

MATERIALS

SCIENCE AND ENGINEERING

Photochemical Properties of TiO_2 Surfaces

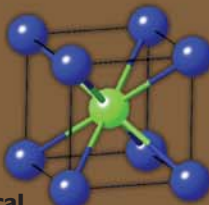
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Class of 2007



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**A Note
From the
Department Head**
**Gregory S. Rohrer,
W.W. Mullins
Professor**

Dear MSE Graduates:

The last several months have seen the start of some exciting initiatives within the Materials Science and Engineering Department that expand our interactions across the University, as well as aligning our own efforts with the missions of both CIT and Carnegie Mellon.

First, we expanded our Research Experiences for Undergraduates (REU) program to include 28 participants. These students hailed from Carnegie Mellon, as well as from schools as far away as Arizona. During their 10-week stay here, they were advised not only by MSE faculty, but also by faculty members in Mechanical Engineering, Biomedical Engineering, Chemical Engineering, and Physics. Initiated by **Professor Mohammed Islam**, the expanded summer research program embraces the entire materials research community across the University. Please see pages 4 and 5 to learn more about this important initiative.

Second, MSE faculty and students are now conducting research with the new Institute for Advanced Energy Studies, sponsored by the Department of Energy through the National Energy Technology Laboratory. The Institute sponsors research throughout CIT, and MSE's research focuses on solid oxide fuel cells and materials for coal gasification reactors.

This Fall, we have also welcomed **Professor Jay Whitacre** to our faculty. Because Jay is jointly appointed by the MSE and Engineering and Public Policy Departments, he will further expand our interactions with others in CIT. Jay's work focuses on materials for energy storage and conversion systems, an area that is well aligned with both Departmental and CIT strategies. See page 3 for more information about Jay.

This issue of the newsletter also highlights new advanced materials characterization equipment that has been added to the Department. Our new small-angle X-ray scattering system is described on page 6, and page 7 showcases the automated metallography device—called Robo-Met.3D—that MSE acquired in August. As we go to press, new funding has just been confirmed for an advanced Transmission Electron Microscope and an Environmental Scanning Electron Microscope, both of which will be added to the J. Earle and Mary Roberts Materials Characterization Facility. These new additions help to ensure that MSE's facilities and technology resources remain state-of-the-art.

I'd like to close by recalling the pleasure of attending the most recent Saltminers Dinner, held in Detroit in September. For those of you who could not make it, please put this alumni event on your calendar for next year. It is held annually at the MS&T meeting. As the MS&T meeting is scheduled to be held in Pittsburgh for the next two years, I hope to have the opportunity to see many of you on campus.



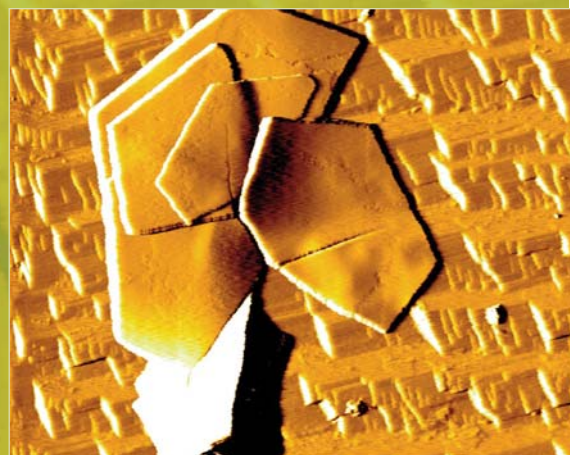
Gregory S. Rohrer
W.W. Mullins Professor and Department Head

“The last several months have seen the start of some exciting initiatives within the Materials Science and Engineering Department that expand our interactions across the University.”

COVER STORY

MSE Undergraduate Studies Photochemical Properties of TiO_2 Surfaces

Photochemical processes at TiO_2 surfaces have been studied because of their importance for the conversion of solar energy, as well as their role in the performance of self-cleaning coatings. Of particular interest is the photocatalyzed synthesis of hydrogen fuel from sunlight and water (photolysis). If the efficiency of water photolysis by TiO_2 can be increased and the cost reduced, it may provide a renewable source of hydrogen fuel. With this goal in mind, students in the Department of Materials Science and Engineering are conducting research aimed at understanding the relationship between surface structure and the efficiency of photochemical reactions. The atomic force microscopy image on the cover was made by **Lizza D. McGregor**, Class of 2007. The image shows platy crystals of hydrocerrussite, $\text{Pb}_3(\text{CO}_3)_2\text{OH}$, formed during the photochemical oxidation of $\text{Pb}(\text{II})$ on the TiO_2 surface. Although the hydrocerrussite is a "spectator" phase that is not central to the photochemical process, it is highly photogenic.



FACULTY UPDATE

Whitacre Joins MSE Faculty



Jay Whitacre

joined the Carnegie Mellon University faculty in September as an Assistant Professor in the Department of Materials Science

and Engineering and the Department of Engineering and Public Policy.

Whitacre received his B.A. from Oberlin College in 1994, where he graduated with honors in Physics. He then earned his Masters (1997) and Ph.D. (1999) degrees in Materials Science from the University of Michigan, Ann Arbor.

Whitacre was a Postdoctoral Scholar at the California Institute of Technology from 1999 to 2000. He subsequently became a Senior Member of the Technical Staff at the Jet Propulsion Laboratory (JPL) in Pasadena, California. His work there focused on synthesizing, characterizing, and implementing nanostructured materials for electrochemical devices such as Li-ion batteries and fuel cells. His other research topics included investigations of solid-state integrated hybrid energy collection and storage devices, high throughput materials selection methods, and conformal polymeric coatings for interplanetary space probes. Starting in 2004, Whitacre was trained as a Power Systems Engineer by the JPL systems design group. He subsequently became a member of "Team X," a concurrent engineering design group focused on developing next-generation spacecraft.

Whitacre's charter in the Department of Materials Science and Engineering is to conduct research on materials for energy systems, while also considering the policy implications involved in selecting and implementing the next generation of renewable energy technologies. His initial work will be focused on large format Li-ion batteries and novel PEM fuel cell catalyst materials and structures.

Whitacre has received several awards in his career, including the *MRS Graduate Research Award*, Fall 1998 (silver medal); the *1999 University of Michigan Departmental Graduate Student Research Award*; the *1999 American Vacuum Society Graduate Research Award* (Thin Films Division); the *2001 Norman Hackerman Young Author Award* (Electrochemical Society); and multiple JPL and NASA *Space Act R&D Awards* from 2002 to 2006.

DEPARTMENT NEWS

Summer Materials Research Program Expands *Undergraduates and High School Teachers Benefit From Outreach Efforts*

The Department of Materials Science and Engineering is committed to establishing its leadership in both research and education. For the past 10 years, the Department has been organizing summer research programs for undergraduates and local high school teachers, sponsored by the Materials Research Science and Engineering Center (MRSEC). Starting this year, the summer program has been expanded with funding from the National Science Foundation (NSF) Research Experiences for Undergraduates (REU) program, MSE, Chemical Engineering, Biomedical Engineering, MRSEC, and PREM (Partnership for Research and Education in Materials), a collaborative effort of Carnegie Mellon and the Florida Agricultural and Mechanical University.



Some of the 28 participants in MSE's summer undergraduate programs pose after making their final presentations.

Undergraduate students from Carnegie Mellon and several other universities from across the country performed cutting-edge interdisciplinary research within seven departments and two colleges at Carnegie Mellon. Their work included intra- and inter-departmental collaborations between researchers, allowing the students to interact with faculty, graduate students, and undergraduates from a wide variety of disciplines. In addition, the summer program provided an opportunity for four high school teachers to develop appropriate science and engineering curricula.

"In today's interdisciplinary materials research and educational environment, MSE must reach out to other disciplines, introducing them to the latest thinking in materials science and engineering," says **Department Head Gregory S. Rohrer**. "By introducing students from other engineering fields and natural sciences to materials science, we can demonstrate the connections between our research and their own interests—which will encourage innovation and

"In today's interdisciplinary materials research and educational environment, MSE must reach out to other disciplines, introducing them to the latest thinking in materials science and engineering."

Carnegie Mellon University

interdisciplinary collaboration. And, by working to educate local high school teachers, we are creating a greater level of interest among young people—and ensuring that our field has a bright future.”

REU: Building Interdisciplinary Connections

Undergraduates in various engineering fields, physics, and chemistry from schools across the country were invited to apply for a 10-week summer research program—during which they would receive a stipend of \$3800, on-campus housing, and additional funds for travel.

This summer, 28 undergraduates were selected from a pool of more than 150 applicants, based on their academic standing and faculty recommendations. Ten students were chosen from across Carnegie Mellon, and 18 students were selected from universities across the country. The 10-week program began with a campus and housing orientation, project definition, lab safety training, and a good research practices workshop with an ethics overview. After five weeks, a symposium was held, where all the students presented oral reports on their project goals, progress to date, and plans for the second half of the summer. The summer concluded with final oral reports in a second symposium; each student also produced a research highlight, prepared a written paper, and answered a questionnaire.

The summer program was punctuated by additional educational activities such as mini-courses taught by MSE faculty, a seminar series for professional development, and fun activities including a Pittsburgh Pirates baseball game, an awards ceremony, and a wrap-up picnic that adjourned the 2007 summer program..

Preparing the Next Generation

The Summer Materials Research Program also sponsored educational activities for local high school teachers, with the goal of introducing secondary students to materials science.

Four high school teachers participated in an intense curriculum development program—the impact of which will be multiplied across the students who attend their classes over the next several years.

During his summer internship, **Eric Laurenson**, Physics Teacher at Peabody High School, distinguished himself by preparing a report entitled “Fracturing of Brittle Materials: The Study of Marble and Granite” that includes research objectives, background materials, lesson plans, and supply lists. Laurenson’s report can be used by other teachers to introduce high school students to the analysis of mechanical and structural properties of materials, as well as the concepts of triple-point and compression testing.

Two high school teachers who had participated in previous summer internships at MSE returned this year to hold an intensive two-day workshop for their peers on June 22-23.

Yue Chu, Science and Math Teacher at Brashear High School, instructed an audience of Pittsburgh teachers in developing materials science lessons plans on the topic of “Monte Carlo Modeling.” **F. Michael Real**, Earth and Space Science Teacher at Taylor Allderdice High School, addressed lesson planning around the topic “Selection of Building Materials.”

This two-day event enabled the participating teachers to return to their classrooms with a variety of lesson plans and activities that they can incorporate into their own science curriculum—exposing a new generation of students to leading-edge topics in materials science and engineering.



Kristina Breuer and Kelly Collier received awards for Best Research Highlight at the conclusion of the summer program.



Chinmaobi Onwunli presents his research project at the final symposium.

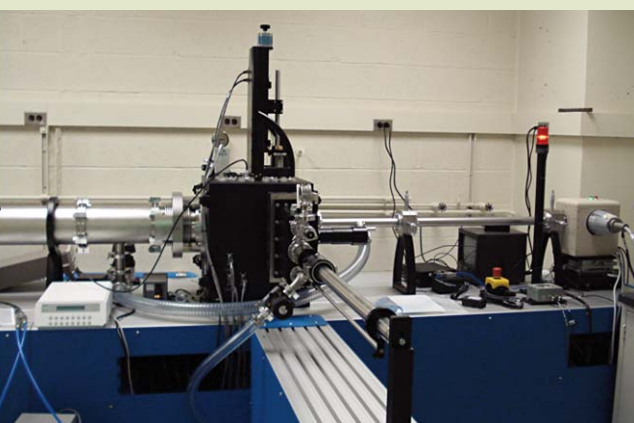
Small-Angle X-Ray Scattering: *A Whole New Dimension*

X-ray scattering and diffraction are among the principal tools for studying the structure of materials. Particularly well known examples are X-ray crystallographic methods that are used to elucidate the atomic arrangement of crystalline materials.

However, in many instances—and, in particular, for polymeric materials—knowledge of the atomic arrangements within crystalline regions is not sufficient to fully characterize the morphology of a material. Researchers also need to know about the arrangement of structural entities on lengthscales ranging from 5 to 100 nm (the so-called mesoscopic region). Small-angle X-ray scattering (SAXS) helps to resolve these lengthscales by essentially analyzing the broadening of a collimated X-ray beam as it traverses the sample.

Through a grant from the National Science Foundation (NSF), the Department of Materials Science and Engineering has added a new RIGAKU combined small- and wide-angle scattering apparatus that will help to concurrently resolve structures on the atomic and mesoscopic scale. It adds a whole new dimension to the already existing X-ray crystallographic infrastructure in the Department, and signifies MSE's determined progress in the areas of soft and nanostructured materials.

As the first dedicated SAXS instrument in the Pittsburgh area, this apparatus also strengthens the position of the Department as a center of excellence in materials characterization—and a resource for researchers both within and outside Carnegie Mellon University.



Shown here is the RIGAKU combined small- and wide-angle scattering apparatus recently acquired by MSE.

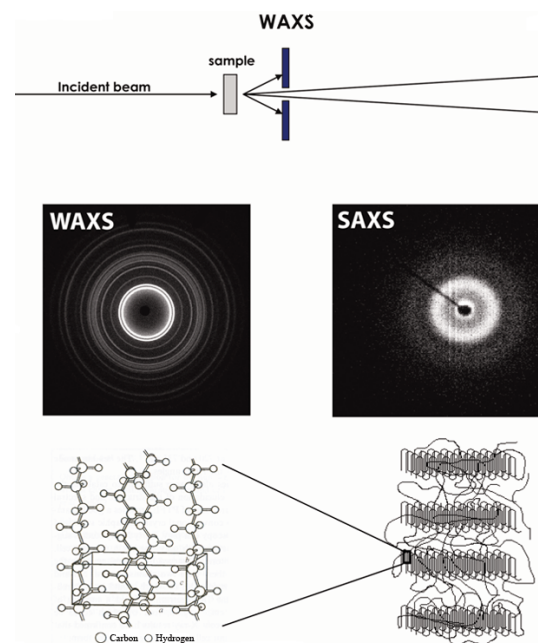
Example: Polyethylene

ANALYSIS OF A MATERIAL WITH ORDER ON THE NANO AND MESOSCALE

Due to the simplicity of its chemical structure, polyethylene is the archetype that was fundamental to researchers' understanding of the solid-state structure of crystalline polymers. The long-chain nature of the polymer molecules implies that the crystallization process results in lamellar "stacks" of crystalline and amorphous layers.

Structural parameters used to describe such a "semi-crystalline" material are the degree of crystallinity, the thickness of crystalline and amorphous layers, and the (crystal) structure of the crystalline layers.

Only with the advent of combined small- and wide-angle scattering techniques is it possible to determine the complete set of structural parameters in one experiment. The figure at right illustrates the principal set-up of the experiment, as well as the two-dimensional scattering characteristics of polyethylene films from which both the mesoscopic order (lamellar spacing, SAXS) and the atomic arrangement within the crystalline layers (orthorhombic, WAXS) can be determined.





Robot-Controlled Metallography

A STEP TOWARD AUTOMATED 3-D MATERIALS CHARACTERIZATION

In August 2007, the Department of Materials Science and Engineering placed an order with UES, Inc., in Beavercreek, Ohio, for the construction of an automated metallography device known as Robo-Met.3D.

This tool, designed by Jonathan Spowart and his colleagues at Wright Patterson Air Force Base (WPAFB) in Dayton, Ohio, employs a robot arm with six degrees of freedom to approximate what a human metallographer would do by hand.

While manually obtaining a single 2-D metallographic section is a routine operation that should be familiar to all MSE graduates, obtaining a large number of consecutive sections—known as serial sectioning—is time-consuming (not to mention mind-numbing). To speed up this process, the Robo-Met.3D uses a robot arm which moves the sample, with a high degree of accuracy and reproducibility, between the main stations shown in Figure 1: the polishing unit, the etching/rinsing/drying unit, and the optical microscope.

“While manually obtaining a single 2-D metallographic section is a routine operation that should be familiar to all MSE graduates, obtaining a large number of consecutive sections—known as serial sectioning—is time-consuming.”

A typical cycle consists of three distinct steps. First, the robot arm mounts the sample on a stage that lowers it to the surface of a precision polishing unit, where it is polished for a set time. Next, the robot arm moves the sample through a series of rinsing and drying steps—with a potential acid etch in between these steps. Finally, the sample is moved onto a high-precision x-y stage mounted above a Zeiss metallographic microscope, where one or more images are automatically recorded and stored. Large areas can be imaged by means of an image stitching procedure.

The entire operation is then repeated until the preset number of sections has been obtained. After the images have been acquired, additional image processing steps are needed to register the entire 3-D stack and produce a true 3-D digital microstructure. The Robo-Met.3D instrument shortens the data acquisition time from several months of manual work to a few days of unsupervised operation.

There are currently only two other Robo-Met.3D instruments in use. One is at WPAFB, and one is at Ohio State University in Columbus, Ohio. MSE's instrument, which was acquired with AFOSR DURIP funding, will be installed in January 2008, and will be equipped with an additional Laue X-ray unit. This unit will consist of a precision x-y stage, a

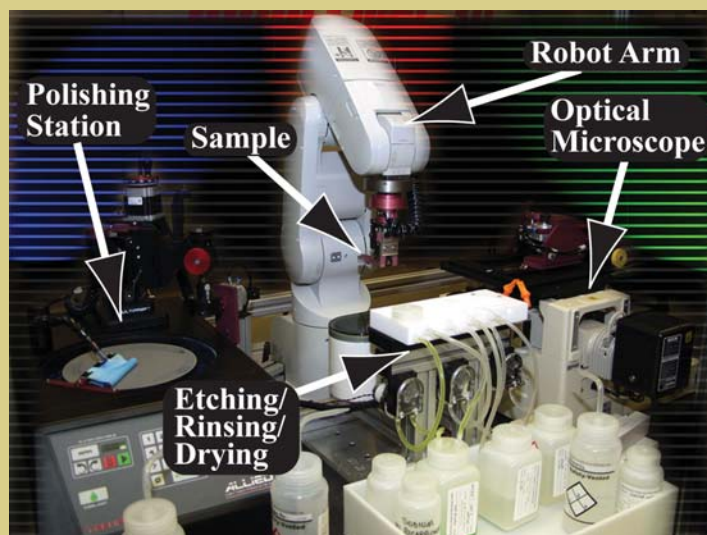


Figure 1: The Robo-Met.3D device features a polishing unit, an etching/rinsing/drying unit, and an optical microscope.

micro-focus high-intensity X-ray tube, and a CCD camera for recording reflection Laue patterns.

Using customized software, the Laue patterns will be indexed automatically so that, in addition to microstructural information, the unit will also be able to produce orientational data. The instrument will be housed in the lab of **Professor Marc De Graef** in Roberts Engineering Hall. It will be used primarily by students associated with the research groups of De Graef and **Professor Anthony D. Rollett**.

Piehler's Retirement Celebrated

Professor Henry R. Piehler

has officially retired after 40 years of dedicated teaching and research. Family, friends, and colleagues gathered for a celebration of his long and successful career on June 29 at the Pittsburgh Athletic Association. Piehler will remain active in the Department—and can also be found at Pittsburgh's Heinz Field, where he is known as the Steelers' #1 fan.



McHenry Focuses on Biomedical Engineering

The research group of **Professor Michael McHenry** is investigating applications of magnetic nanoparticles in biomedical engineering. This research project includes utilizing the efficient point source heating of metal nanoparticles for thermoablative cancer therapies.

This work is being done in collaboration with MSE's **Professor Michael Bockstaller**, as well as Dr. Preet Chaudhary of the Hillman Cancer Research Center at UPMC. The team is focused on tagging and changing the shape of tissue scaffolds, in collaboration with the McGowan Tissue Engineering Center at UPMC, MSE alumnus **Dr. Tom Gilbert**, and his colleague Dr. Steve Badylak.

The application of magnetic nanoparticles requires adherent, biocompatible oxide shells functionalized to stabilize aqueous ferrofluids. The research uses the materials paradigm in (1) developing knowledge of plasma torch synthesis of appropriately sized core-shell nanoparticles, (2) identifying crystallographic facets of metallic nanoparticles, (3) understanding orientation relationships between thin, stable adherent oxide shells and the metal core, (4) measurement of magnetic and magnetoelastic properties, and (5) assessment of the performance of the nanoparticles in RF heating and magnetoelastic applications.

Research has been pursued through two MSE Capstone Design Projects (Fall 2006), a BME Capstone Design Project (Spring 2007), and Summer 2007 REU research with funding from the American Chemical Society and Carnegie Mellon ICES PITA.

Project Results in Publications, Awards

This collaborative effort has resulted in a number of published papers and awards for team members:

- The research of **Ashfaque Habib** and **Courtney Ondeck** will be presented at the 2007 Magnetism and Magnetic Materials (MMM) Conference. A paper entitled "Evaluation of Iron-Cobalt/Ferrite Core-Shell Nanoparticles for Cancer Thermoablation" has been submitted to the *Journal of Applied Physics*.
- **Kelsey Miller** has submitted a paper to the *Journal of Applied Physics* entitled "FeCo Nanoparticles for the *In-Vivo* Tracking of ECM Scaffold Degradation Products."
- **Matt Jones** and **Marybeth Wilson** won the *Phi Kappa Theta Award* at the 2007 Carnegie Mellon "Meeting of the Minds" event for their paper, "FeCo Magnetic Nanoparticles for Extra Cellular Matrix Tissue Engineering Scaffold Degradation Tracking."
- **Rebecca Snyder** was awarded second prize in the "Surgery for Engineers" course for her research paper called "Use of Ferrogels to Improve Catheter Navigational Control: Neurointerventional Radiology-Based Applications."
- **James Rogers** won third prize in the 2007 CIT Honors research competition for his paper, "Synthesis of FeCo Nanorods to Act as Heat Sources for Thermoablative Cancer Therapy."
- Carnegie Mellon freshman **Kelly Collier** and Florida State senior Kristina Breuer were also awarded prizes as part of a successful NSF-sponsored REU program.

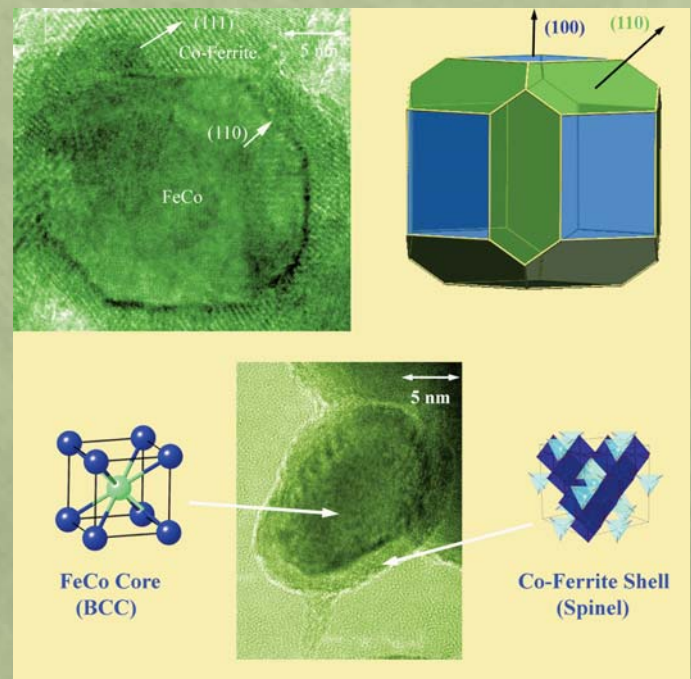
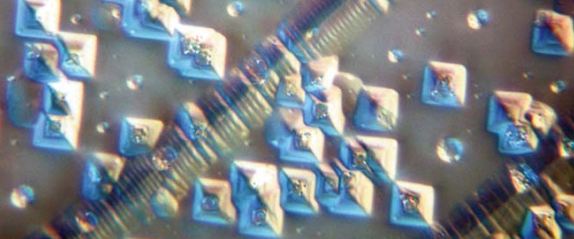


Figure 1 shows the work of Kelly Collier in modeling crystal facets and orientation relationships between FeCo cores and ferrite shells in HRTEM images taken by Yuling Qin.



ALUMNI NEWS



Sheldon (Lee)

Semiatin (M.S. '72, Ph.D. '77) has been named the 2007 recipient of the *Gold Medal of ASM*. He was cited for his outstanding contributions to the development and application of fundamental understanding of thermo-mechanical and other advanced processes for aerospace materials, including both conventional metallic and inter-metallic alloys. Semiatin is Senior Scientist, Materials Processing/Processing Science and Research Leader, Metals Processing Group, in the Air Force Research Laboratory, Materials and Manufacturing Directorate.

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Glenn Beltz (B.S. '88), Assistant Professor of Mechanical Engineering at the University of California, Santa Barbara, recently accepted the appointment of Associate Dean for

Undergraduate Studies in the UCSB College of Engineering.

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George T. "Rusty"

Gray III (Ph.D. '82) was named a Fellow of the American Physical Society. Gray was selected for his "important contributions to the understanding of defect

generation and storage in materials subjected to shock loading, and for advancing the state-of-the-art of shock recovery techniques to benefit shock physics."



Alumni Profile: Cindy Giroux

Since graduating from the Department of Materials Science and Engineering, **Cindy Giroux** (B.S. '80, M.S. '85) has been employed by Corning Incorporated, where she has performed a wide range of process engineering, development, and, most recently, corporate research. Giroux has worked on industrialization, scale-up, and cost reduction of optical fiber production—as well as new product development for fiber and optical components.

Five years ago, Giroux moved into her current role as Technology Director, Thin Films and Surfaces Research, where she leads a group of 35 people who work on electronics on glass, self-assembly, carbon materials, and deposition and patterning of inorganic thin films. She is co-inventor on six US patents.

Giroux is active in her community as a leader of the corporate fundraising program for the Seven Lakes Girl Scout Council. She also rides her bike in an annual charity event for the Juvenile Diabetes Research Foundation (JDRF) and serves on the Board of Trustees for the Rockwell Museum of Western Art. Giroux and her husband, Marc, live in Corning, New York, with their two Shetland sheepdogs.



George E. Maley

(B.S. '47) was on hand for CIT's 2007 Homecoming Reception, where he celebrated the platinum anniversary of his graduation. Maley, a veteran of

World War II, spent 38 years at the ABEX Corporation. He currently resides in Tucson, Arizona, where he is a dedicated fan of the University of Arizona women's basketball team.

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Clare M. Rimnac

(B.S. '78) was named Chair of the Department of Mechanical and Aerospace Engineering at Case Western Reserve University in July. Rimnac

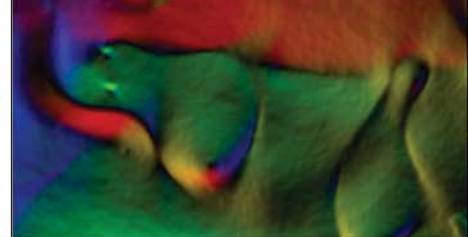
also holds the Wilbert J. Austin Professor of Engineering endowed chair.

IN MEMORIAM



We recently learned that **John E. Hatch** (M.S. '48) passed away on April 13, 2007.

Hatch began his career at ALCOA in 1940. During his tenure there, he was on the team that developed the alloys for the wings of the 737 and 747, as well as the team that developed the aluminum beer can in the 1960s. Hatch also directed the computerization of lot tickets, standard practices, and order entry. He retired from ALCOA in 1977, after 37 years of service. In 1978, he started teaching at Carnegie Mellon University. He taught a course that he developed on "Practical Metallurgy," which addressed how to do presentations in the work environment. While teaching at Carnegie Mellon, Hatch edited the book *Aluminum: Properties and Metallurgy* (1984) for ASM.



MSE Donors: *Making a Difference*

The Department of Materials Science and Engineering would like to thank the following donors for their contributions to the Department in fiscal year '07. Alumni generosity is important to MSE, and is greatly appreciated.

Contributions from loyal MSE graduates, parents, and friends serve many purposes. For example, their financial support allows the Department to provide funding for undergraduate research projects, as well as to continuously improve undergraduate laboratory facilities. Funds are also used to upgrade the Department's computing facilities and to support projects developed in the MSE Capstone Design course.

MSE is committed to providing an outstanding educational experience for all students, and the continued support of our alumni and friends helps us to achieve this goal.

AARONSON, HUBERT I.
ALBERT, ROBERT L.
ALLISON, JOHN E.
BAILEY, ARTHUR
BANKS, WILLIAM C.
BARTEL, THOMAS G.
BEDILLION, MARK DAVID
BIRCIW, JOHN
BLOCH, RICHARD J.
BROOKS, JOHN A.
BROWN, KEVIN C.
BURQUIST, WILLIAM A.
BYTNAR, JAMES HENRY
CAMPBELL, RONALD C.
CERULLY, LAURA B.
CHAN, KARENA YEEMAN
CHING, KALANI
CHOI, DAIWON
CHOOKAJORN, TONGJAI
CINKOVIC, TERREA
CIRRA, JOANN H.
CLARK ESQ., RICHARD K.
CLUM, JAMES A.
COLAROSSO, TONY
COOK, CELESTE R.
COOLEY, CALVIN J.
COSANDEY, FREDERIC
COX JR., JOHN J.
COX, THOMAS B.
CREWS, ANDREA M.
CROSBIE, GARY M.
DANKO, JOSEPH C.

DAPOS, ELIO
DARBY, MICHELE L.
DAVIS, BERT N.
DI TOMMASO, ANTHONY
DIETER JR., GEORGE E.
DIMIDUK, DENNIS M.
DONEGAN, JENNIFER L.
DRAGE, DAVID JACK
DRESHER, RONALD J.
DUKELOW, DONALD A.
EDWARDS, WILLIAM P.
EMERICK, HAROLD B.
ERWIN, WILLIAM E.
FORBES, ROBERT E.
FORTINI, OTAVIO
FOUNTAIN III, ALTON N.
FOX, ARTHUR V.
GIBALA, RONALD
GOLDMAN, KENNETH M.
GOODWALD, JERRY A.
GORDON, BARRY M.
GRACE, RICHARD E.
GRGURAS, RICHARD
GUERRY JR., JOHN B.
HA, SEYONG
HARROVER JR., ROBERT E.
HART III, JOSEPH H.
HARTMAN, THOMAS L.
HECKEL, RICHARD W.
HELPER, FARREL B.
HIRTH, JOHN PRICE
HOFFMAN, EMILY E.

HOFFMANNER, ALBERT L.
HOUSKA, CATHERINE M.
HRESKO III, GEORGE C.
HUEBSCHMAN, JENNIFER REBECCA
HUH, SUNG WOOK
JAFFE, DONALD
JOSEPH, THOMAS M.
KAUNE, JAMES E.
KELLY, PAUL C.
KENIN, MAXINE
KERLIN, KERRY J.
KLINE, MARTIN A.
KNOTH, ROY J.
KOMOLWIT, PIYAMANEE
KONOVAL, GEORGE
LAMBERT, WILLIAM N.
LANDERMAN, EDGAR
LANGE, WALTER F.
LARSEN, JAMES MILLIGAN
LASALVIA, ROBYN L.
LEE, HYUN K.
LEWANDOWSKI, JOHN J.
LHERBIER, LOUIS W.
LITTMAN, LAWRENCE E.
LU, WEIER LARRY
LUTZ, CARL F.
LYNN, LAWRENCE H.
MADJARIC, EDWARD T.
MARINIS JR., THOMAS F.
MAXTON, ROBERT C.
MCFADDEN, ROBERT SIMBOLI
MIGHTON, JOHN W.

MILLER, HERBERT M.
MILLER, REED A.
MILLER, TIMOTHY ALAN
MILLS, ROBERT C.
MITCHELL, CONRAD
MONTGOMERY, ALLEN M.
MULLINS, GARRICK R.
MULLINS, OLIVER C.
NARAYANAN, KESH S.
NARAYANAN, VIJAY
O'CONNELL, THOMAS E.
PAXTON, HAROLD W.
PEREPEZKO, JOHN H.
PHILIPS, BRETT A.
POMRANING, STEPHEN R.
PORTER, LISA M.
PUGLIELLI, DIANE
PYLE JR., GEORGE M.
RAO, LALITHA
REINSHAGEN, JOHN H.
REYNOLDS, WILLIAM T.
RIGONI, LESLYN GREEN
ROBINSON, GEORGE H.
ROUDABUSH, LISA A.
RUSSELL, KENNETH C.
SATTEWHITE, KEITH D.
SAUVAGEOT JR., A. BURT
SCHLOSBERG, WILLIAM H.
SCHWARTZ, AARON
SHIELDS, BRUCE M.
SIEBERT, WILLIAM R.
SIMMONS, JEFF P.
SINGELYN, JENNIFER M.
SMITH, PAUL ANDREW
SNEE, DAVID J.
SOHN, IL
SQUIRE, FREDERICK J.
STEYER, TODD E.
STOSUY, ATHAN
TAYLOR, JERRY M.
VAN SAUN, JOHN B.
WANG, YARW-NAN
WARNER, HOWARD R.
WILLARD, MATTHEW ASHE
WILLIAMS, ROBERT K.
WOLF, ROBERT E.
WOLFE, RICHARD A.
WOODS, CHARLES R.

Carnegie Mellon



Hua Yuan

COMMENCEMENT | CLASS OF 2007

The 2007 MSE Diploma ceremony was held on May 20. The auditorium was filled to capacity with family, friends, and faculty congratulating the new graduates on a job well done—and wishing them the best in their future endeavors. Many of the graduates planned to further their education in doctoral programs across the country, at schools such as Northwestern, Caltech, UC Santa Barbara, Stanford, and the University of Pennsylvania. Other graduates found employment at top-notch companies including Nucor Steel, Johnson & Johnson, Dow Chemicals Company, L'Oreal USA, Accellent, General Electric, BP, and Reckitt Benckiser:

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During the ceremony, many awards were presented. **Keng Yong Goh** received the *Mullins Award*, which is given to the graduating senior in MSE who best exemplifies the qualities associated with **Professor Bill Mullins**. Upon graduation, Goh began a position with the Agency of Science Technology and Research's Data Storage Institute in Singapore.



Fiona Wang and Wei Wang

The *Paxton Award for the Best Doctoral Dissertation* in MSE was given to **Paolo Nolli** for

his thesis "Initial Solidification Phenomena: Factors Affecting Heat Transfer in Strip Casting." Nolli is currently working as an R&D Engineer with Vesuvius Research in Pittsburgh.

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The *Hubert I. Aaronson Undergraduate Award*, which is given to a deserving undergraduate metallurgy student who is planning to attend

graduate school, was presented to **Esther P. Yu**. She is enrolled at the University of Pennsylvania as a doctoral student, with a concentration in Biomaterials and Tissue and Cell Engineering.

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Matthew R. Jones was awarded the *James W. Kirkpatrick and Jean Keelan Kirkpatrick Scholarship*, given to "a graduating senior who has best supplemented his/her intellectual abilities with effort and work ethic." Jones is attending Northwestern University as a doctoral student, where he has been awarded the *Ryan Fellowship* for nanoscience and technology.

.....

Mary Beth Wilson received the *William T. Lankford Jr. Memorial Scholarship*, which is presented each year to a student in the Department who exemplifies the attributes associated with **Bill Lankford**—true scholarship, high standards, great potential, and the willingness to help others unselfishly. Wilson is currently enrolled at the University of Alabama at Birmingham in its six-year D.M.D./Ph.D. program, which offers a dual degree in dental medicine and biomedical engineering.



Scott Roberts and James Rogers



Ruby Chen and Abbie Bednar



Amber Fuller



Katie Benintende

Shown left to right:
Nan Boonyachut, Paolo Nolli, Professor Greg Rohrer, Sai Venkateswaran, and Wanlin Wang



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It's Official: Carnegie Mellon Is Cool!

Sierra Magazine recently ranked Carnegie Mellon the 10th Coolest School, in honor of the University's efforts to create a "greener" campus. The publication is the national magazine of the Sierra Club, with 1.2 million readers. The article recognized Carnegie Mellon for a number of green initiatives—including the student-designed green roofs atop The Posner Center and Hamerschlag Hall; the nation's first eco-friendly residence hall, New House; and the Collaborative Innovation Center, which features a modular raised-floor system that doubles the building's fresh air circulation. Read the full article at <http://www.sierraclub.org/sierra>.

