to encourage younger students to interact with older students and learn from them.

MMS Speaker Series 2012–13

Professor Akram Boukai, MSE Department
John (Chip) Keough, CEO, Applied Process Inc. (Alumnus)
Dr. Mike Wixom, Director of Research, A123 Systems (Alumnus)
Jason Hertzberg, Corporate Vice President, Exponent (Alumnus)
 Professor Peter Green, MSE Department Chair
Tim Rickard, Quality Assurance Manager, US Steel
Kae Trojanowski, Student Relations, ASM Detroit Chapter
Dr. Fabio Albano, Chief Materials Scientist, Energy Power Systems, LLC (Alumni)
 Professor Alan Taub, MSE Department
Dr. Louis Hector, Research & Development, General Motors
Thomas Cayia, Operations Manager, ArcelorMittal
Christopher Smith, Attorney, Brooks Kushman (Alumnus)
Dr. Mark Sonnenschein, Dow Chemical Co.

Beyster Fellowship

University of Michigan College of Engineering student Katherine Sebeck has been chosen as the 2013–2014 fellow for the J. Robert Beyster Computational Innovation Graduate Fellows Program.



Katherine is a PhD candidate and NDSEG fellow in the Kieffer Group within the Material Science and Engineering Department. As a Beyster Fellow, she will be performing computational materials simulations of the dynamic polymerization of the epoxy/graphite interface, which, among other benefits, will translate to significant improvements in fuel efficiency across all industries.

Katherine is also actively involved as a volunteer with the Open Data IGERT program within the University of Michigan's School of Information.

The J. Robert Beyster Computational Innovation Graduate Fellows Program was established by four-time alum Dr. J. Robert Beyster (BSE Engineering Math 1945, BSE Engineering Physics 1945, MS Physics 1947, PhD Physics 1950) and his wife Betty to acknowledge that PhD students are “the originators and carriers of innovative ideas and solutions from the University to the world,” and to emphasize the pivotal role that high-performance computing must play in solving our societal challenges.

MSE Image Contest

We are pleased to announce the winners of the 2012 MSE Imaging Microstructure Contest. We wish to thank the judges for their time, Kevin Worth for web support, and Professor Green and Dr. John Mansfield for their continued support and for providing funding for the contest from the Department and from EMAL (www.emal.engin.umich.edu).

Grand Prize Winner, Scientific Merit: Jiashi Miao “Quasicrystal in Mg Alloy” (Allison group). This is a HAADF-STEM image of Al₄Mn quasicrystal phase formed in super vacuum die casting AZ91 magnesium alloy.

Grand Prize Winner, Artistic Merit: Terry Shyu “Stretch Study” (Kotov group). This particular example demonstrates the gradual change of texture and topology stemming from the localization of mechanical instabilities, where local rotations and bending of elements occur. The material used was a 10-micron thick graphene oxide/polyvinyl alcohol composite. Periodic arrays of cuts are introduced by plasma etching.

The rest of our winners:

Optical and Scanning Electron Microscopy

- 1st—Joong Hwan Bahng “The Giant Hedgehog Particles” (Kotov group)
- 2nd—Ryan Breneman “Triplets, hidden light” (Halloran group)
- 3rd—Jian Zhu “Collision” (Kotov group)

Simulated Microstructures as Products of Computational Materials Science

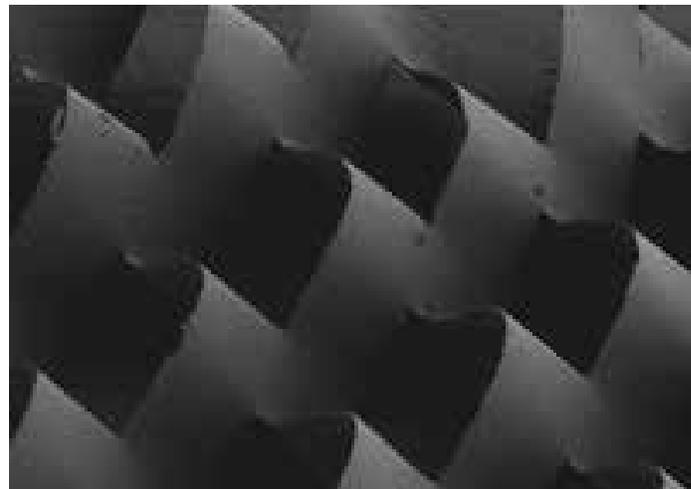
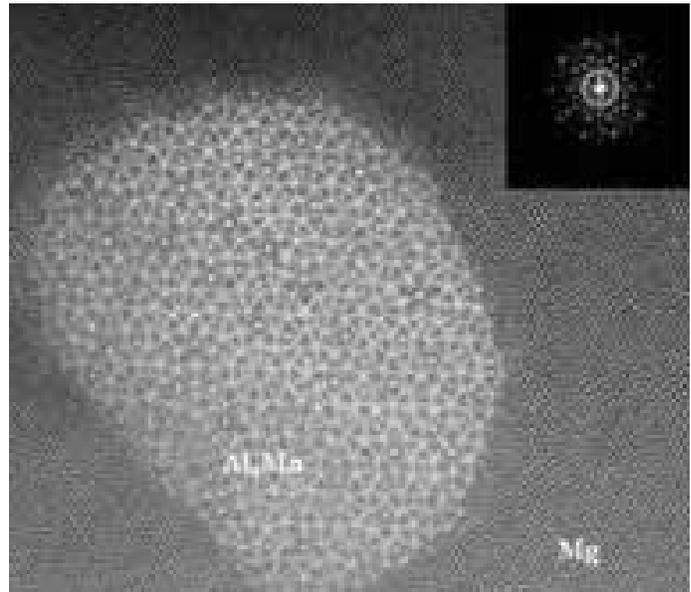
- 1st—Bernardo Orvananos “Interactions between lithium iron phosphate nanoparticles” (Thornton group)
- 2nd—Dylan Beryl “Psi hexagonal” (Kioupakis group)
- 3rd—Guangsha Shi “Porous silicon” (Kioupakis group)

Digitally Enhanced or Colorized Images of Microstructures

- 1st—Anne Juggernaut “Lonely Leaf” (Love group)
- 2nd—Jian Zhu “Nano Halloween Masks” (Kotov group)
- 3rd—Kevin Golovin “AUtumn POSS” (Tuteja group)

Facebook Fan Prize Riddhiman Bhattacharya “Max Phase Fractured Surface” Adviser

Goulbourne (Aerospace Engineering), Allison (MSE)



View winning images at www.mse.engin.umich.edu/internal/imaging-microstructure-contest/2012/winners

Scholarships, Fellowships, and Awards

UNDERGRADUATE

Department Awards

Richard A. Flinn Scholarship
Carrie Tamarelli

Fontana-Leslie Scholarship
Emily Breneman, Kyle Doubrava,
Caroline Lupini, Kelly McKeon

**James W. Freeman Memorial
Scholarship**
Eric Chung-Kai Hung, Dillon Kipke

John Grennan Scholarship
Zhentao Yang

Jack J. Heller Memorial
Sea Dong, Suzanne Hardy

William F. Hosford Scholarship
Kathleen Chou, Marissa Lafata

Schwartzwalder Memorial Scholarship
Nicholas Austin, Adam McFarland, Satish
Subramanian, Margaret Tantillo

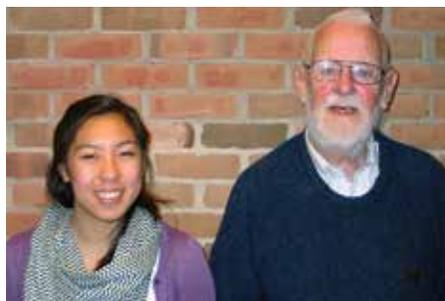
**Clarence A. Siebert Memorial
Scholarship**
Nadav Geva, Abigail Hall,
Sang Woo Woo

Alfred H. White Memorial Scholarship
Marie Hoffman, Natania Hortsch,
Pengrui Wang

Brian D. Worth Prize
Adam McFarland

MMS Anvil Award
William Mohr

James P. Lettieri Undergraduate Award
Nadav Geva



**Hosford Scholarship recipient Kathleen Chou with
Professor William F. Hosford**

College/University Awards

**CoE Distinguished Leadership Award
Undergraduate Student**
Carrie Tamarelli

CoE Distinguished Achievement Award
Marissa Lafata

Arlen R. Hellwarth Award
Melissa Wickman

External Awards

**TMS Brimacombe Presidential
Scholarship 2014**
Kathleen Chou

GRADUATE

Department Awards

**MSE Graduate Student
First Publication Award**
Olga Shalev, *Organic Electronics*,
September 2012
Gulin Vardar, *Applied Physics Letters*,
January 2013
Andre Thompson, *Journal of Colloid and
Interface Science*, March 2013

**Best Overall Graduate Student
Instructor**
Jong Doo Ju and Aaron Tan, 2012
Jong Doo Ju, 2013

College/University Awards

**2013–2014 Rackham Predoctoral
Fellowship**
Gibum Kwon

**2013–2014 Rackham Barbour
Scholarship**
Yan Dong

CoE Distinguished Academic Achievement
Jared Tracy

CoE Distinguished Leadership Award
Sibu Kuruvilla

Bob and Betty Beyster Fellowship
Katherine Sebeck

**Rackham Centennial Spring/Summer
2013 Fellowship**
Matt Dejarld

External Awards

**Materials Research Society Graduate
Student Silver Award**
John Thomas (PhD 2012)

**National Science Foundation
Fellowship 2013**
Sibu Kuruvilla

**National Science Foundation
Fellowship 2014**
Aeriel Murphy

**Department of Defense Science,
Mathematics & Research for Transformation
Fellowship 2013**
Katherine Sebeck



C-PHOM students participating in the 2013 Summer Research Symposium in West Hall

C-PHOM Summer Research

The Center for Photonic and Multiscale Nanomaterials (C-PHOM), established in 2011, offers a High School Research Program for seniors, and a summer Research Experiences for Undergraduates (REU) program for college students. The program is run by Prof. Rachel Goldman (C-PHOM Director of Education) and Akesha Moore (Education Coordinator). Students conduct research in the fields of nanomaterials, nanophotonics, and nanophysics under the guidance of faculty and graduate students.

The High School Research Program is a nearly year-round program that includes an eight-week residential component. The students return to campus several times during the year to prepare for local, regional, and national science fair competitions. The REU program is a 10-week residential program for non U-M juniors and seniors. At the completion of the summer residential programs, the C-PHOM students present their research at the U-M Summer Research Symposium.

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