VOLUME II, No. II

MATSE

PENN STATE

on the cover:

A simulated 3–D microstructure of gamma-prime precipitate particles (gray) embedded in a gamma matrix (transparent) that are present in nickel based superalloys. The image was generated by Dr. Long-Qing Chen using the phase-field model described in the article *Model Materials*.

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Model Materials

by June Heywood

Materials scientists have always relied on tools to help them characterize materials, see materials microstructures, or understand how particular processing techniques have changed a material. As tools became better and the knowledge base and experience of materials scientists grew, the materials became better. But today materials requirements are more stringent and processing conditions more complex. The scientist's knowledge and intuition are no longer enough to solve the new materials problems. New tools must be used. One of those new tools is the computer.

Can you tell the difference? Comparison of simulated and experimental images of tetragonal precipitates embedded in the cubic matrix of a MgO-ZrO_2 alloy system. (Simulation by Wang, Chen and Khachaturyan. Experiment by Bateman and Notis.)

Before the 1970s, computers less powerful than the one sitting on your desktop right now occupied entire rooms. Ironically it was advances in materials that reduced the size and increased the speed of computers making them nearly as commonplace as toasters—in fact, your toaster probably has a computer chip in it. However it is only within the past ten years or so that computers began to be utilized on a wide-scale basis as tools for understanding the processes that make better materials. For many materials scientists a computer is indispensable. It is used for everything from predicting and visualizing microstructural development in all types of materials to understanding hazardous waste immobilization, the complex processes involved in fusion welding, and developing new theories and materials for specific applications. For the following materials scientists, solving materials problems would be impossible without a computer.

Morphing Microstructures

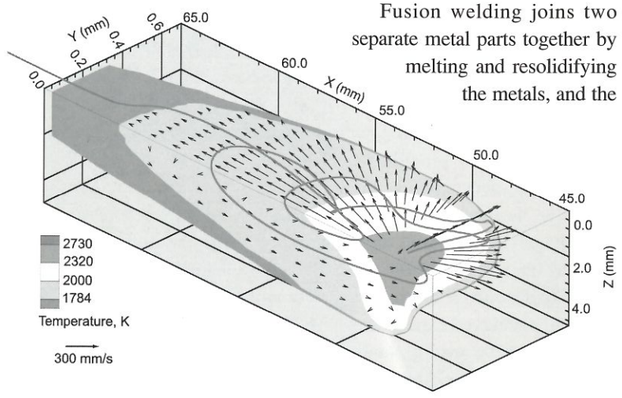
Computer modeling has many benefits: It can replace repetitious experiments that take time and cost money by providing a basis for directing experimental activities. It can provide validation of analytical theories or be used to observe materials behavior under conditions that are not easily achieved experimentally but can be readily simulated on a computer. And it can be used to predict materials properties before they are ever created. A material's microstructure is key to understanding its properties, and in order to control a material's properties, one must control its microstructure.

Modeling and understanding materials microstructures is what Dr. Long-Qing Chen, associate professor of materials science and engineering, is all about. Chen is using a phenomenological model called a "phase-field approach," that combined with computer simulations can predict any material's microstructural evolution. Because the model is phenomenological it isn't material specific. Any number of materials processes can be simulated. "One can model the evolution of arbitrary morphologies and complex microstructures, describe various processes including phase transformations, particle coarsening, grain or domain growth, diffusion or nondiffusional processes," says Chen.

Here's how it works. Start with an initial microstructure, which can be created on the computer or input from an experimental image. Then calculate the thermodynamic driving forces, integrate the kinetic equations with appropriate boundary conditions, and voila: output a simulated microstructure at any given moment of time during the process. Or to

be more specific, "we can start with a microstructure, heat it up to 1000°, then quench it, and see what is happening at any point during the process by outputting a microstructural image," says Chen. He flips open his lap top computer and loads a presentation that he recently gave at Brown University. Page after page of simulations scroll by—precipitation of an ordered intermetallic phase, martensitic transformations, microstructural evolution during grain growth . . . . "You see this?" he says, pointing to two images side by side on the screen. "Which one do you think is real, and which one is the simulation?" It is impossible to tell. They are almost identical.

Eventually Chen would like to be able to take his modeling a step further and be able to compute the properties of any particular microstructure and see what it will do in an application. For now he is happy to know that he can accurately predict a material's microstructure without ever stepping in a lab.



Simulation of the path a single inclusion takes as it gyrates through the circulating weld pool, shrinking and growing with temperature changes and movement until it is deposited in the cooling metal.

Welding Whys

While it is useful to be able to simulate microstructural development, sometimes computer modeling is the answer to solving specific problems—like why seemingly identical processing parameters result in completely different weld metal characteristics.

Twenty-five years ago, Dr. Tarasankar DebRoy, professor of materials science and engineering, was a graduate student studying metallurgical processing techniques using an IBM 360; a computer that required two rooms full of equipment to run analytical calculations that a desktop PC can easily run today. From there his research evolved and DebRoy became interested in the problems related to welding—a process that the American Welding Society estimates is used in more than fifty percent of the U.S. Gross Domestic Product. Over the past two decades DebRoy has worked to understand welding processes by developing a computer model that is based on the physical processes occurring during the welding cycle.

Fusion welding joins two separate metal parts together by melting and resolidifying the metals, and the weld metal's reliability and safety is critical in applications that range from bridges and buildings to the automotive, shipbuilding, and aerospace industries. The ability to predict weld metal microstructures based on processing conditions is essential, but the interactions occurring between the welding heat source and the material are complicated and until recently were poorly understood. "One can repeat the experiments hundreds of times," says DebRoy. "Without computer simulations to explain the processes that are occurring, we would never understand what is happening in the metal."

For DebRoy, microstructure includes three main concerns: inclusions, phase composition, and grain orientation. The processes affecting these three elements include temperature, gas dissolution, heat transfer and fluid flow, vaporization of alloying elements, and cooling rates—many of which are interdependent. Using computer modeling and simulations that demonstrate weld pool geometry and weldment composition and structure based on heat transfer and fluid flow in the weld metal pool ultimately provides the key to understanding how microstructure develops.

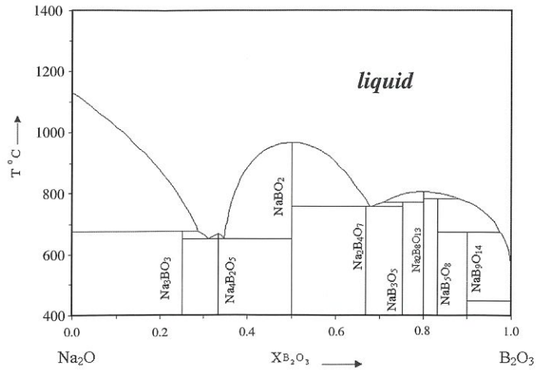
DebRoy pulls up an infrared video image on his computer screen and watches as the temperature fluctuates with increasing time as the heat source is passed over the metal. Red, orange, yellow, green, and blue concentric rings represent the decreasing temperatures farther out from the heat source. "This is the starting point for determining temperature in the models," says DebRoy. He hits a key on the computer and a new image appears, similar to the first but with uniform rows of tiny arrows pointing in the direction of heat flow. It is the computer simulation of the weld pool. From this point DebRoy can examine the weld pool geometry in three dimensions, and using calculations for heat flow and velocity through the weld pool, can visually demonstrate how inclusions form and phase composition and grain orientation develop.

Through this modeling process, DebRoy and his students have been able to solve long-standing questions about the role of sulfur in weld penetration, how inclusions form, and how phases evolve throughout the welding process. One of DebRoy's models shows the path of a single inclusion as it gyrates through the circulating weld pool, growing and shrinking with temperature changes and movement until it is finally deposited in the cooling metal. As he leaves for the night, DebRoy's computers continue to churn, crunching data for more than 10,000 such particles. In the morning, when he returns, the information will be ready to analyze and input into other models that depict how grain structure develops in the weld metal.

Nuclear Glass

"Thermodynamics doesn't lie," says Dr. Karl Spear, professor of materials science and engineering. But it can be tricky. Spear used to be able to intuitively predict the chemical behavior in a system. When he started to be wrong fifty percent of the time he decided that the chemistry was just too complex to try to predict without help, so he turned to the computer. In 1979 Spear bought his first PC—a Radio Shack TRS80.

Calculated phase diagram for the Na_2O–B_2O_3 system—one of the waste glasses Spear is modeling using ChemSage™.



"The computer is a tool for thinking about, understanding, and predicting complicated chemistry at high temperatures," he says. And he's been using it ever since to study all kinds of systems and processes from chemical vapor deposition of diamond films, corrosion mechanisms in silicon carbide materials, environmental degradation of mechanical properties in carbon-fiber reinforced glass matrix composites, and most recently for nuclear waste immobilization. The common thread in all his research is the application of high-temperature chemistry principles, phase equilibria, and thermodynamics to predict and understand materials behavior.

The weapons production of the past fifty years has generated enormous amounts of nuclear waste that was converted to liquid solutions and stored at facilities across the country in containers that are beginning to leak. It is generally recognized that incorporating the waste into a solid provides a better means of storing the waste as its radioactivity decays over hundreds of thousands of years because it reduces volume and eliminates leakage problems. Although a crystalline material would be ideal for this application, processing concerns are an overriding factor in materials selection. Glass has many qualities that make it a good solution—it can be produced in large quantities, at acceptable temperatures, and it can be remotely processed in the radioactive hot cells without any human contact.

However predicting the volatility, corrosion reactivity, and leaching action of a glass system with these dissolved radioactive species is critical. "We don't have a logical way of making predictions about the glass stability and what changes in composition would do to the glass properties," says Spear. Thermodynamic data doesn't exist for many of the nuclear waste materials that are incorporated into the glass form, so these values must be determined.

Spear is using a recently developed associate species solution model to generate accurate thermodynamic data as a function of temperature and total glass composition for what is essentially an "extremely complex oxide liquid phase." He has used the model before for other glass systems, and selected it for this problem because it can accurately represent the thermodynamic behavior of very complex solutions, and it will be easy for nonexperts to understand and use. The waste glasses that Spear is modeling can incorporate up to thirty elements in the most complicated of the systems. To create a description of the liquid solution, Spear uses the thermodynamic program ChemSage™ and the associate species model (along with his own intuition and accumulated knowledge of thirty years) to compare phase diagrams and the stabilities of crystalline compounds. "If we determine the associates for describing liquids in two and three component systems, we can compile a set of associate species that describe the more complex liquid solution," he says.

The work that Spear is doing has already generated previously unknown thermodynamic data for many compounds. "The thermodynamics and phase diagrams are coming together for ceramics and glasses," he says. "When we're finished we'll have good thermodynamic data for essentially all oxide liquids." In the future, Spear hopes that this "simple model" and the thermodynamic data it has generated will be useful in solving many other glass processing problems.

Time and Space

What it comes down to says Dr. Sanat Kumar, professor of polymer science, is a way of thinking about problems that is changing. "We're working on theory, but with a purpose." Kumar is interested in the class of materials called associating polymers. "Anything from that paint surface to that plastic bag," he says pointing at the wall and his garbage can, respectively. If someone comes to him with a materials problem requiring a material that will perform a specific function, Kumar will use computer modeling to get from Point A: knowing what the molecules are, to Point B: the materials properties.

From Point A where things are measured on the Angstrom scale and in femtoseconds to Point B where materials are measured in meters and are required to last for years is quite a gap to bridge. The length and time scales that must be dealt with are immeasurable. Without computers the distance would be impassable, and even with today's faster, more powerful computers, modeling a materials properties on the macromolecular scale with the same precision that one can model a single angstrom of the material is a monumental task and still prohibitively time consuming. So something must be done to simplify the simulated system. Nonessential elements are removed from the system equation thereby losing some fine detail but doing so in such a way that the major properties of the system are preserved. Kumar explains it in terms of a camera lens. "If you look at an object through a camera lens, as the lens is pulled back away from the object the focus decreases and you lose some of the detail that was once there, but the picture is still understandable."

As variables in materials processing become more complex, development timeframes

collapse, and funding sources dwindle, computers will be used more frequently to design new materials before spending a dime in the lab, to tailor experimental processes, and to develop theories to explain the complex relationships between structure, processing, and properties that are the basis of materials science. Even today new models and programs are being developed to help understand the complexities of new materials systems.

At Penn State computers are becoming more and more a way of understanding the structure-processing-properties triangle. It is evident in the current research of Chen, DebRoy, Spear, and Kumar, and interesting to note that three new faculty members, Gopalan, Liu, and Manias, are all members of the new breed of materials scientists using computers to solve materials mysteries. The materials and processes they study are widely varied, but they have in common the use of a single tool that helps them visualize and understand the relationships that exist between atoms, molecules, and bulk materials—the computer.

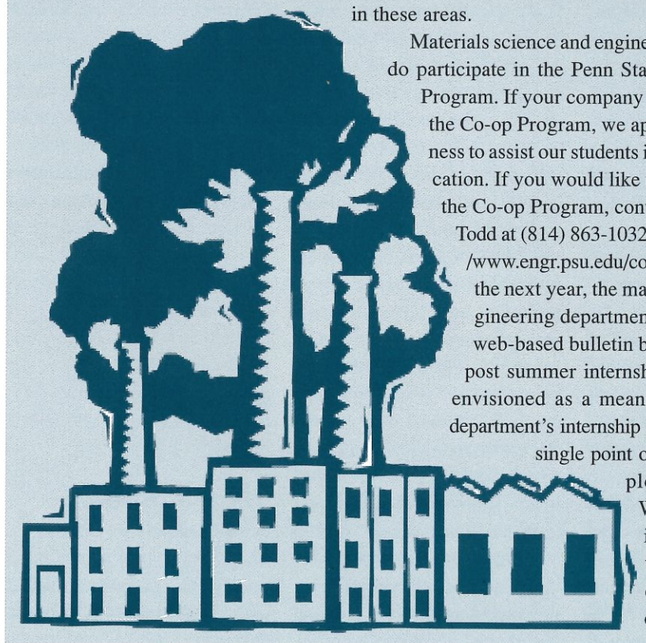
THE REAL WORLD EDGE

At the beginning of each semester students head off to the bookstore to pick up the texts they'll need for their classes—or at least check out the lecture notes on the course web site. They spend the semester sitting in lectures, solving homework problems, and taking exams. Usually a lab course or two is required and sometimes they work in groups or teams to solve problems. But often they're left wondering what it all has to do with "the real world." How does it apply to the jobs students are expected to get when they graduate four to five years later?

For many students all their hard work at school begins to make sense when they have a summer internship or participate in the Engineering Cooperative Education Program (Co-op). In the atmosphere of a company, students begin to see what all those chalk marks on the blackboard add up to. They have the opportunity to use the tools, machines, and equipment that make the materials they've learned about. And they begin to understand what it is that process engineers, polymer chemists, manufacturing engineers, research and development scientists, metallurgists, plant managers, and ceramic engineers actually do.

The materials science and engineering department strongly encourages students to pursue summer employment related to their degree or to participate in the Co-op program. While it's not mandatory, it is becoming obvious that students who have the real world experience have an edge over those who don't. For some employers the experience that students gain in an internship or co-op setting is more important than the degree they hold. In fact, members of the department's Industrial and Professional Advisory Committee have strongly recommended that a Co-op experience be mandatory for materials science and engineering students who plan to work in industry.

While internship or co-op experience probably won't become a mandatory requirement for a materials science and engineering degree, the department is working to make more internships and co-ops available to students. Recent changes in the department such as the new option in Electronic and Photonic Materials as well as a polymer engineering study track within the Polymer Science and Engineering Program create a new need for internship and co-op opportunities in these areas.



Materials science and engineering students can and do participate in the Penn State Engineering Co-op Program. If your company already participates in the Co-op Program, we appreciate your willingness to assist our students in improving their education. If you would like to become involved in the Co-op Program, contact the director, Anita Todd at (814) 863-1032 or via the web at http://www.engr.psu.edu/coop/. In addition, over the next year, the materials science and engineering department will be developing a web-based bulletin board for companies to post summer internship opportunities. It is envisioned as a means of streamlining the department's internship process by providing a single point of contact for both employers and students. When the bulletin board is ready to go, we hope that you and our students will have many opportunities to use it.

department news

Ceramics Program Celebrates Its Seventy-Fifth

Undergraduate and graduate students in the Ceramic Science and Enginering Program took a minute out of their busy schedules during Ceramic's 75th Anniversary year to pose for this picture on the steps across from Steidle Building.

In the 1920s, the production value of the Pennsylvania ceramics industry was second in the nation, and The Pennsylvania State College, realizing the value of ceramic education established a ceramic engineering curriculum leading to a bachelor's degree and formed the Department of Ceramic Engineering. The 1923 General Catalog stated: "Ceramic Engineering, which deals with the clay-working and allied industries, recently has been made a separate department, offering a course intended to prepare men for engineering, administrative, or research positions in the brick, tile, pottery, cement, glass, and allied industries."

Today the complex and multifaceted ceramic science and engineering discipline has far surpassed the "traditional" ceramic fields listed in the 1923 General Catalog and become the foundation for the electronic, aerospace, and communication technology industries. The Ceramic Science and Engineering Program celebrated its 75th Anniversary in 1998. At the Pennsylvania Ceramic Association's 53rd Annual Forum, Penn State friends and alumni celebrated Penn State's rich history as a leader in the science and technology of ceramics and examined what the next century holds for ceramic technologies. "Advanced Ceramics for the 21st Century: Prospects and Challenges," the keynote lecture presented by Stephen Freiman, president of the American Ceramic Society focused on the challenges facing the ceramics industry including reducing manufacturing costs, predicting performance, and facilitating ceramic materials selection for designers and end users. The forum program featured Penn State alumni, faculty, and former faculty whose expertise ranged from refractories and cements to glass fibers, ceramics for medicine, advanced ceramic processing techniques, and electroceramics. At the close of the day, Dr. Robert Newnham's inaugural Alumni Achievement Award in Ceramics lecture, "Ceramic Engineering in the 21st Century: Scaling Up and Scaling Down," was an inspiring look at the role ceramics may play in feeding an exploding world population and the evolution of the human–computer interface.

HISTORY

Evidence of Penn State interest in ceramics can be found as early as 1898 when Thomas C. Hopkins, assistant professor of economic geology, published *Clays and Clay Industries of Pennsylvania.* From 1911 to 1923 professors in the Department of Geology offered lecture courses on clays and cement raw materials and the Department of Metallurgy provided some informal instruction on refractories, but little progress in ceramic instruction was made until the department was formed in 1923.

The department's curriculum during those early years followed the practice common at the time of teaching students the industrial methods in use. When Nelson W. Taylor arrived to take over as head of the department in 1933, his first objective was to develop a scientifically oriented curriculum and research agenda. He began by purchasing new equipment and establishing a curriculum that cor-

related students' physics and chemistry training with high temperature ceramics phenomena and developed refractories courses that were of particular importance to the ceramics industries. At that time Penn State was the only school offering a lab course in refractories. Dr. Nelson Taylor in his 1940 report on the department wrote, "The quality of the refractories course is illustrated by the fact that one of the recent graduates, on entering the employ of the world's largest refractory company, was able to complete his special training in two weeks instead of the two months usually needed by graduates of other colleges or universities."

Early research in the ceramics department focused on the fundamental properties of clays, refractories and slags, the beneficiation of raw ceramic materials, and solid phase reactions. Over the ensuing thirty years, world-renowned scientists joined the faculty lending their expertise as both teachers and scientists. Scientists like Woldemar Weyl, author of the definitive text *Coloured Glass*, Floyd Hummel, whose work on ceramic phase diagrams is still referenced today, clay-mineralogist George Brindley, and Wilhelm Buessem, who joined the faculty in 1952 and propelled the Penn State ceramics into the field of electroceramics, molded a department renowned for its ceramic expertise.

PROFESSIONAL IMPACT

Penn State ceramics, in all its incarnations from department to program, has played a strong role in establishing and developing local and international ceramics related professional societies. Especially notable is the program's participation in the American Ceramic Society. Over the hundred-year history of the Society seven Penn Staters have served as president of the Society itself, five others are Distinguished Life Members—the Society's highest honor, while numerous others are fellows, chair the Society's many scientific divisions or its committees, and share their expertise at the annual meetings.

Penn State ceramics was also instrumental in establishing the Pennsylvania Ceramics Association (PCA). Since the PCA held its first meeting as an official organization in November 1945 in the Mineral Industries Art Gallery at Penn State, the two organizations have worked together to promote cooperation among Pennsylvania's ceramic industries and foster ceramics education. The Penn State ceramics program has benefited from the relationship. One of the PCA's earliest efforts was to combat the ignorance surrounding the scientific and technological discipline of ceramics and recruit new ceramics students especially for Penn State. Not only did the PCA help Penn State with its recruiting, but it also provided financial support to students through its annual scholarship fund—scholarships that are still awarded today.

TODAY

When the U.S. Government recognized "materials science and engineering" as a critical national need in the 1950s, Penn State was ready to lead the way. The Department of Materials Science and Engineering was established in 1967 enveloping the Departments of Ceramic Science, Metallurgy, and Fuel Science. In 1972 the Polymer Science Program was added to the curriculum and research agenda to complete the department.

Today the Penn State Ceramic Science and Engineering Program is one of the country's largest and most revered. The faculty members carry on in the established tradition of excellence receiving numerous awards each year for their teaching, research, and leadership activities. Advances in telecommunications, computers, aerospace applications, and medical diagnosis that have occurred over the past 75 years mirror the research activities of the faculty. The materials and processes that they study include computer modeling of materials microstructure, green processing techniques, ceramic materials for sensors and actuators, superconductors, biomedical ceramic materials, ceramic membranes for separation applications, and ceramic mechanical properties. From the bricks of yesterday to the microchips of today and on into the next century, the Penn State Ceramic Science and Engineering Program will continue to lead the way.

FUELS–MINERAL ENGINEERING MERGE

Fuel Science and Engineering has seen its share of changes since its establishment in 1932 as a new curriculum in the "College of Mineral Industries"—the first program of its kind an American College. In 1967 it became part of the newly formed Department of Materials Science and Engineering. This year the Fuel Science and Engineering program is merging with the Department of Mineral Engineering to create a new entity: The Department of Energy and Geo-Environmental Engineering.

There are many reasons for this change. One of the most obvious is the unmistakable link between the research and educational initiatives in fuel science and mineral engineering. Until now, research and education across the spectrum of the energy discipline have been divided within the College. Extraction and processing activities were housed in the Department of Mineral Engineering while value-added production and utilization were focused in the Fuel Science and Engineering Program. The merger of these two units to create a new department will combine these activities in a way that will enhance both educational and research initiatives for the College.

The new department will maintain existing degree programs (including a graduate program in fuel science), and in addition will offer a broad-based energy degree at both the undergraduate and graduate levels. The new broad-based degree is based on the philosophy of educating students across the discipline and will run the gamut from extraction and processing, to utilization of fuel materials. Alan Scaroni, head of the new department and professor of fuel science, thinks that this new option for students will produce engineers who are adaptable to the broad range of needs that the energy and mineral industries are going to increasingly require in the future; engineers who understand the energy continuum from "mine to market." Scaroni also thinks that these same "synergies between the former fuels faculty and our colleagues in mineral engineering, petroleum, and natural gas will allow for better response to RFPs" in the research arena.

What does all this mean for the Department of Materials Science and Engineering? Although a vital section of the department is gone, collaborative activities between materials science and engineering and energy and geo-environmental engineering faculty will still be possible and are expected to continue. The Department of Materials Science and Engineering itself was formed in response to the changing world needs, and it continues to evolve as those needs constantly change. "We are in an era in which change is essential for survival," says John Dutton, dean of the College of Earth and Mineral Sciences. "We are making some of those changes."

If you received a degree in the fuels specialization option and would like to continue receiving Penn State MATSE, please send us a note to that effect. The address is 215 Steidle Building, University Park, PA 16802-5006. You may also contact us via e-mail: jxh33@psu.edu; the World Wide Web: http://www.ems.psu.edu/MATSE/alumni.html; or phone: (814) 865-3208.

MATSE Elects New GEMS Board Reps

The newly elected GEMS Board Reps for the materials science and engineering department. From left to right: Mike Starsinic, David Michel, and Tom Kleeb.

The Department of Materials Science and Engineering has three new representatives on the Board of the Graduates of Earth and Mineral Sciences (GEMS) Alumni Society. The new members are Thomas Kleeb, David Michel, and Michael Starsinic. The three new members replace our former representative, Eric Minford ('76 B.S., '83 Ph.D. Ceramics) whose term expired this year. During his six-year tenure, Eric served on the Board in a number of roles, and continues to participate as a non-board member on the Board's Campus and Resource Committees.

Thomas M. Kleeb ('73 Ceramics), recently became new product development manager with Harbison Walker Refractories Company in Pittsburgh, Pennsylvania. Tom has been with Harbison Walker for 25 years. As the new product development manager, Tom will be responsible for commercializing technologies developed at the Garber Center as well as identifying industrial trends in the use of refractories. He holds fourteen U.S. patents, and in 1984 received the Dresser Industries Medal for Technical Creativity. Tom will be serving on the GEMS Diversity Committee which is responsible for helping the College attract and retain minority students as well as working with alumni and student minority groups to promote Earth and Mineral Sciences.

David J. Michel ('66 M.S., '68, Ph.D. Metals) is the associate superintendent of the Navel Research Laboratory's Materials Science and Technology Division in Washington, D.C. David has authored more than 100 scientific publications and is a co-editor of three books. He holds two U.S. patents and has received several awards including the GEMS Alumni Achievement Award and is a Fellow of the American Society of Metals (ASM) International. David will be serving on the Career Committee, which is responsible for the Point of First Contact Program, and is working on establishing and promoting internship and COOP experiences for EMS students.

Michael E. Starsinic ('80, '82, '84 Polymers) coordinates efforts to develop polymers for unique nonwoven and film applications for Montell, Inc. in Wilmington, Delaware. He holds five U.S. patents. Mike formed Gor-Star, Inc. in 1994 with former polymers faculty member Bronco Gordon, and in 1995 he established the Mike Starsinic Award in Polymer Science to be given annually to the "undergraduate exhibiting outstanding leadership and dedication to the program." He is a Centennial Fellow of the College. Mike will be serving on the Campus Committee, which is responsible for recruitment and retention activities at the Penn State Commonwealth Campuses. These activities include attracting and retaining students, identifying alumni to assist in recruiting activities, and promoting the expansion of EMS courses at Commonwealth Campuses.

The GEMS Alumni Society was established in 1990. It was formed to encourage alumni participation in College activities including student recruitment, mentoring, advising the Dean of the College, and to promote communication between the College, its departments, and alumni. Alumni who are members of the Penn State Alumni Association are also members of GEMS. Since its inception GEMS has begun publishing the GEMS Update-a triannual newsletter sent to all GEMS members, initiated a "Point of First Contact" program to mentor EMS students, established a commencement reception, developed an emergency assistance fund and a professionalism course, and holds social events including an an-

nual tailgate. Many of these activities are carried out through five GEMS Board Committees-Campus Committee, Career Committee, Diversity Committee, Resource Committee, and the Executive Committee. Alumni participation on these committees has been helpful in accomplishing the GEMS Board goals.

Our new GEMS Board representatives attended their first meeting this fall where GEMS Board president Ron Landon (Geosciences), expressed a desire to shift the focus of the GEMS Board outward to the faculty, students, and alumni and make OUTREACH the theme for this year. Tom, Dave, and Mike have taken this call seriously. In November they met with the materials science and engineering department head and program chairs to discuss what they can do to help the department. Several items were discussed including new student recruiting efforts, developing a web-based internship and job bulletin board, and promoting materials science and engineering with the University administration. As plans for these activities advance over the next year, we will keep you updated on progress and hope to get many alumni involved in our activities.

For more information on GEMS, visit their web site at http://www.ems.psu.edu/GEMS/. Please contact one of the GEMS Board representatives if you would like to help in any way.

Laxman Mulay

Laxman "Bal" Mulay, professor emeritus of solid state science, died on August 19, 1998 at Centre Community Hospital. His wife, Dr. Indu Mulay of State College and a brother, Jagdish of Irvine, California, survive him.

Mulay joined Penn State in 1963 as an associate professor of solid state science and was promoted to professor in 1968. From 1967 to 1972 he was also the chair of the Solid State Science Program. In addition to his position with the Department of Materials Science and Engineering, Mulay was associated with the Materials Research Laboratory where he conducted much of his research. He retired in 1990.

While at Penn State Mulay conducted pioneering research and was internationally recognized in the fields of magnetism, NMR, and catalysis. He published more than 170 papers and three books on magnetism, and was writing another at the time of his death. He was a Fellow of the Chemical Society, London, and a member of the American Chemical and American Physical Societies. In 1978 he was elected a Fellow of the Royal Society of Chemistry.

Mulay was born in Rahuri, India in 1923. He received his Ph.D. from the University of Bombay, India. Before joining Penn State Mulay was a research associate at Northwestern University and Harvard University, and an assistant professor at the University of Cincinnati and an associate professor of chemistry at Harvard University.

Upcoming Events

National Engineers Week
February 21–27, 1999
For info: http://www.eweek.org

Spring Break
March 8–12, 1999
University Park

Earth and Mineral Sciences Expo
University Park
March 20, 1999

1999 McFarland Award Lecture
University Park
April 24, 1999

Blue and White Weekend
April 24, 1999*

Spring Commencement Ceremonies
University Park
May 14–16, 1999

*Tentative date.
If you have an event for the Upcoming Events Column, please contact the *Penn State MATSE* editor for consideration.

alumni news

Thirties

M. J. Mianulli ('39 Metals) is retired from his position as national marketing manager for Brass-Copper-Aluminum Industries. During his career he served as member and chairman of committees with ASM International, ASTM B-5, AWS, and the Copper Development Association. He is a founding and charter member, as well as three-term president, of the Center County Chapter of the Penn State Alumni Association. He received a life membership award from ASMI and a Meritorious Citation by CDA.

Robert A. Addison ('33 Metals) is retired. He worked in several areas during his career including thirteen years in the South African Gold Mines and five years in mining machinery in U.P. Michigan.

Edward E. Slotterback ('35 Metals) is retired from U.S. Steel Corp. after 42 years of service. His final position was staff metallurgical engineer.

Dave E. Tomkins ('37 Ceramics) writes that he is "essentially retired," but continues to be involved in R&D in a family owned business. He is a registered professional engineer in Pennsylvania and Texas, holds four patents, and before retiring held positions in industry from manager to president.

Forties

Ellis S. Bergey ('43 Fuels) is retired from PECO Energy Co. He worked there from 1946 to 1986.

Harold B. Federman ('43, '45 Metals) is currently Chairman of the Board of Pollock Research & Design, Inc. which he helped establish in 1967. There are presently three locations in Maryland, Ohio and Pennsylvania employing more than 100 people.

Harold E. Lowery ('48, Ceramics) is retired from Ferro Corp. He has forty years of experience in R&D, sales, technical service, and marketing of inorganic colors and pigments. During the last twenty years of his career he worked and lectured in Ferro's foreign subsidiaries in South America, Europe, and Japan. He holds several inorganic pigment patents.

Samuel R. MaLoof ('43, '45, '49) is a consultant in the environmental area. He is specifically interested in recycling organic materials including pelletized biosolids.

George H. Rowe, III ('44, '49 Metals) is retired. His work experience was in R&D of engineering materials with an emphasis on design. He is an author on more than forty technical papers. For five years he was deputy director of the Institute for Statics and Dynamics at the University of Stuttgart. He also holds patents for improving the low cycle fatigue life of jet engine compressor discs and for the design of a solar power tower that minimized thermal cycle fatigue of the components.

W. W. Simpson ('42 Metals) is a metallurgical consultant. He worked at Crucible Steel, Empire, and Armco during his career and is now employed part time by Logan Machine Company in Akron, Ohio. He was a member of ASM, AISI, and SAE.

Charles O. Tarr ('42 Metals) is retired from AEC. He pioneered AEC programs for space power using rare metals such as Iridium, Rhenium, Hafnium, Rhodium, Yttrium, Niobium, Osmium and most refractory metals. His patents and awards are classified "secret" via AEC. He now works independently on patentable energy programs.

Horace J. Weymer ('47, '48, Metals) retired from Abey Corp in 1985 as technical director. He worked at Abey for 37 years.

Fifties

Alfred J. Babecki ('53 Metals) retired in 1984 from NASA. He received his Master's in 1962 from the University of Maryland. In addition to NASA, Babecki was also employed by ACF Ind. Research Lab, and the U.S. Naval Research Labs. He has published numerous research reports and articles, and holds one patent.

John O. Brittain ('43, '51 Metals) is professor emeritus at Northwestern University. Before retiring from Northwestern he was also employed by ALCOA, Battelle Memorial Institute, the U.S. Army, and was on the Scientific Staff at Columbia University. He received the McFarland Award from the Penn State Chapter of ASM, the Teeter Award, was a Kyoto University Scholar, and was president of the Chicago NW Chapter of ASM.

Paul J. Diffenbach ('54 Metals) is retired from Bethlehem Steel Corp. with forty years of experience in management positions in metallurgical Quality Assurance and product application.

Thomas N. Elston ('54 Fuels) is retired. He worked for Combustion Engineering, Keystone-Connemaugh Project, the General Public Utilities, and Penn Electric Company, in various engineering, management, and administrative positions. When he retired in 1994 he was vice president of the Human Resource Division of Penn Electric.

Ronald D. Gray ('59 Metals) is employed by EMC International, Inc. He held a progression of positions with increasing responsibilities from management trainee to staff metallurgist, manager of process engineering and vice

Alumnus Receives Medal Posthumously

Adolph J. Lena ('48, Metals) received the Medal for the Advancement of Research from ASM International "in recognition of personal achievements and unwavering support of special alloy and process technology research during times of great challenge to the special metals industry." The award was established in 1943 to honor an executive of an organization whose important activities include the production, fabrication, or use of metals and other materials, and who has by foresight and action substantially advanced the arts and sciences of materials science and engineering. Lena was a fellow of ASM and former president and chief operating office of Carpenter Technology Corporation in Reading, PA. He received the McFarland Award from the Penn State Chapter of ASM in 1971. Lena passed away before the award could be presented. His wife accepted it on his behalf.

1998 Alumni Achievement Award

Robert J. Petcavich ('76 Chemistry, '77 Solid State Science, '80 Polymers) received the 1998 GEMS Alumni Achievement Award from the College of Earth and Mineral Sciences. The award was established in 1993 to recognize outstanding achievement by EMS alumni. Petcavich is an entrepreneur who has founded and developed companies such as AlphaScribe Express, which grew to the largest regional transcription company in California, and Planet Polymer Technologies—a high technology materials company concerned with designing, developing, manufacturing, and marketing degradable polymer materials. Petcavich has made numerous radio and television appearances, and holds more than thirteen patents in fields such as electronic and microwave packaging, stealth design, and degradable polymers. He is a member of Phi Beta Kappa and Phi Kappa Epsilon honor societies, and was also an EMS Centennial Fellow.

Alumni Honored at ACerS Centennial Celebration

Delbert E. Day ('60, '61 Ceramics) presented the 1998 Friedberg Memorial Lecture at the Annual Meeting of the American Ceramic Society, in Cincinnati, Ohio. He spoke on "The Fascinating World of Glass Microspheres." Day is the Curator's Professor of Ceramic Engineering and senior investigator of the Graduate Center for Materials Research at the University of Missouri-Rolla.

David W. Johnson, Jr. ('64, '68 Ceramics) is the 1998 John Jeppson Award recipient of the American Ceramic Society in recognition of distinguished scientific, technical, or engineering achievements in ceramics. Johnson has been head of the Ceramics Research Department at Lucent Technologies since 1988, and is a member of the National Academy of Engineering. His research has focused on spinel ferrite fabrication and processing, high-temperature oxide superconductor synthesis, and sol-gel processing of glass ceramics. He is an author on more than 120 publications and 28 patents.

Laura Stearns ('87 Ceramics) received the 1998 Ross Coffin Purdy Award from the American Ceramic Society with her former advisor at Lehigh, Professor Martin Harmer. The award is given for the most valuable contribution to the technical literature in 1997. Their papers are titled: "Particle-Inhibited Grain Growth in Al_2O_3-SiC: I, Experimental Results" and "II: Equilibrium and Kinetic Analyses."

president of technology. Gray is also a lecturer and course organizer for a continuing education firm. He holds three patents on steelmaking processes and equipment.

Hal L. Harman ('56 Metals) continued his education at MIT and earned a Master's degree in metallurgical engineering. He joined U.S. Steel at Homestead Works where he rose to chief control metallurgist. He joined Acme Steel Co., in Chicago attaining the position of group vice president responsible for casting manufacturing for the aircraft and aerospace industry. He is a recipient of the McFarland Award from the Penn State Chapter of ASM. He and his wife Cay, are retired and divide their time between Florida and North Carolina.

Albert L. Hoffmanner ('58, Metals) is employed by Walker Manufacturing, a Division of Tenneco Automotive. He is currently the director of advanced products for original equipment and after market products. Hoffmanner is the inventor of the Champion Copper-Phase Sparkplug. He was also editor, author and organizer of *Metalforming: Interrelation Between Theory and Practice,* published by Plenum/AIME in 1971.

Michael Kotyk ('54, '56, '68 Metals) is retired. He worked for 37 years in R&D with U.S. Steel, and six years at AROD in funding and contracts.

Robert Lowrie ('44, '59 Metals) is a consultant on materials and design of oxygen equipment, on failure analysis of oxygen equipment, and is an expert witness. He is a fellow of ASTM.

Daniel B. Murphy ('58 Fuels) retired in 1991 as emeritus professor of chemistry at Lehman College of CUNY after 34 years. He still teaches an occasional course and does some research on pyrolytic carbon.

Asu T. Pal ('56 Metals) writes that he "worked as a metallurgist, Posts & Telegraphs Department and retired as deputy director, Defence Metallurgical Research Laboratory." His work included R&D, production, technical services, and administration. Pal likes to travel and spent 1994 visiting his son **Uday B. Pal** ('84 Metals) in Boston, Massachusetts.

Ben Roesch ('52 Ceramics) is president of WinCor Electronics. He has also been employed by Raytheon Semiconductor, Fulton Electronics, and Corning Glass.

Charles V. Rue ('54 Ceramics) is retired from Norton Company. He writes, "after several years in technical ceramics, I taught at NC State for nine years, then began a career in abrasives research. During my thirty years in research I was granted 25 U.S. patents and many foreign patents."

Robert J. Ryder ('55, '59 Ceramics) is a consultant. Previously he worked for Brockway Glass where his final position was vice president of Tech Services, and at Owens-Brockway where he was vice president of Packaging Services. He is a fellow of the American Ceramic Society and received the Phoenix Award in 1989.

Merrill Shafer ('53, '56 Ceramics) is retired. He worked at IBM Research Lab from 1956–1959 where he managed the solid state chemistry program. His main interests were in magnetism and magnetic materials, and high temperature superconductors.

Charles E. Smeltzer ('53 Metals) is retired from Solar Turbines Inc. of San Diego, California, where he was a research staff engineer. He worked on alloy development for high temperature gasturbine applications over a period of 35 years at three industrial research laboratories which, in addition to Solar Turbines, included General Electric and Carpenter Technology Corp.

Richard M. Spriggs ('52 Ceramics) has had a distinguished career. He spent sixteen years at Lehigh University where he founded the ceramic program, and was the senior staff officer and staff director for the National Research Council at the National Academy of Science. He was named executive director of the New York State Center for Advanced Ceramic Technology when it was established in 1987 at Alfred University. Spriggs has received numerous awards and in 1996 was named a Centennial Fellow of the College of Earth and Mineral Sciences.

Sixties

John E. Werner ('54, '60 Metals) retired as president and CEO of the Ben Franklin Technology Center on September 30, 1997. Before joining Ben Franklin, Werner spent 32 years at Bethlehem Steel in Operating and R&D management. He retired from Bethlehem in 1985 as director of research. Werner was recognized as the 1997 Supporter of Entrepreneurism, and in 1996 as an EMS Centennial Fellow. He is the Vice Chairman of the Tri-County Habitat for Humanity, and has received ASM Chapter Awards including the McFarland Award from the Penn State Chapter and the Bradley Stoughton Award from the Lehigh Valley Chapter.

Seventies

Leslie D. Kramer ('68, '71 Metals) is the manager of Advanced Materials and Structures at Lockheed Martin Corp. From 1971 to 1985 Kramer was the manager of materials engineering at Westinghouse, and in 1982 was an ASME Silver Medalist. In 1996 Kramer received the Lockheed Martin Apex Award.

Eighties

Robert P. Bauer ('80 Ceramics) has been in sales and marketing for electrical controls and factory automation companies. He is currently the president of Control Techniques Drives, a division of Emerson Electric Company.

Richard S. Cesaretti ('88 Polymers) is employed with Union Carbide Corp. as a senior project engineer for Unicarb® technology, and leads an applications group in Amherst, Ohio for all of North America.

Francis Joseph Chinnici ('83 Metals) received his MBA from Jacksonville University in 1997. After graduating from Penn State he worked in failure analysis, and then moved into quality assurance and supplier evaluation as director of quality at CSX Transportation. He is currently the general manager of engineering at CSX, and in 1995 received the CSX Corporation "Presidents Award of Excellence."

Michael A. Chronister ('86 Polymers) is employed at Bostik, Inc. as a product development chemist. His main areas of research are with single component, moisture-reactive polyurethane systems. He won a 1995 Worldwide Bostik Development Award for formulating a new polyurethane-based hardwood flooring adhesive that has sold close to $10 million.

John J. Conway ('82 Metals) is the manager of process engineering at Crucible Compaction Metals—a company that makes powder metallurgy parts for jet engines.

Darrell E. Dorman ('88 Fuels) was promoted to senior engineer at DB Riley, Inc. He co-authored and presented the paper "Recent Gas and Oil Low NO_x Retrofit Experience" at the 1996 International Joint Power Generation Conference in Houston, Texas.

Honghua Du ('88 Ceramics) is an associate professor in materials science and engineering at the Steven's Institute of Technology in New Jersey. From September 1997 to August 1998 he was on sabbatical at Bell Labs, Lucent Technologies and involved in the R&D of dielectric materials for wireless communications.

Colette Zellock Duffy ('89 Polymers) is a technical service engineer at LNP Engineering Plastics. She is responsible for injection molding troubleshooting, material recommendations, seminars on the company's products, "along with much more!"

Kerry Anne (Bundy) Dunn ('85, '87 Metals) began her career in 1987 at the Savannah River site of Westinghouse in failure analysis. She has moved on to principal engineer managing programs related to materials. She received the site Presidents Award in 1994 and the Outstanding Young Member Award from the Savannah River Chapter of ASM.

Douglas Eidle ('83 Ceramics) is the Southeast regional manager for MPM Corp. He also worked as a manufacturer's representative selling equipment to the electronics packaging industry and as a production manager for ion beam products.

Nia Francis-Scrutton ('86 Metals) completed a Ph.D. in materials science and metallurgy at Cambridge University, and since then has worked as a welding metallurgist and a freelance scientific abstractor in the polymers, welding/metallurgy, and ceramics areas.

Lance Gardner ('86 Polymers) is a technical manager with Congoleum Corp.

Theresa Geneczko ('82 Metals) is employed by Lockheed Martin. She has fourteen years of experience working for aerospace companies as a materials engineer, failure analyst, quality assurance engineer, and design engineer.

Nancy Ryan Gray ('85 Fuels) is currently the special assistant to the director of membership of the American Chemical Society. Prior to her current position she worked for nine years with Exxon Production Research Company. In 1990 she received the Best Presentation Award at the International conference on Applied and Analytical Pyrolysis.

Harvey Paul Hack ('87 Metals) has 25 years of experience in marine corrosion research at the Naval Surface Warfare Center. He has been at Northrop Grumman Corp. since August 1996. Hack is on the Board of Directors of ASTM, was on the Board of Directors of NACE International, is past president of the Council of Engineering and Scientific Specialty Boards, and is a certified corrosion specialist and cathodic protection specialist by NACE International. He is a Fellow of ASTM, NACE International, the Institute of Corrosion, and the Washington Academy of Sciences.

Karen Hanner ('87 Polymers) worked at Dow Chemical Co. for six years as a senior research chemist. She is currently employed at the Marietta Family YMCA as the assistant aquatic director and is a homemaker. She has three children: Nicholas, Jenna, and Erinn.

Joseph L. Hughes ('87 Polymers) is the environmental compliance manager supporting the National Oil Program at the National Institute for Petroleum and Energy Research. He is employed by BDM-Oklahoma, Inc.

YoungTai Kho ('89 Metals) is working at Korea Gas Corporation. He was nominated to secretary general of the Koran Society of Corrosion Science in January 1997, and in October 1994 received the Best Paper Award from that Society.

Bruce A. Kschinka ('83 Ceramics) has been a materials engineer with Knolls Atomic Power Lab (a division of Lockheed-Martin) for ten years. He works on naval nuclear propulsion.

Mary Beth Lange ('84 Ceramics) received her Master's in materials science from San Jose State in 1990. She is employed by Motorola.

Dan Lansberry ('81 Metals) is the manager of quality assurance and metallurgical services at Greer Steel Co. His article "Diary of an ISO 9000 Audit," was published in *American Metal Market*.

Maoqiang Li ('84 Ceramics) is a principal engineer at the China Building Materials Academy's Institute of Advanced Ceramics. He is studying ceramic powder synthesis, refractories, and functional ceramics. He is a member of the Board of Directors of Refractories and a member of the editorial committee of the *Journal of the Chinese Ceramic Society*.

Douglas C. Markley ('80 Ceramics) is working at North American Refractories Company. He is a member of the Refractories Institute, the Society for Chemical Hazard Communications, and ASTM.

Daniel R. Marx ('76, '83 Metals) was promoted to vice president of sales in June 1996 at Sputtered Films, Inc. He holds five patents in electroplating, material purification, and sputtering.

Todd D. Nelson ('89 Metals) writes "after nearly thirteen years at Bethlehem Steel Corp., most of which was spent working in the area of large, open-die forgings, I have joined Ingersoll-Rand as a materials engineer in the Materials Technology Center." He received his Master's degree in materials science and engineering from Lehigh University in 1994.

Robert C. Nester ('85 Metals) has been at Bethlehem Steel since 1986 and is responsible for the X-ray and metallographic laboratories. He and his wife, Lynn had a son, Ryan, in 1994.

Doug Pauline ('89 Ceramics) is a regional sales manager for EYE Lighting International of North America.

Eric S. Peiffer ('84 Polymers) is a team leader for a LAN technical support group. He spends his time designing, deploying, managing, and maintaining local area network solutions and configurations for the Defense Distribution Region East.

Kevin R. Quinn ('80 Polymers) is employed by LNP Engineering Plastics. His expertise is in static dissipative plastics for electrostatic dissipation.

David A. Reeder ('84 Metals) is a plant manager at Towanda MetaDyne, Inc. Prior to his current position he held several engineering positions with Carbide Powders.

Gerald S. Rellick ('73 Fuels, '84 Polymers) is working at The Aerospace Corporation. He specializes in carbon-fiber composites for structural and high thermal conductivity in spacecraft applications, as well as polymer-matrix composites.

Peter B. Riley ('88 Ceramics) is currently the director of sales at U.S. Can Co.

Scott M. Smouse ('84 Fuels) after ten years in R&D and project development, was named the first International Program manager at the U.S. Department of Energy's new Federal Energy Technology Center.

Frederick M. Smyser ('82 Metals) is an extrusion engineer with Hydro Aluminum Automotive Structures, Inc.

Timothy K. Stangle ('87 Ceramics) is the manager of research engineering at Lenox China. He is in charge of new product development and process improvement strategies, and recently designed a $1.2 million technical services facility.

William D. Varnell ('77, '81, '82 Polymers) has been the corporate director of R&D since 1991 for Polyclad Laminates. He was named an EMS Centennial Fellow in 1996.

Brien A. Weiss ('86 Metals and Industrial Engineering) is a senior product engineer at ARMCO Inc.'s Butler Operations.

faculty facts

Honors and Awards

David L. Allara, professor of chemistry and materials science and engineering, is the winner of the 1998 Spectrochemical Analysis Award from the Analytical Chemistry Division of the American Chemical Society. The award is given for advancing the fields of spectrochemical analysis and optical spectrometry. It was presented at a special symposium at the fall ACS National Meeting in Boston.

Merrilea J. Mayo, associate professor of materials science and engineering, received a 1998–1999 Congressional Science and Engineering Fellowship that is jointly sponsored by the Materials Research Society and the Optical Society of America. She began a sabbatical leave in September and will spend the next year working directly in the office of Senator Joe Lieberman (D-CT). Lieberman is a ranking member of the Acquisitions and Technology Subcommittee of the Armed Services Committee under which R&D falls.

The purpose of the fellowship is to "contribute to the more effective use of optical and materials science knowledge in government, and to broaden awareness about the value of scientist and engineer–government interaction." Mayo hopes that the fellowship will help her gain an understanding of how government works because "government funds most of the research and research is what we live off of."

As a member of Lieberman's staff, Mayo has a set of issues to cover that includes all of civilian and military R&D. She is also involved in identifying issues that should be included in bills the Senator sponsors, finding cosponsors for bills, and briefing Lieberman and other senators on scientific needs and problems. Mayo has a variety of experiences including her participation on the Advisory Committee on Army After Next Logistics that have given her some insight into the military's future R&D needs. She says she's "having a blast," and thinks it will get even more interesting once Congress begins its new session in January.

Harold H. Schobert, professor of fuel science and engineering, has been named director of the College of Earth and Mineral Science's Energy Institute. The Energy Institute is a collection of laboratories and centers that specialize in specific areas of fuel materials and processes including coal, carbon, and applied catalysis. "Collectively, the units of the EMS Energy Institute represent one of the most complete and state-of-the-art research organizations in the nation devoted to understanding the fundamental nature of fossil fuels, the impact of their use on the environment and the development of advanced fuel technologies."

Schobert assumed the directorship on June 1, 1998 replacing **Alan Scaroni**, professor of fuel science, who stepped down to take charge of the merger between the Fuel Science Program and the Department of Mineral Engineering. Scaroni is now head of the new entity, which was named the Department of Energy and Geo-Environmental Engineering.

Richard E. Tressler, professor and head of the Department of Materials Science and Engineering has been elected an honorary member of the Société Française de Métallurgie et de Matériaux. He was greeted by the Société at the Official Awards Sitting during its October meeting in Paris, France.

Tressler is internationally recognized for his work on ceramics and composites for use in high temperature and extreme environments. He has received numerous awards for his work including the International Prize of the Japan Fine Ceramics Association in 1998, and was elected an Academician of the International Academy of Ceramics in 1996. From 1996 to 1998 he was head of the University Materials Council, and was the president of the American Ceramic Society from 1993 to 1994.

Promotion and Tenure

Four materials science and engineering faculty members were promoted and received tenure during the last promotion and tenure review cycle. A synopsis of each person's career and research interests follows.

Long-Qing Chen is now associate professor of materials science and engineering with tenure. Chen joined the department in 1992 as an assistant professor in the Ceramic Science and Engineering Program after receiving his Ph.D. in materials science and engineering from MIT and a brief stint as a postdoctoral associate at Rutgers University.

Chen's research interests include materials theory and computer modeling, microstructural evolution during sintering, ferroic domain growth, thermodynamics and kinetics of phase transformations in ceramics and alloys, and interfacial structure and properties. He is a member of the American Ceramic Soci-

ety, the American Physical Society, the Materials Research Society, and The Minerals Metals and Materials Society (TMS). In 1995 Chen received a Young Investigator Award from the Office of Naval Research, and more recently a "Special Creativity Extension" from the National Science Foundation for his research on microstructural evolution.

Ljubisa R. Radovic was promoted to full professor. Radovic received his Ph.D. in fuel science from Penn State University in 1982. He joined the Fuel Science Program in 1986 as an assistant professor and was promoted to associate professor in 1992.

Radovic's research program covers gas/solid reactions, heterogeneous catalysts, the use of carbon materials in air and water pollution prevention, carbon material surface properties, and the kinetics and catalysis of coal conversion and carbon gasification. He is also interested in the methodology of teaching energy issues to nontechnical students and the public. Radovic has been honored with a Fulbright Scholarship, and in 1989–1990 received the Pergamon Press Award for the best paper published in *Carbon*. He is a member of the American Carbon Society, the American Chemical Society, and the American Institute of Chemical Engineers.

Darrell G. Schlom received tenure and was promoted to associate professor of materials science and engineering. Schlom received his Ph.D. in materials science and engineering from Stanford University in 1990. After two postdoctoral research positions, one at IBM Zurich Research Laboratory and the other at Stanford University, he joined the Ceramic Science and Engineering Program in 1992.

Schlom is currently studying the heteroepitaxial growth and characterization of oxide thin films that he grows using pulsed laser deposition and molecular beam epitaxy. He is interested in both ferroelectric and superconducting oxides. Schlom has received several awards for his research and his teaching including a NSF and an ONR Young Investigator Award in 1993, the IBM Invention Achievement Award in 1991, and a Penn State Wilson Teaching Award in 1997. He is co-author of 95 publications and holds five patents.

Susan Trolier-McKinstry completed her Ph.D. in ceramic science at Penn State in 1992. She joined the materials science and engineering faculty that year as an assistant professor of ceramic science and engineering, and was promoted to associate professor with tenure this year.

Trolier-McKinstry is predominantly interested in electroceramic materials and ferroelectrics for sensor and actuator applications, and especially in the structure-microstructure-property relations in thin films of these materials. She has also developed a spectroscopic ellipsometry technique for nondestructive evaluation purposes. Trolier-McKinstry is a member of the American Ceramic Society, the Materials Research Society, IEEE, ASM, and ASEE, and is the vice president of Keramos.

John Hellmann, chair of the Ceramic Science and Engineering Program presents Bob Newnham (right) with the Inaugural Alumni Achievement Award in Ceramics at the Ceramics 75 Anniversary Banquet.

Newnham Receives Inaugural Alumni Achievement Award in Ceramics

Robert E. Newnham, professor emeritus of solid state science, was presented with the first Alumni Achievement Award in Ceramics in October. He received the award at a banquet celebrating the 75th Anniversary of the Penn State Ceramic Science and Engineering Program. Prior to his retirement in 1997, Newnham served as a Penn State ceramics professor for more than 35 years, as well as associate director of Penn State's Materials Research Laboratory, and chairman of the Intercollege Solid State Science Program. In his acceptance speech in front of family, colleagues, and friends, Newnham expressed his appreciation saying, "I've won a lot of prizes over the years, but most of the awards came from people who know me only by reputation—it is quite another thing to be honored by those who know you best"

Newnham has received numerous honors and awards throughout his career for his skill as an educator and his contributions to ceramic scientific knowledge. Among his most prestigious are Penn State's Faculty Scholar Award (1984), The Ceramic Educational Council's Outstanding Educator Award (1990), and the American Ceramic Society's John Jeppson Medal (1991) for "distinguished, creative, and inspiring contributions to ceramic science, technology, and education in the area of electronic ceramic materials." He is past president of the American Crystallographic Association, a Fellow and Distinguished Life Member of the American Ceramic Society, and in 1996 was the Turnbull Lecturer of the Materials Research Society. In 1989 he was elected to the National Academy of Engineering.

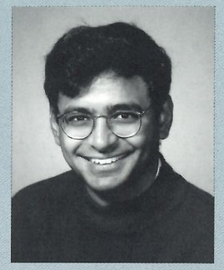
Newnham is especially well known for his research on structure–property relations, electroceramics, composite materials for electronic applications, and smart materials. His work has been reported in more than four hundred research papers, twenty patents, and four books. In 1997 his patent on a hydrophone device that is used to locate underwater oil deposits generated more than $100,000 in royalties and for the first time catapulted Penn State over the $1 million revenue mark for inventions.

In retirement Newnham has turned his focus toward the future of the ceramic science and engineering discipline. In his inaugural Alumni Achievement Award in Ceramics lecture, "Ceramic Engineering in the 21st Century: Scaling Up and Scaling Down," Newnham predicted that in the future ceramics will help feed the world and bring about the union of humans and computers through the evolution of a conscious chip. Although he no longer actively teaches, Newnham is continuing his research at the Materials Research Laboratory.

THREE NEW PROFS JOIN DEPARTMENT

Recent retirements and new directions for the department have prompted the hiring of three new faculty members across the spectrum of materials research. For your information we have included a brief bio on their research interests and background.

vgopalan@psu.edu



Dr. Venkatraman Gopalan recently joined the department as an assistant professor of materials science and engineering. Gopalan received his M.S. and Ph.D. in materials science and engineering from Cornell University. Before joining Penn State he held several postdoctoral research positions, and was most recently a director-funded postdoctoral fellow at Los Alamos National Lab in the Center for Materials Science.

Gopalan will be jointly appointed between the department and the Materials Research Laboratory, and will contribute to the department's Ceramic Science and Engineering Program. He plans to continue his research on non-linear optics, photonic materials, and designing and fabricating integrated optical devices. Specifically Gopalan is studying ferroelectrics as a special class of materials for non-linear optical applications and non-volatile memory. He is also developing new optical and electrical probes for studying crystal structure, domain structure, and defect chemistry in perovskite oxides.

zikui@psu.edu

Dr. Zi-Kui Liu joined the department's Metals Science and Engineering Program as an assistant professor of materials science and engineering. He comes to Penn State from his former position as a research associate at the University of Wisconsin-Madison. Liu received his M.S. in materials science from the University of Science and Technology in Beijing, China, and his Ph.D. in physical metallurgy from the Royal Institute of Technology in Sweden.

Liu's research has focused on computational thermodynamics and numerical kinetic modeling of alloys. At Penn State Liu will focus on developing thermodynamic data bases for polymers and electronic, nuclear, and refractory materials to be used in performing realistic thermodynamic calculations of multicomponent systems, which is also useful in simulating microstructural evolution. He also plans to continue previous work on system materials design with the purpose of providing quantitative guidelines for processing materials with optimized properties at lower cost and in shorter times.

manias@psu.edu

Dr. Evangelos Manias is joining the department as an assistant professor of materials science and engineering. He received his M.Sc. in physics from the Aristotelian University of Thessaloniki in Greece, and his Ph.D. in polymer physical chemistry from the University of Groningen in The Netherlands. Manias was a postdoctoral research associate at Cornell University prior to accepting the position at Penn State. His teaching and research interests will have an impact on both the department's Polymer Science and Engineering and Electronic and Photonic Materials Programs

Manias combines computer modeling and experimental techniques such as AFM, solid state NMR, dielectric spectroscopy, neutron scattering, and infrared and Raman spectroscopy to study the fundamental structural and dynamical properties of polymers near surfaces and at interfaces and in extreme confinements. He is particularly interested in self-assembled monolayers, thin polymer films, polymer–inorganic composite materials and nanocomposites, confined polymer systems such as polymer silicate intercalates and polyelectrolytes in layered inorganic hosts.

863-2980

student scoop

1998 Xerox Award Winners

The Xerox Awards in Materials Research are given each year for the best published work or research by a Ph.D. and a Master's candidate, and for the best research by a baccalaureate degree candidate—up to two in each category. The awards are based solely on creative research accomplishment without reference to grades, recommendation letters, or other honors. This year the following students in the Department of Materials Science and Engineering received Xerox Awards.

Ph.D.

Honglan Lu (Mike Chung, advisor) for his thesis, *Synthesis of Reactive Polyolefins via Metallocene Catalysis and Their Future Functionalization Reactions.*

James F. Tressler (Robert Newnham, advisor) for his thesis *Capped Ceramic Underwater Sound Projector The "Cymbal."*

M.S.

Todd Link (Don Koss and Arthur Motta, advisors) for his work on *Failure of Zircaloy Cladding Under Severe Loading Conditions.*

B.S.

Amit K. Daga (Clive Randall, advisor) for *The Development of Thin Electrodes by Electrophoretic Deposition for Multilayer Devices.* Amit graduated in May 1998 from the Electronic and Photonic Materials Program.

Keith Whitmire (Suzanne Mohney, advisor) for *Phase Equilibria in the Pt-Ti-In-Ga-As System.* Keith graduated in May 1998 from the Metals Science and Engineering Program.

Student Wins National Poster Competition

Rattikorn Yimnirun, (Robert Newnham, advisor) won the Graduate Student Poster Contest at the Centennial meeting of the American Ceramic Society in April for his poster on "Interferometric and Compressometric Studies of Electrostrictive Properties of Low-K Ceramics." The poster was based on research Rattikorn conducted for his doctorate in ceramic science. The Ceramic Education Council sponsors the poster competition and contestants are judged on technical merit, poster quality, and verbal effectiveness.

Undergraduate Takes Top Honors in Speaking Contest

Andrea Lang, (senior–ceramics) won the Student Speaking Contest at the American Ceramic Society Meeting in April. Andrea spoke on "The Role of Dissolution in Pressure Filtration of Yttria Stabilized Nanocrystalline Zironia." Her talk included a discussion of pressure filtration, successful pressure filtration results with submicron zirconia, and the problems encountered with pressure filtration of nanocrystalline zirconia. She also presented evidence that nanocrystalline particles dissolve in suspension which may explain the problems encountered during pressure filtration. "[Andrea] was articulate and poised" during her presentation says her speaking coach, Dr. Susan Trolier-McKinstry. "It was remarkable how poised she was."

The Student Speaking Contest is sponsored by the Ceramic Education Council to give undergraduates the opportunity to present technical papers and hone their public speaking and presentation skills. The contest is a highly competitive event among undergraduate ceramic programs and departments. Congratulations to Andrea on her victory!

ASM Bestows Scholarship

Timothy DeHennis (junior–metals) received the Delaware Valley Scholarship from the Philadelphia Chapter of ASM International. Each year the chapter awards four $1,500 scholarships to students pursuing degrees in science and engineering. Timothy was selected from among thirteen applications representing six colleges and universities.

Starsinic Award

Enrico Bellamo (senior-polymers) received the 1998 Starsinic Award at an awards ceremony held last spring. The Starsinic Award was established in 1997 by alumnus Michael Starsinic to recognize the outstanding junior in the Polymer Science and Engineering Program

1998–1999 Scholarship Recipients

The Department of Materials Science and Engineering has been fortunate to have generous alumni who have endowed scholarships that provide support for current materials science and engineering students. In fact, many students in the department received scholarship awards for the 1998-1999 academic year. The awards are mainly merit based. The availability of endowed scholarships are a major factor in the department's recruiting efforts and help reduce the financial burden students incur while at Penn State. To all those who have helped fund these scholarships, we are deeply grateful.

AVX/Kyocera Foundation Scholarship in Materials Science and Engineering
Jason Fickley
Jamie Morley
Colin Reilly

Frances Hamilton Byers Scholarship
Enrico Bellamo
Amy Kushner
Valentina Landrine

C. Philip Cook, Jr. Memorial Scholarship in Ceramic Science and Engineering
Emily Brucker
Andrea Lang
Stephen McCashin
Brent Miller
Matthew Motyka
Jeffrey Murray
Matthew Opitz
Tarah Pecora
Norman Phelps
Michael Sleaster

Richard P. and John N. Davis Scholarship in EMS
David Whitcomb

Glass Container Industry Research Corporation Scholarship
Marissa Huth

George Gleason Memorial Scholarship
David Crouch

Donald W. Hamer Scholarship in Electronic and Photonic Materials
Edward Filowat
David Fox
Stephen Fulk
David MacMahon
David Pikas
Ryan Williams

Harman Award in Metallurgy
Nicholas Marchetti

Hommel Scholarship in Ceramic Science and Engineering
Craig Stringer

Floyd A. Hummel, Jr. Scholarship in Ceramic Science and Engineering
Matt Hollenbeck
David Whitcomb

GM Scholar
Briama Cooper
Kevin Urman
Stefan Williams

Harvey P. Kocher Memorial Scholarship
Joseph Harvey
Melissa Marshall
Robert Zilionis

Thomas M. and Eleanor W. Krebs Scholarship in Metallurgy
Mitchell Rudman
Ricki Stevenson

Helen R. and Van H. Leichliter Metallurgy Scholarship
Kirstin Hamphill
Peter Kirkham

Mr. and Mrs. Frank D. Lovett, Sr. Memorial Award
Craig Stringer
David Whitcomb

Penn State Metallurgy Alumni Scholarship
Stephen Chatfield
Timothy DeHennis
Christian Dela Cruz
Tonya Faust
Shawn Holmberg
Shawn McKinney
Dennis O'Leary
Jonathan Wickstrom
Jeffrey Wozniak

Pennsylvania Ceramics Association Scholarship
Amy Kushner
Matthew Motyka

PPG Industries Minority Scholarship in Materials Science and Engineering
Obiefune Ezokoye

Anthony J. and Alberta L. Perrotta Scholarship in Materials Science and Engineering
Emily Brucker

James and Mary Ellen Tietjen Scholarship in EMS
Nathan Crowther
Nathan Sanfilippo

George H. and Madeleine Hager Todd Scholarship
Carl Brubaker
Stephen Heffelfinger
Nicholas Marchetti
Keith Williams
Ryan Wolfe

Virginia S. and Philip L. Walker Jr. Scholarship in Materials Science and Engineering
Michael Murphy

Sam Zerfoss Memorial Scholarship
Jody Crampo
Amy Kushner
Dana Lemesh
Varrada Loryvenyong
Jamie Morley
Tarah Pecora
Joseph Rahalla
Ian Scrymegeour
Michael Sleaster
Richard Wolf

The Cooperative Program in Metals Science and Engineering (COOP) that is held each year provides students with an opportunity to formally present their research findings and to interact informally with members of industry. Pictured here at the 1998 COOP meeting are (left to right) students Sarangapani Sista and Tao Hong, Dr. Murali Collur from Allegheny Ludlum Technical Center, and student Ritwik Biswas.

MATSE WWW Guestbook

We've added a new feature to the Materials Science and Engineering website. It's a guestbook for alumni to leave messages for former classmates, provides suggestions and comments about the website after you've checked it out, or just drop us a note about whatever is on your mind. You can access the guestbook from the main department page at http://www.ems.psu.edu/MATSE/materials.html. See you there!

MRS CHAPTER ACTIVITIES

The Penn State chapter of the Materials Research Society is again planning several activities for the upcoming year. All Penn Staters interested in materials science are invited to participate.

- On February 18, 1999 at 6:30 PM in room 26 Hosler, Dr. Carlo Pantano, director of the Materials Research Institute, will address the Materials Research Society regarding current topics of interest to the Penn State materials community. Wine and cheese will be served beforehand. Contact Jordan Priest (jmp176@psu.edu) for more information.
- Résumés are still being collected to post on the MRS web page for prospective employers' perusal. Contact Eric Readinger (edr2@psu.edu) for more information.
- MRS is sponsoring a "Faculty Feud." Faculty members will be challenged to divine the responses materials students gave most frequently when answering basic science questions. Details to follow.
- Interested in nighttime ice skating by a bonfire under the lights at Stone Valley? For a modest charge you can join MRS in this winter activity at a time and date to be announced. Afterwards we will have refreshments in front of the lodge's fireplace. See our web page in the near future for details.
- "Penn State® Materials Science" embroidered golf shirts are on sale for $20.00. The shirts are 100% combed cotton. To get yours contact Jordan Priest (jmp176@psu.edu).
- Check out the local MRS chapter's web page at: http://www.clubs.psu.edu/mrs/

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