MichiganEngineering
Materials Science and Engineering

University of Michigan
College of Engineering

MSE News

WINTER 2007

The Newsletter of the Department of Materials Science and Engineering

The New Faces of Materials Science & Engineering

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Professor and Chair

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Assistant Professor

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INSIDE

Letter to the Alumni

By most metrics, our department has done well this year. We earned a six-year accreditation from the Accreditation Board for Engineering Technology (ABET). According to *U.S. News and World Report*, during the past five years, our undergraduate program has consistently ranked in the top five in the nation, we are 4th in 2007. Our graduate program ranking rose to 6th, after a four-way tie for 8th during the previous year. The combined enrollment in our graduate and undergraduate programs reached an all-time high this year. Two start-up companies were founded based on research by our faculty. MSE faculty continued to publish scientific papers in the most high profile journals in the world and they continue to compete for, and attract, significant resources for new and innovative programs in science, technology and education. In my last letter to you, I briefly described some of the changes the discipline of MSE has undergone and the transformation the department underwent during the last five years that largely reflects changes in the field. I now use this opportunity to provide a "snapshot" of the department and share some plans that are currently underway.

Despite nationwide trends of a slight decline in enrollment in MSE around the country during the last decade, the enrollment in our department has increased, particularly over the last five years. Currently, we have 140 MSE majors, a 17% increase over last year's enrollment. This number includes a handful of students who are double majors in biomedical engineering and MSE. Approximately 40% of our BS graduates are female, substantially higher than the 20% of engineering graduates nationwide recently reported by the American Society for Engineering Education (ASEE). Approximately 90 graduate students are enrolled in MSE; 30 additional students in other programs, such as applied physics, chemical engineering, mechanical engineering and electrical engineering, are supported and mentored by MSE faculty. The percentage of female graduate students is just under 30%, which is considerably higher than the national average. By way of comparison, the very largest MSE departments in the country have a comparable number of undergraduates, but a considerably larger graduate student body. However, the size of our faculty, is only 2/3 the size of those departments. One key message is that graduate student class size is correlated with faculty size. In fact, while our enrollment has increased by ~160% during the last five years, the number of faculty has increased by ~15%. I see this as one of the future challenges for the department.

I now comment on the undergraduate experience and plans for changes in the curriculum. More of our students are beginning to study abroad as new opportunities arise; this is consistent with nationwide trends. This year three of our students studied at Shanghai Jiao Tong University (SJTU). Additionally, two of our faculty, Joanna Mirecki Millunchick and Xiaoqing Pan, taught summer courses there. With the establishment of the new joint institute between the University of Michigan and SJTU, we anticipate rapid increases in the number of students interested in studying in China. Our students are now doing internships in a broader cross section of companies, including those concerned with electronic materials and biomaterials. A large fraction of our undergraduates, on the order of 50%, went on for advanced degrees in MSE and other areas such as biomedical engineering–compared to other areas of engineering, with the exception of biomedical engineering, this large percentage is not unusual. We formed a taskforce to examine changes to the undergraduate curriculum, particularly in light of the new changes in the field and the diverse technical interests of newly hired faculty. Michael Falk presented a summary of our plans for changes to the undergraduate curriculum during the Alumni Advsiory Committee meeting last October. We hope to provide you with an update in our next newsletter.

Our research portfolio remains strong and we continue to have an impact in the areas of science and technology. This is measured by publications in the very best refereed archival journals and by patents filed and awarded. In addition, we can measure this by the expenditures of external research funding by individual faculty. This year, our

total expenditures from competitive external sources has increased to just over $6.7 million. The expenditures from corporate sources was 15%, which is approximately double that of the prior year. Support for research from the National Science Foundation and from the Department of Defense remain high and account for nearly 80% of our portfolio. Funding from the Department of Energy and the National Institutes of Health each remain less than 5%.

Having mentioned the expenditures, it is worthwhile to tell you about new programs in our department this year. I will highlight three of them to illustrate the diversity. John Kieffer is the PI for a $1 millon Department of Education program geared toward training a new generation of graduate students to acquire strong skills in both computational and experimental materials science. Dave Martin is the PI for a $5.5 million program, supported by the Army, which aims to develop multifunctional, adaptive, and biointegrated prosthetic limbs. There is more information on these two programs in the newsletter. We have not abandoned our roots; Wayne Jones won a ~$1 million NSF Focused Research Group (FRG) program (Fundamental Approaches to Design of New Magnesium Structural Alloys). In addition to these activities, two start up companies, Nano-Alpha and Nanomag LLC, were initiated by work in the department, by Richard Laine and Amit Ghosh, respectively.

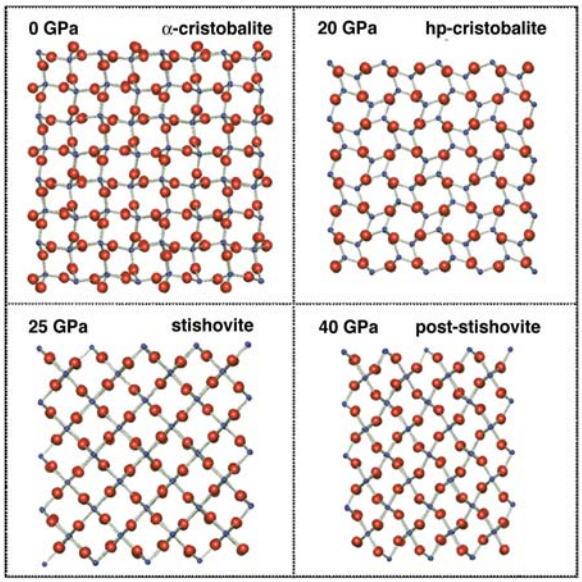
Looking into the future, it is apparent that funding trends in the government and industrial sectors will continue to have a significant impact on how research is conducted at universities, and certainly in our department. Federal government spending on research in the life sciences has increased enormously in recent years, while there has been comparatively modest increases in investment in the physical sciences (this includes MSE and engineering sciences). In recent years, the number of scientific papers published by European institutions in the physical sciences has exceeded those from US institutions. This has been compounded by the recent decline of basic research performed in US corporate laboratories. In the life sciences, however, the trends are quite the opposite; research productivity by US institutions remains higher than Asian and European institutions. The future for funding in the physical sciences, nevertheless, promises to be good. The American Competitiveness Initiative, which was announced by President Bush earlier last year, and had broad bipartisian support, promises considerable support for research in the physical sciences. With regard to future research support, it is anticipated by everyone that funding the area of energy will increase appreciably. In addition, funding in the areas of nanoscience and nanotechnology, and for research problems at the interface of materials and medicine, promises to be very be good. Through collaborations and future hiring, the department should be well positioned to take advantage of these opportunities.

It is apparent that funding trends in the government and industrial sectors will continue to have a significant impact on how research is conducted at universities, and certainly in our department.

This newsletter contains a number of exciting developments in our department that include an article about faculty who taught in Shanghai. It also includes faculty recognition and awards. I hope that you enjoy reading the newsletter and we look forward to hearing from you. If you are planning to visit the University, I would look forward to meeting with you and giving you a tour of the facilities.

Go Blue!
Peter Green

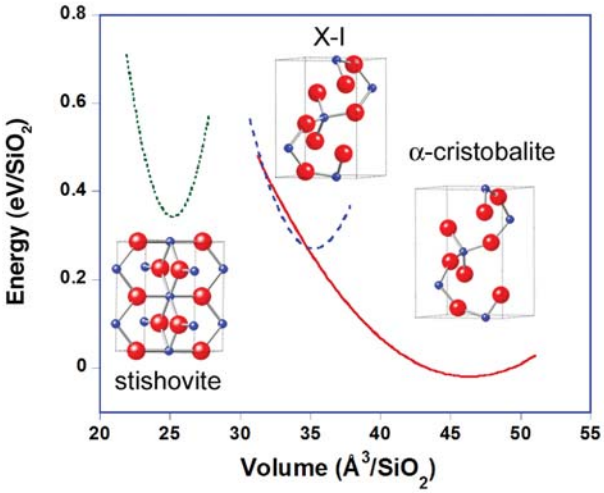
Two Steps to Densify...
and a 15-Year Old Mystery Solved



Using simulations, John Kieffer's research group has uncovered a ubiquitous mechanism by which certain inorganic compounds densify under pressure. This finding is important for understanding the response of materials under severe mechanical impacts and the deformation of rocks in the Earth's interior, and is therefore relevant in contexts ranging from materials design to earthquakes, and possibly, the flow of glaciers. The mechanism they observed is also fascinating from a purely scientific point of view. As revealed by their concurrent molecular dynamics simulations and first-principles calculations, materials that have polyhedral network structures, under normal conditions, compact according to a two-step process. First, a compact high-symmetry anion sub-lattice forms, governed by the strong repulsion between large anions. Subsequently, cations redistribute onto interstices of this sub-lattice. These steps are illustrated for the case of cristobalite in Figure 1.

The researchers observed this for two different polymorphs of silica, i.e., quartz and cristobalite. The intriguing aspect of this process is that in both cases the first step results in the formation of a highly symmetric close-packed oxygen sub-lattice (bcc in the case of quartz and hcp in the case of cristobalite). They reported these findings in the December 2006 issue of *Nature Materials* (Liping Huang, Murat Durandurdu, and John Kieffer, "Transformation Pathways of Silica under High Pressure," **5**, 977). Note that different polymorphs of ice, namely ice II and ice Ic have the same space groups as quartz and cristobalite, respectively. Hence, this process may be taking place at the very moment we chew the ice from our beverage.

As an added point of interest, for cristobalite, the completion of the first stage in this two-step process is manifest by the formation of a metastable phase, which corresponds to an elusive new phase (X-I silica) that has been observed in experiments over a decade ago (*Nature* **347**, 267, 1990). The nature of this phase has so far remained elusive because the corresponding diffraction patterns were too ambiguous to be indexed. By reproducing the compression experiment in the computer, these researchers now have identified the structure of this new polymorph, and furthermore, they explain the role it plays in the densification of silica, i.e., X-I corresponds to the structural state where the hcp anion packing is achieved (Figure 2). This is an illustrative example of how computer simulations can enhance experiments. The importance of this demonstration has been described by Yagi, the author of the 1990 *Nature* paper, in a News & Views article that accompanies the paper in the December issue of *Nature Materials*.



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Faculty Win Two AFOSR-MURI Grants for Perfect Imaging

MSE faculty are members of two multi-university teams that will receive a combined total of in excess of $10 million over the next five years to support interdisciplinary research on negative refraction. The two groups of materials scientists, chemical engineers, electrical engineers, biomedical engineers, physicists, chemists, and mathematicians from twelve universities will explore methods to produce new synthetic materials that can refract, or bend, light waves "backwards."

The phrase "negative refraction" describes the property of a material that refracts light in the opposite direction of substances found in nature. Refraction is a well-known phenomenon of light and other electromagnetic radiation. In essence, it is observed as light bending as it passes from one medium to another. Stick your finger into an aquarium and you will see that your finger does not appear to line up with the rest of your hand because light waves bend as they leave the water and go through the glass side and air before reaching your eye.

Since this negative refraction was first predicted in the 1960s, scientists have debated whether it exists, and have struggled to definitively demonstrate this property. In recent years, some of these obstacles have been overcome and scientists, including those at the U–M, are developing new methods for creating "smart, self-assembling" polymers, nanoparticles, organic thin-films and semiconductor materials with the desired negative refraction characteristics.

One goal of this research is to create materials that can perform as a lens without needing the curved surfaces found in traditional lenses. It has been predicted that materials with negative

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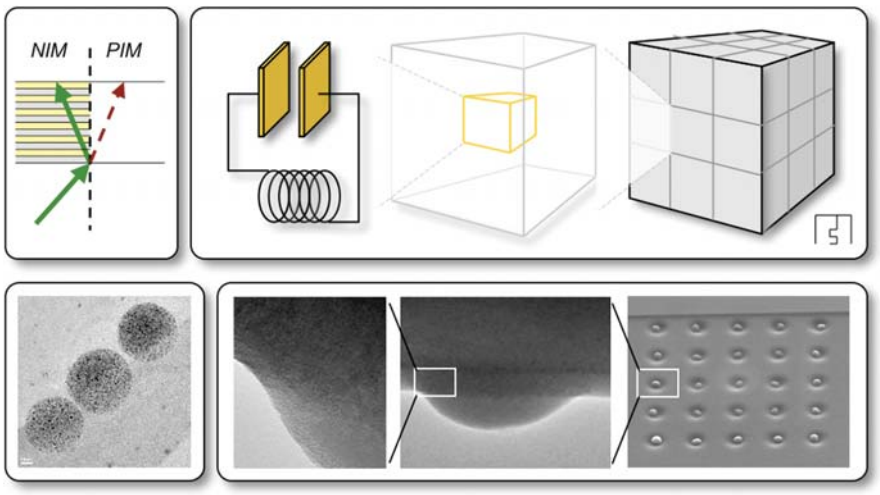
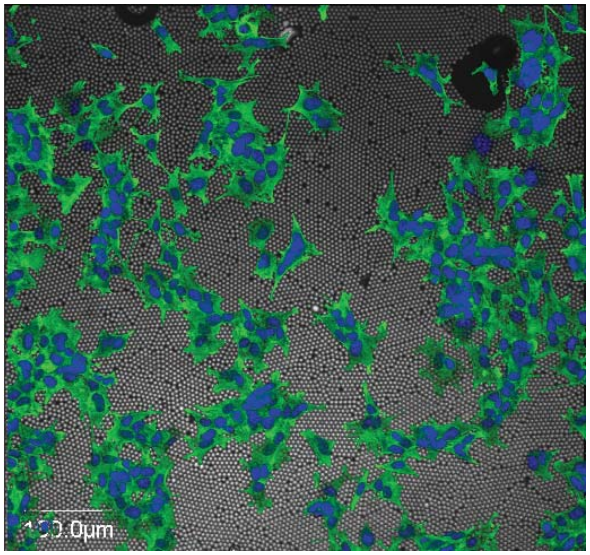


A depiction of a metamaterial possessing a negative index of refraction as a result of the complex interaction of electromagnetic waves with metallic nanoparticles embedded in a dielectric matrix. MSE researchers are investigating both organic- and inorganic-based material systems for the matrix, as well as high-vacuum and colloidal nanofabrication techniques.

Building the Bionic Woman

In the future, it is possible to envision engineered devices that are seamlessly integrated into living systems. There are many examples of this from science fiction and popular culture, including artificial bionic limbs, eyes, and ears. Consider movies such as "Star Wars," and television programs such as "The Six Million Dollar Man & The Bionic Woman." However, in order to make this happen, there need to be materials available that can better accommodate the dramatic differences in properties between living (biotic) systems and the synthetic (abiotic) devices.



SY5Y neural cells (actin–green, nuclei–blue) grown on a patterned surface of PEDOT, an electrically conducting polymer. Image obtained by Matt Meier (undergraduate in BME) and Dr. Sarah Richardson-Burns (postdoctoral scientist in MSE).

David C. Martin and several of his colleagues at the University of Michigan have recently been given an opportunity to explore this scientific frontier in more detail through a Multi-Disciplinary University Research Initiative (MURI) award from the Army Research Office. This grant will focus on the design and development of materials at the interface between a prosthetic limb and living tissue. Four engineered materials–tissue interfaces are of interest for the project: (1) structural frame–bone, (2) wire–neurons, (3) sensor/actuator–muscle, and (4) protective coating–skin. In each case there is a need to optimize the geometry, mechanical properties, electrical properties, and regenerative capability of the interface. The goal of the five year, $5.6 million project is to create the fundamental enabling technology needed to realize new generations of artificial arms and legs. It is also expected that aspects of the technologies and ideas that are developed in this research effort will have implications for other biomedical devices.

Of particular interest to the current project are soft, electrically conducting polymers that can be used to improve the long-term performance of biomedical devices when implanted in neural tissue. These materials have been of interest to Martin and his students for the past several years, with a focus on improving the performance of microfabricated neural prosthetics that have been developed at the University of Michigan in the Center for Neural Communications Technology. Participating with Martin on the MURI are professors Daryl R. Kipke from biomedical engineering, Paul S. Cederna from surgery, and Steven A. Goldstein from orthopaedics.

AFOSR-MURI GRANTS

CONTINUED FROM PAGE 5

refraction can image objects that are significantly smaller than the wavelength of light. Although this is an impossible task for common materials, this may be achieved by the development of negative refraction media. Over the course of this project, the interdisciplinary teams of researchers intend to improve upon existing materials exhibiting negative refraction at microwave frequencies and show the way toward the creation of a new class of devices with a broader range of applications.

Both programs began in May 2006. The Michigan MSE participants include professors Sharon Glotzer, Rachel Goldman, Jinsang Kim, Stephen Forrest and Nicholas Kotov.

GAANN – Integrating Computational and Experimental Research

In 2006, the department was awarded a $1.1 million grant from the U.S. Department of Education for Graduate Assistance in Areas of National Need (GAANN). This training grant, which was secured based on the initiative of Graduate Chair John Kieffer, is specifically targeted at preparing MSE graduates for careers as educators at research universities.

The objective of this project is to educate a new generation of PhD materials scientists in the development and application of computational techniques of investigation, so they can integrate these in their research on par with experimental methodologies. Even though modeling and simulation has matured into an essential tool for interpreting experimental observations and predicting materials properties, this approach is underutilized in materials science. The prevailing culture in our discipline has thus far been to favor descriptive knowledge and empiricism over rigorous computations and engineering design, mainly because by nature, the problems we are concerned with are exceedingly complex and multi-faceted. Given the progress in numerical modeling approaches, simulation algorithms, and computer performance, we have now passed the threshold at which computational materials science has become a strategic tool for research and development, as well as an essential skill in the repertoire of materials scientists and engineers. In this project, we work to proliferate this new way of thinking by training GAANN Fellows to become future educators in materials science.

GAANN Fellows will be co-advised by one computational and one experimental faculty member in carrying out thesis projects that emphasize computational approaches in traditionally experimental areas of study. Furthermore, we will engage them in the development of new curricula and instructional technologies, based on the use of computation for enhancing the cognitive process, knowledge transfer, and increasing the computational skill of materials science undergraduates. We expect this project will generate a progressive way of thinking in materials research that will persist beyond the duration of the GAANN project, permanently affect the undergraduate curriculum in our discipline, and result in an increase of the number of women and underrepresented minority students in our program.

Faculty Teach at Shanghai Jiao Tong

Professors Parakis (NAME), Mirecki Millunchick (MSE), and Im (ME) at the Shanghai Pearl Tower

This past June, Joanna Mirecki Millunchick traveled to Shanghai Jiao Tong University (SJTU) to teach MSE 220, Principles of Engineering Materials and Manufacturing, as part of the Joint Institute between SJTU and the University of Michigan. The Joint Institute was established in 2001 in order to provide degree programs for students at both universities.

Of students enrolled in MSE 220, 90 were from all over China, 6 from Purdue University, and 15 from the University of Michigan. The pace of the class itself was blistering; fourteen weeks of lectures, homework, and exams were packed into a scant four weeks. Despite the relentless tempo, the students exhibited a high level of academic standards, good humor, and hospitality.

Kudos

Michael Atzmon was promoted to Professor with tenure.

Rod Ewing received the 2006 Dana Medal of the Mineralogical Society of America, the 2006 Lomonosov Large Gold Medal from the Russian Academy of Sciences, and was elected Fellow of the American Geophysical Society.

Michael Falk was promoted to Associate Professor with tenure.

Sharon Glotzer served as the 2006 Chair of the Forum on Industrial and Applied Physics of the American Physical Society, received the 2006 Monroe-Brown College of Engineering Research Excellence Award, and was elected a 2006 Fellow of the American Physical Society, through the Division of Computational Physics.

Rachel Goldman was the 2005-2006 Augustus Anson Whitney Fellow at the Radcliffe Institute at Harvard University, served as a Member of the Board of Directors of the American Vacuum Society (2005-2007), and was elected Member-at-Large of the Forum on Industrial and Applied Physics of the American Physical Society (2007-2009).

Peter Green served as the 2006 President of the Materials Research Society, completed a six-year term as Divisional Associate Editor for Physical Review Letters, and was appointed Chair of the National Research Council Solid State Sciences Committee.

John Kieffer was selected to receive the 2006-2007 Materials Science and Engineering Department Award.

Jinsang Kim received the 2006 Jon R. and Beverly S. Holt Award for Excellence in Teaching, from the College of Engineering.

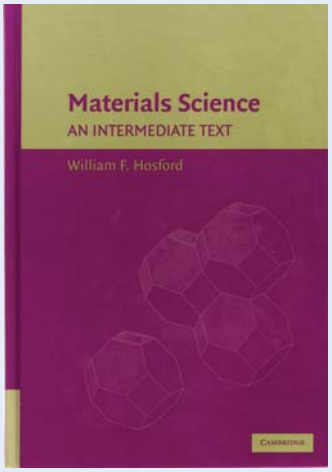
Nick Kotov received the Boeing Welliver Fellowship and the SFI Walton Award.

Richard Laine was elected a 2006 Fellow of the American Ceramics Society.

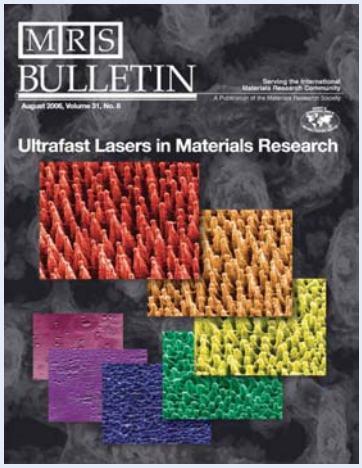
Jyoti Mazumder received the 2006 William T. Ennor Manufacturing Technology Award from the American Society of Mechanical Engineering.

Tresa Pollock served as the 2006 President of the TMS, and received the 2005-2006 Materials Science and Engineering Department Award.

New Publications in 2006



William Hosford published *Materials Science: An Intermediate Text* (Cambridge University Press).



Steven Yalisove served as guest editor for the August 2006 issue of the *Materials Research Society Bulletin* issue entitled "Ultrafast Lasers in Materials Research."

Inventions

Amit Ghosh: "Thixomolded Light Alloys" (license).

Rachel Goldman: "Narrow Energy Band Gap Gallium Arsenide Nitride Semiconductors and an Ion-Cut-Synthesis Method for Producing the Same" (patent).

Richard Laine: "Well-Defined Nano-sized Building Blocks for Organic/Inorganic Nanocomposites" (patent).

Kim Receives Holt Teaching Award

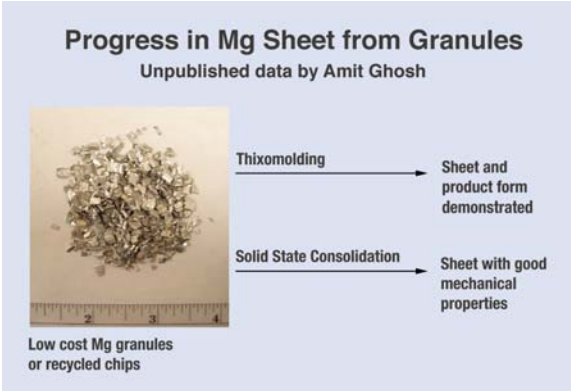
Jinsang Kim received the 2006 Jon R. and Beverly S. Holt Award for Excellence in Teaching from College of Engineering. Since he arrived at the U–M, Kim has successfully introduced soft materials science into courses and undergraduate and graduate research opportunities. Design principles of functional polymers and their applications in biomedical engineering and optoelectronics are emerging research areas he has introduced to Michigan students.

Kim completely revised BME/MSE/Macro 410, Design and Applications of Biomaterials. The two important principles in biomaterials science are materials science and biology. The course has been revised in such a way that students can systematically understand biology-related material design principles and the host reaction to biomaterials. This elective course has become popular and 60–70 graduate and undergraduate students from various departments, such as MSE, BME, ChE, Macro, ME, and from the medical school, take the course each term.

He has also improved MSE 365 Materials Laboratory II, by developing and incorporating a new lab, functional polymers, shaper memory polymers, and biopolymer gels, into the course. The new lab was designed to promote the students' understanding in functional soft materials through experiments. The experience in this new lab enables students to obtain a molecular level of understanding on polymerization chemistry, physical and chemical crosslinking, and the related design issues and applications. Kim is currently developing another new lab on nanomaterials and quantum dots that will be incorporated into the course in the 2007 winter term.

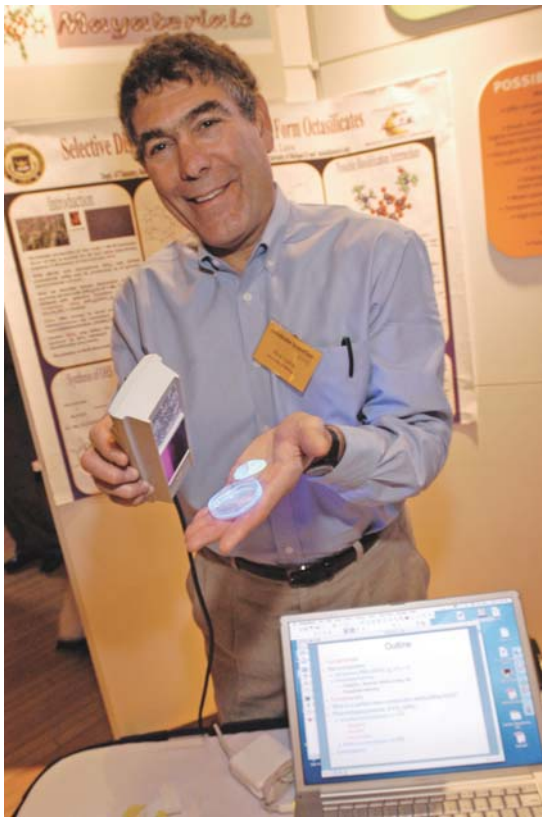
New Start-up – Nanomag

A new development for producing submicron grain Magnesium alloys is showing considerable interest in applications of these materials to complex lightweight parts. The process of fabrication depends on imparting large plastic deformation to Mg alloys by using sinewave shaped dies or rolls. The process minimizes strong texture formation and can eliminate twinning deformation in fine grain Mg, creating a more homogeneous and high strength material.



Amit Ghosh from MSE has teamed up with Dr. Ray Decker of Thixomat Inc., adjunct professor in MSE, to combine the sinewave die process with rapidly solidified thixomolded Mg alloys containing fine scale eutectic structure to produce high strength alloys with good ductility and warm formability. As a result of this and related inventions, a new company–Nanomag, has been incorporated with a licensing agreement with the University of Michigan to produce Mg parts for defense and automotive industry. The company has been awarded an NSF-STTR project for demonstrating feasibility for forming Mg parts.

Scaling Up Nano Entrepreneurship



In addition to the obvious potential for producing synthetic gems, the nanocomposites Laine seeks to bring to market through his most recent venture could be used to increase the incandescence of sodium vapor lights by as much as 30 percent-thus saving billions of kilowatt hours per year. (photo by Peter Smith)

"I've always been interested in developing materials from basic nano building blocks," says Richard Laine, director of Macromolecular Science and Engineering and professor of Materials Science and Engineering. "I've also had a strong interest in technology transfer." Over the past 20 years, that dual fascination has resulted in 33 patents, more than 200 publications, and 3 start-up companies.

In 1990, Laine and his U–M research team made their first major breakthrough: low-cost inorganic polymers for manufacturing ceramics, produced from beach sand, lye (liquid plumber) and recycled antifreeze. In 1996, he launched Tal Materials, Inc. to commercialize the discovery. Subsequently, he and his team learned to dissolve these polymers in alcohol, aerosolize and then combust them, producing metal-oxide nanopowder soots. Tal Materials then focused on commercializing the production of multiple types of nanooxide. A group of investors was found to help grow the business, now named Nanocerox.

As an extension of this technology, the Laine group discovered a way to dissolve the silica in rice hull ash to produce "perfect" molecular silica nano building blocks. As he notes, "These molecules are exactly one nanometer-or one billionth of a meter-in diameter to which can be attached eight organic groups giving novel 3-D molecules that can be assembled nanometer by nanometer for use in an enormous numbers of applications." Mayaterials was launched in 2003 to market the resulting "cubes" or nano organic/inorganic hybrids.

Laine's newest venture, Nano-Alpha, is an unexpected off-shoot of the original nanopowder combustion technology. By taking the originally produced nanopowders and "reshooting" them in the flame, the Laine group has developed completely different sets of products including the first nano-sapphire powders. These powders could lead to more efficient street lights and lasers, and stronger hip and knee implants.

Article by Linda Fitzgerald, published in 2006 Tech Transfer Annual Report, an U–M College of Engineering publication.

Laine and his U–M research team made their first major breakthrough: low-cost inorganic polymers for manufacturing ceramics, produced from beach sand, lye (liquid plumber) and recycled antifreeze.

Gifts from our Donors – 2006

Thank you for your generous gifts to the Department of Materials Science and Engineering, or to the College of Engineering for the benefit of the department. If we have missed someone, please accept our sincere apology, and let us know so that we can correct our records.

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Major Gifts From Dr. Anne Rowe and Dr. and Mrs. Otto Riegger

Dr. Anne Rowe (PhD, '73)

This year, our department was fortunate to receive a number of donations that will have an important impact on the quality of education that our students will receive. We are especially thankful to donors who consistently give to the department each year and acknowledge them each year in the newsletter. Some of our alumni give generously each year, often $1000 or more. This year we especially want to acknowledge two very generous gifts to the department.

The first of these is a bequest of $500,000 from Dr. Anne Rowe that will constitute an endowment and will eventually provide funds for student activities. Dr. Rowe has the distinction of being the first female to earn a PhD in materials science and engineering from the University of Michigan, in 1973. She commented that Professor Emeritus Wilbur Bigelow had an especially important impact on her life as a student here and her career, and made this gesture, in large part, in acknowledgement of this.

Dr. and Mrs. Otto K. Riegger made an especially generous donation of $45,730 late in December to the Metallurgical Engineering special fund. This was not their first gift. Dr. Riegger received all his degrees in engineering from Michigan and he earned his BS degree in 1959. This gift is especially valuable as it will have an immediate impact on department operations and on the student and faculty experience.

The MSE students and faculty especially want to thank all donors for their kindness to the department.

Lawrence H. Van Vlack Lectureship

Professor Ali S. Argon with MSE faculty Tresa Pollock (L), and Ron Gibala (R)

Professor Ali S. Argon, Quentin Berg Professor of Mechanical Engineering at the Massachusetts Institute of Technology, was honored as the 2006 Lawrence H. Van Vlack Lecturer. He presented lectures on "Atomistic Simulation and Analysis of Plasticity in Amorphous Silicon as a Space Network Solid" and "How to Toughen Brittle Plastics" during the two-day event in April.

Professor Argon is known for his numerous contributions to the field of mechanical behavior of materials. His research has covered a wide range of materials, including metals, ceramics, glasses, polymers and composites---both experimentally as well as through mechanistic computer modeling. His publications are in excess of 315 journal articles and include two books on the mechanical behavior of engineering solids.

Argon is the recipient of a number of awards and honors, including the Charles Russ Richards Award (1976), the Nadai Metal (1998) of ASME, and membership in the National Academy of Engineering (1989).

Professor Manfred Rühle will be the 2007 lecturer on April 16 and 17. Professor Rühle has been a director at the Max-Planck-Institut für Metallforschung (MPI-MF) since 1991, and has received numerous awards for scientific achievement (notably Foreign Member of the National Academy of Engineering). He has done groundbreaking work in developing and using quantitative high-resolution electron microscopy to understand interfaces in materials. His research addresses a range of structural issues, including grain boundaries in pure metals, semiconductors and intermetallic or inorganic compounds to heterophase boundaries between very different materials, particularly metal/ceramic interfaces.

ASM Materials Camp

The fourth annual ASM Materials Camp-Teachers in Ann Arbor was held on July 18-22, 2006 in the Department of Materials Science and Engineering. Twenty-eight participants enrolled for this event which included a blend of local teachers, teachers from across the US, two teachers from Alberta, Canada and one teacher from Austria.

Daily activities included both classroom discussion of materials (metals, ceramics, polymers and composites) and

hands-on laboratory experiments. Volunteers from both the Detroit and Saginaw Chapters of ASM were present to augment the master teacher discussions and share their experiences of working in the materials engineering world. Evening activities included industry tours to Masco Corporation and Thixomat. At Masco Corporation, the teachers were given an insight into some of the R&D behind the production of various plumbing products including faucets, wheels for shower doors, and bathtub materials. Meanwhile, at Thixomat, the participants learned about dispelling the myths of the dangers of working with magnesium. Following an interesting presentation, they were able to spend time watching magnesium castings being made.

Congratulations 2006 MSE Graduates!

Undergraduate Degrees

April 2006

Joy E. Allen
Timothy Jung Augustin
Dayangku Awang Sh'Ri
Sung-Chul Baek
Carrie E. Bayer
Shweta S. Bhat
Suzanne M. Brown
Clinique L. Brundidge
Thomas E. Conry
Phillip A. Creed
Adam C. Falkenberg
Michael B. Katz
Sheila M. Kornylo
Shana G. Kramer
Sameer Kumar
Joseph H. Lai
Amanda L. Martel
Jason Moore Morgan
David M. Pinkney
Laura K. Povlich
Patrick M. Roscoe
Kendra T. Sass
Timothy V. Waxweiler

August 2006

Tian Lian

December 2006

Brian Clayson
Eric Heininger
Seunghee Hong
Anna Lawitzke
Kerbie Reader
Tao Sun

Graduate Degrees

April 2006

Sarah Margaret Mayes, MS
Zachary Andrew Olds, MS
Russell Weikit Pong, MS
Thomas Ray Hinklin, PhD
Dongchan Jang, PhD
Leenaporn Jongpaiboonkit, PhD
Matthew Jarrett Reason, PhD
Yunfeng Shi, PhD
Zachary Nicholas Wing, PhD
Aomin Wu, PhD

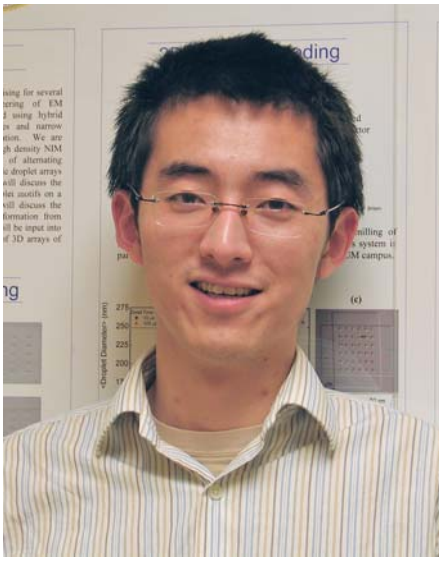
August 2006

Jeffrey Gleason, MS
Sarah Goldfarb, MS
Sigrun Karlsdottir, MS
Brian Puchala, MS
Fatima Syed-Picard, MS
In Jung Yoon, MS
Ying Wang, PhD
Xi Zhang, PhD

December 2006

Angela Knapp, PhD
D. K. Shan Wickramanayake, PhD

Wang Chu Chien-Wen Research Internship Award Given to Tao Sun



The Wang Chu Chien-Wen Research Internship Award was created by MSE alumnus, Tony K. H. Wang (BSE '73, MSE '75), in memory of his mother. The fund is used to support summer interns in the department. Tao Sun, a senior MSE undergraduate student, received the award in the summer of 2006 and began conducting real-time studies of metallic droplets on semiconductor surfaces, working with the Goldman research group.

Metallic nanodroplets are of interest for a broad range of applications such as magnetic memory arrays, plasmonic waveguides, nanowire growth seeds, and negative index of refraction materials. Although nanometer-sized metallic droplets often form on compound semiconductor surfaces during epitaxial growth, thermal annealing, and/or ion irradiation, the mechanisms of their formation are not well understood. In Sun's research, the formation and motion of metallic droplets during ion-irradiation of semiconductor surfaces were examined using real-time imaging in a focused-ion-beam system. Last fall, Tao gave a presentation on this topic during a Michigan Materials Society (MMS) lunch.

Moreno Awarded Hosford Scholarship

The Hosford Endowed Scholarship Fund, provided by Professor Emeritus William F. Hosford, is used to provide financial support for students pursuing a major in materials science and engineering, who are in the top half of their class in academic standing and have an interest in metallurgy or mechanical behavior. Rene Moreno, a senior undergraduate student in the department received the inaugural scholarship in 2006. Rene's experience in metallurgy was complemented by his internship with U.S. Steel at their Great Lakes Works electrogalvanizing plant, where he analyzed the development of blisters on zinc-plated sheet metal. Outside his scholastic interests, Rene's extracurricular pursuits include soccer, drawing, and reading classic literature. Rene's high academic standing is coupled with his service as president of the Michigan Materials Society, where his main responsibility is to bring together students and faculty. His efforts both inside and outside of the classroom make Rene a deserving recipient of the Hosford scholarship.

2006 Scholarships and Awards

Richard A. Flinn Scholarship
Garret DeNolf
Chichen (Michael) Liu

Mars G. Fontana-William C. Leslie Scholarship
Emma Chan

James W. Freeman Memorial Scholarship
Michael Kravchenko
Andrew McCrum
Tao Sun

John Grennan Scholarship
Eric Heininger
Kaitlin Gallup
Tyler J. Higgins

Jack J. Heller Engineering Scholarship
Andrew Lesko
Zachary Shemon

William F. Hosford Scholarship
Rene Moreno

William Mikulus Fund
Kaitlin Gallup

Schwartzwalder Memorial Scholarship
Nathaniel W. Tindall, III

Clarence A. Siebert Memorial Scholarship
Michael Bartlett
Thomas R. Carter
Lorea Coronado-Garcia
Katelyn Howay
Amanda Head
Courtney Martin
Philip Standiford

Wang Chu Chien-Wen Research Internship Fund
Tao Sun

Alfred H. White Memorial Scholarship
Pieter Cook
Da Mao
Alexander Melville
Eric Sterling

Brian Worth Award
Laura Povlich

MMS Anvil Award
Eric Heininger

Distinguished Achievement Award
Undergraduate–Laura Povlich
Graduate–Kangwon Lee

Best Overall Doctoral Written Exam
Yiying Zhao

Best Overall (Graduate) GPA for 2005
Sibasish Mukherjee

Best Overall Teaching Assistant
Angela Knapp

Department of Education GAANN Training Grant
Arthur Feldman
Jessica Ter-Bush

Distinguished Leadership Award
Jessica Ter-Bush

Intel Foundation Ph.D. Fellowship
Obiefune Ezekoye

MSE Graduate Service Award for Recruiting
Obiefune Ezekoye
Chris Nelson
Lang Sui

ONR/HBEC Future Engineering Faculty Fellowship Award
Jonathon Madison

Roy G. Post Foundation Graduate Student Scholarship
Lindsay Shuller

Bement Receives the 2006 Alumni Society Medal

David Munson, Dean of the College of Engineering, and Arden Bement at the Alumni Society Dinner on October 27, 2006.

MSE alumnus, Arden Bement, Jr., received the 2006 Alumni Society Medal from the College of Engineering. Bement (PhD 63), director, National Science Foundation, oversees the agency's support of research and education in non-medical fields of science and engineering. He has served as director of the National Institute of Standards and Technology (NIST) and, at Purdue University, the David A. Ross Distinguished Professor of Nuclear Engineering, and head of the university's School of Nuclear Engineering. In addition, he held appointments in Purdue's departments of Materials Engineering, and Electrical and Computer Engineering; he had yet another appointment in the Krannert School of Management. Bement chaired the Commission for Engineering and Technical Studies, and the National Materials Advisory Board of the National Research Council. He also has been vice president of technical resources and of science and technology for TRW Inc.; U.S. deputy under secretary of defense for research and engineering; director, Office of Materials Science, DARPA; professor of nuclear materials, MIT; manager, Fuels and Materials Department and the Metallurgy Research Department, Battelle Northwest Laboratories; and senior research associate, General Electric Co. He is a fellow of the American Academy of Arts and Sciences and a member of the National Academy of Engineering.

Article by the College of Engineering

2006 Alumni Society Award

Dr. Won Suk Cho (PhD, '88) is the 2006 winner of the Alumni Society Merit Award for Materials Science and Engineering. He is currently the president of the Hyundai Kia America Technical Center. He received his PhD in MSE here at Michigan in 1988 and later returned to Korea, where he became actively involved in their automotive industry. He subsequently became a senior vice president at the Hyundai Motor Company. He also served on key advisory committees, including one for the Korean Ministry of Science and Technology.

The 2006 Alumni Society Dinner (L/R) Wayne Jones, Won Suk Cho, Peter Green, and John Allison from Ford Motor Co. Jones and Allison were Dr. Cho's PhD advisors.

Michigan Engineering Weekend
October 27-28, 2006

On December 8, 2006, Joy E. Allen (BSE '06), visited the MSE department to give a presentation at the MMS lunch. Here is Joy in front of a Caterpillar 3520 engine.

Alumni News

Jim DeRudder (PhD, '77) received the 2006 Edison Award from GE, where he has worked for a number of years, for excellence in research and contributions to the company. His advisor was Frank Filisko.

Chris Dingell (BSE, '78) was elected to the College of Fellows of the Engineering Society of Detroit.

Xi Charles Zhang (PhD '06) received his PhD in December and is now working at Microsoft. His advisor was Sharon Glotzer.

Amanda Martel (BSE '06) is working at Medtronic in Minneapolis, MN. She is a quality engineer working with batteries that are used in pacemakers and neurological devices. Medtronic offered her a full-time position in 2006. Amanda is now in the process of applying for graduate school again. She's applying to the University of Minnesota. It's called U of M out there, but she knows where the *real* U of M is!

Michael Lear (BSE '05) did contract/consulting research work for two non-profits in Washington DC, the National Low Income Housing Coalition and the National Alliance to End Homelessness, after graduation. Last fall, he entered a master's program at the Wagner School of Public Service at New York University to study international development planning in the Urban Planning Department.

Come visit us...

The Michigan Materials Society (MMS) encourages alumni and friends to visit and speak at our weekly luncheons. The Fall 2006 MMS speakers are listed below. We hope to see you during 2007! If you are interested, please contact the current MMS President, Rene Moreno, at mmsofficers@umich.edu.

Fall 2006 MMS Speakers

John Keough (BSE, 77)
Applied Process

Bart DePompolo
U.S. Steel Automotive Research Center

Jonathan Custer
Sandia National Laboratories

Joy Allen (BSE 06)
Caterpillar

Michael Pollina (BSE, 04)
Adaptive Materials

Kevin Hoffman
Unisolar Ovonics

Please send us a news update–about your job, a recent move, milestones in your life, your accomplishments, and more. Send a note to: mse-alumni-update@umich.edu.

Tseng-Ying Tien

Professor Emeritus Tseng-Ying Tien, of the Department of Materials Science & Engineering, died on February 26th 2006. He had a distinguished career as a mentor, teacher, academic researcher, industrial researcher and engineer, and consultant to industry and governments.

Tien was a pioneer in advanced ceramics, providing crucial insight into the phase equilibrium of multiphase ceramic systems that generated both an immediate and lasting impact on the development of technologically enabling materials. Such research has resulted in 20 patents. He developed sensors of zirconium and titanium oxides to control pollution from automotive exhaust systems. He carried out basic developmental research on the use of zirconium dioxide as a solid electrolyte in fuel cells. He carried out extensive research on structural ceramics of silicon nitride and zirconium oxide.

He was widely regarded as one of the world's foremost ceramists, and was awarded an honorary doctoral degree from the Swiss Federal Institute of Technology Zürich (ETHZ) in 1992. In the same year, Professor Tien received the College of Engineering Excellence in Research Award. Professor Tien has supervised and mentored more than 30 PhD students, including some in Germany. He has also supervised more than a dozen postdoctoral researchers. Together they have published more than 125 papers in refereed journals. He also edited two books.

Tien was born in Shan-Hai-Guan, China, in 1924, and received his BS in chemistry from Fu-Jen University in Beijing in 1948. For the next ten years he worked as a chemist, and later as product manager, in a bottle glass factory in Taiwan, where he developed a unique sulfide amber bottle glass that has since been produced in quantities of up to 300 tons per day. He came to the United States in 1957 and received his MS and PhD degrees in Ceramic Technology from the Pennsylvania State University in 1960 and 1965, respectively. During this time, he also worked as a research scientist at the Westinghouse Research Laboratory. He joined the faculty of the University of Michigan in 1966 as an associate professor, was promoted to professor in 1973, and to professor emeritus in 1996.

His popularity as a teacher is illustrated by the following quotations from two of his PhD students:

"Professor Tien is one of those rare teachers who combines a wealth of practical industrial experience with powerful scientific ability. His abiding and continued interest in students who are willing to learn is one of many traits I would like to emulate." and, "it is difficult to summarize completely Professor Tien's impact on the field of ceramic science. A part of his outlook is summarized by one of his quotes, 'you are a scientist, but always remember you are also a citizen.' "

He is survived by his wife of over sixty years, five children, nine grandchildren, and one great grandchild. He will be fondly remembered and greatly missed by his host of friends and associates here and around the world

We remember him as being a modest and helpful colleague as well as an outstanding scholar.

Tien Memorial Symposium

The Department of Materials Science and Engineering is sponsoring a memorial symposium to honor Professor Tien's contributions to and achievements in education and research in advanced ceramics. The symposium will held in the Johnson Rooms in the Robert H. Lurie Engineering Center, on Monday, April 16, 2007. There will be a memorial dinner at the Michigan Union, Sunday evening, April 15, 2007. For detailed information, please e-mail John Halloran (peterjon@umich.edu) or Xiaoqing Pan (panx@umich.edu.)

Robert Snow

Bob Snow passed away in Ann Arbor on November 8, 2006. At the time of his retirement in 1996, Bob was the facilities manager for the Department of Materials Science and Engineering and participated in the instructional labs. He was a valuable member of the department, the University, and the Ann Arbor community. He will be fondly remembered by several generations of students, staff, faculty, and neighbors as associate and friend.

Bob first came to Ann Arbor to work in Ed Hucke's laboratory in the early 1960s. Ed, now professor emeritus, has provided some memories of Bob's long-time service to the department.

In early Fall 1963, I interviewed Irene and Bob Snow in New York City to persuade them to join my research group at the University. I had no idea this meeting would begin an association with the University and Ann Arbor that would span more than 40 years.

In 1953, Bob graduated from the University of Illinois with a BS in metallurgical engineering and after several years at General Motors and the Army, was working for the Union Carbide Development Corporation on the commercialization of research stemming from our work in Ann Arbor. He joined us in October 1963 as a research associate, to further advance our process development in a more controlled laboratory setting.

Bob's work over the next 14 years with equipment design and materials characterization in many laboratories put him in close contact with a large number of students, staff, and faculty of both the chemical and materials sides of what was then the Chemical and Metallurgical Department. His friendly outgoing manner and spirit of helpful cooperation won him many friends throughout the department. Bob soon became the first person sought when locating, modifying, or operating experimental equipment.

By 1977, most of our process development had shifted to industrial laboratories, allowing Bob to spend half time in maintaining and teaching materials engineering laboratory courses. His experience and hard work were essential to the smooth relocation of the departments to North Campus in 1982 where he spent full-time caring for and teaching in the materials laboratories until his retirement in June of 1996.

Theo F. Sharp

Theo (Ted) F. Sharp died on May 12, 2005. Sharp earned his BSE in 1943 in metallurgical engineering from Michigan. Throughout his lifetime, he made significant and innovative contributions to industry in the fields of metallurgy, product development, company reorganization, manufacturing technology, and management systems.

In 1986, he retired as vice president and general manager of the components division of Clark Equipment Company, after eleven years of service in various vice presidential capacities. Following retirement, he served as a consultant in the areas of strategic business planning and advanced manufacturing technology.

In October 1996, the Department of Materials Science and Engineering awarded him the Alumni Society Merit Award for his many contributions to the field.

As a resident of the South Bend, Indiana area, Sharp served as vice president and president of the St. Joseph County Area Planning Commission, and as chair of the Corporate Committee for the Friends of the Snite Museum of Art at the University of Notre Dame.

You make the difference

Every year we strive to offer our students in Materials Science and Engineering the best possible educational and research opportunities. Your annual gifts to the department provide the funding for that margin of excellence which prepares our graduates to compete successfully in today's world and to contribute substantially to society. We count on you to help us continue our offering of exceptional educational opportunities in our department. Please use this form to send your gift.

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