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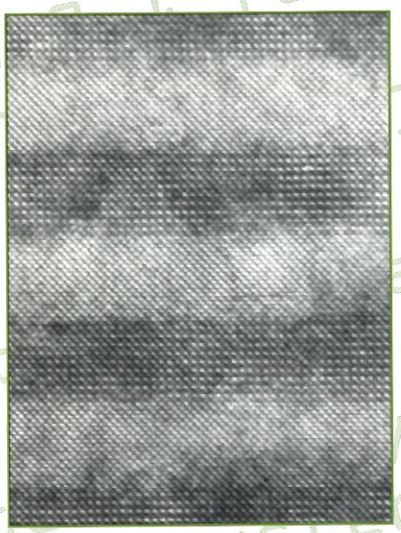
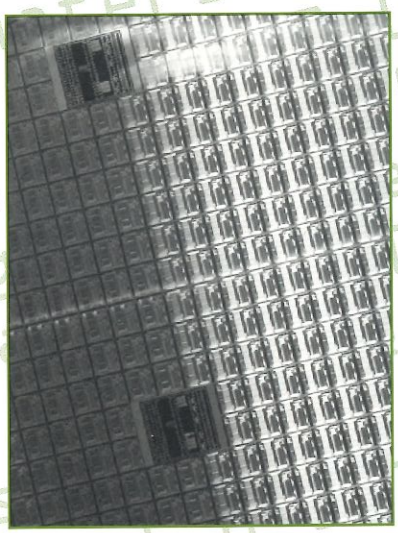
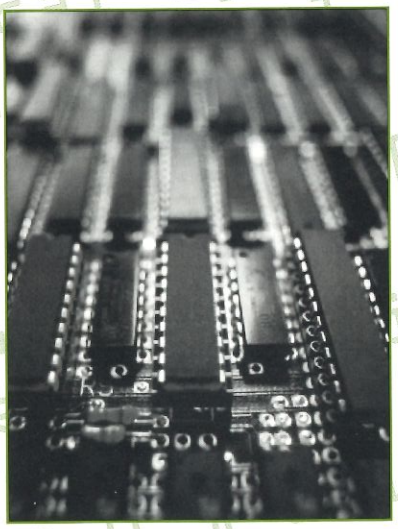
MATSE

PENN STATE







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on the cover:

Clockwise from upper left. Sandwich of lead titanate and strontium titanate grown in Schlom's lab by MBE; Mohney's work on metal contacts to semiconductors could lead to new industry standards; McKinstry's new thin film piezoelectric materials would be useful in high resolution ultrasound applications; A major use for thin electroceramic materials is in miniature capacitors for circuit boards.

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BETTER
Thinner, Smarter, Faster...

by June Heywood

In the information age, almost everyone is looking at how they can make materials smaller, thinner, smarter, faster, and better than they've made them before—especially the materials used in high-tech electronic equipment, optical devices, sensors, and computers. As the field of electronic materials continues growing, four of the newest faculty members of the Penn State materials science and engineering department have a keen interest in where it grows. Their research interests range from better bulk processing methods for electroceramic thick films, wide band-gap semiconductor contacts, and thin film piezoelectrics, to the far off land of perfect superconductor sandwiches.

Thin Is In

Clive Randall, associate professor of materials science and engineering and recently appointed director of the Center for Dielectric Studies, came to Penn State in 1987 as a research associate at the Materials Research Laboratory. In 1995 he joined the Department of Materials Science and Engineering faculty.

For Randall the issue in bulk electroceramic materials processing is how to optimize and tailor the properties of a material as the layers become thinner and thinner. "The traditional ways of assembly are logical," Randall begins thoughtfully in his drawling British accent. "You can control the chemistry, dope better, and mass production with particles is better than for thin films." But traditional methods of materials assembling such as tape casting bottom out at around one micrometer. Randall wants to get below that range into the submicrometer regime. Acknowledging that on this scale he is in direct competition with the people who are developing thin film technologies, Randall says "we're really looking at the issues of miniaturization and practical processing."

In its most practical terms, Randall is looking at the present electroceramic materials processing industry and finding weaknesses in its production methods. After that it's a matter of developing novel bulk processing methods for thin electroceramics that would easily drop into the industry's existing infrastructure. "We want to revolutionize just key parts of the process," Randall says. He and his students are investigating two processing methods that use electric fields to manipulate particles into new structures and layers at the submicrometer scale.

Randall heads to the blackboard and begins drawing—particles, containers, positive and negative symbols—as he explains the two processes that he thinks will work. These methods, dielectrophoretic assembly and electrophoretic deposition, have already shown promise for bulk electroceramic processing at the laboratory scale, and industry is beginning to increase its funding for the studies.

In dielectrophoretic assembly, particles are suspended in a polymer. An alternating current is applied across the system creating areas of positive and negative charge on the particles—a dipole. In its turn a dipole-dipole interaction develops causing the particles to line up like strings of beads. An in situ polymerization "glues up" the structure to create the thin layered material. Then by manipulating what's called the connectivity, Randall can achieve enhanced material properties.

> We want to revolutionize part of the process.
> —Clive Randall

You've got to get the current in and out.

—Suzanne Mohney

In electrophoretic deposition a direct current electric field is applied to particles in suspension. Under the influence of the electric field, the particles migrate and deposit on a surface. In this way, "we build uniform layers with submicrometer powders and can then fire them to 98 percent density," says Randall. They have combined this electrophoretic deposition method with the traditional method of tape casting to build multilayer capacitor devices.

Randall's group has used these methods to make capacitor, piezoelectric, and fuel cell materials. They are on their way to starting a thin revolution in the electroceramics powder processing industry.

Contact

Lately there's been a lot of talk about using wide band-gap semiconductors such as gallium nitride in devices including blue light-emitting diodes for full color displays and compact disc reading lasers, and silicon carbide for high temperature and high power applications. In all these applications one of the main problems is getting current in to and out of the semiconductor.

Suzanne Mohney, assistant professor of materials science and engineering, became interested in materials as a junior in chemical engineering when she sat in on a semiconductor processing course. From there her summer experience in the microelectronics department at McDonnell-Douglas and her research in graduate school led her into solving the problems of metals in electronic materials applications. One of Mohney's main interests is studying the relationships between semiconductors and the metal contacts used to get current in and out of them.

"The reaction between a metal contact and semiconductor can be both good and bad," Mohney explains with a smile. Good because a controlled reaction can be used to engineer the interface properties, and bad because an uncontrolled reaction can produce irreproducible results or even consume the semiconductor and ultimately destroy the device properties. "We're trying to find out what it is about the reaction that leads to good properties," she says.

By "good properties" Mohney means low-resistance contacts. One of the main problems with semiconductor technology is that a great deal of power can be lost at the point of contact between dissimilar materials such as a metal–semiconductor interface. So Mohney is studying the interface to find out how to make a better contact. After depositing the contacts via physical vapor deposition or electrodeposition and patterning, the contact and semiconductor are annealed in a rapid thermal annealing (RTA) furnace to get a reaction between contact and semiconductor. Mohney and her students have studied the thermodynamics and kinetics of the semiconductor–contact interface after annealing, and although the group studies several varieties of semiconductors it is the results for gallium nitride and silicon carbide that they find most interesting.

"The formation of a thin nitride layer between gallium nitride and the metal contact is important," Mohney stresses. "And the annealing gas is important for some of the semiconductors." The thin interfacial nitride layer that forms between the semiconductor and metal contact is the key to a low-resistance contact to n–type gallium nitride.

Because of the intensity of the applications it is used in, "stability is a big issue for silicon carbide," says Mohney. As part of a collaborative effort, her group is the first to report that a metal boride contact on silicon carbide will remain stable even when heated to extremely high temperatures. This feature makes it an excellent candidate for high temperature applications like transistors for automobile engines.

Ceramic Muscle

Many of us grew up with the space shuttle as just another fact of life. For Susan McKinstry, assistant professor of ceramic science and engineering, it provided the spark that led to a career in materials science and engineering. After her first year in college with a double major in aeronautical engineering and ceramic science, McKinstry found herself drawn to the ceramics side and quickly became immersed in materials.

These days McKinstry finds herself interested in ceramic materials on a much smaller scale. In her no-nonsense manner, McKinstry begins explaining how researchers have miniaturized a mass spectrometer to minuscule dimensions (one by two by one-half inch square she indicates with her fingers), and how it could be used to monitor environmental pollutants. But the miniaturized mass spectrometer is missing the vacuum system for gas delivery. And she explains how DNA analysis has been miniaturized onto a chip, but there isn't a way to transport the sample fluid on the wafer. "So how can you move things," asks McKinstry. Out of four options (thermally, magnetically, electrostatically, or piezoelectrically), McKinstry chooses piezoelectrically as the best method. The problem is that these miniature applications require miniature—thin film—materials.

McKinstry began studying piezoelectric thin films in graduate school. Today, she and her students make piezoelectric thin films using four methods—sol-gel, pulsed laser deposition, magnetron sputtering, and ion beam sputtering—depending on the film size, chemistry, complexity, and need for controlled layer orientation. It sounds simple enough, but thin film materials come with a special set of problems. In bulk piezoelectric materials the motion of the domain walls under an applied electric field—called the extrinsic property—supplies about one-half of the total piezoelectric coefficient. At the thin film scale, piezoelectric materials like lead zirconate titanate (PZT) end up with only half the normal piezoelectric coefficient. It seems, McKinstry has discovered, that the extrinsic property of piezoelectric materials isn't active in thin film form. So where does one turn for a little more muscle? "Change the processing conditions," says McKinstry. "Or try different materials."

The current standard for thin film piezoelectric materials is zinc oxide. McKinstry wants to make piezoelectric thin films that are a hundred times more active than zinc oxides; materials that can be used for biomedical ultrasound devices with resolutions high enough to detect skin cancers and defects in the eye, or in catheter applications to look at blood vessels near the heart. Currently she's studying lead magnesium niobate–lead titanate (PMN–PT) which exhibits a much higher piezoelectric coefficient than PZT "even in films," says McKinstry.

To make better piezoelectric thin film materials, McKinstry is using spectroscopic ellipsometry (SE) to analyze their structure. This nondestructive evaluation technique gives Angstrom scale resolution and allows McKinstry to study the material's buried interfaces. "It's only light." she says. And as long as she can get light in, she can get back information without destroying the sample. She uses spectroscopic ellipsometry to monitor the microstructure of the piezoelectric films and how the microstructure changes as the materials are annealed. She can then adjust the processing conditions to improve the final result. A second SE that can collect data as fast as every sixty milliseconds is being used in collaborative work to study superconductor sandwiches as they grow.

Superconductor Sandwiches

Darrell Schlom doesn't look like a radical. But in the 1980s, while in graduate school at Stanford, Schlom did something radical. He got interested in high temperature superconductors and along with his advisor decided that molecular beam epitaxy (MBE) might be a good way to make them. Back then it wouldn't have been advisable to start dumping yttrium, barium, and copper—materials Schlom calls "death to semiconductors"—into an MBE machine that was used only for growing semiconductors. But at Stanford Schlom was close to Varian, and the company just happened to have an old MBE machine that they had recently discarded. So they let him use it to try to grow high temperature superconductors. "And it worked," says Schlom.

It's been ten years since then. Schlom, now an assistant professor of materials science and engineering at Penn State, has his own MBE system dedicated to growing perovskite oxides. In that time Schlom has grown a lot of superconductors using MBE. But just growing high temperature superconductors isn't Schlom's focus anymore. Today it's all about control. For Schlom control is such an issue that he had his MBE machine built with atomic absorption analysis—the first ever commercial machine to incorporate this feature. It allows him to measure the spray being released into the MBE vacuum chamber in real-time and adjust it to maximize a layer's smoothness as it grows.

Schlom's focus has also shifted away from just growing superconductors. "We're trying to put together a superconductor material with other materials like metals and insulators," he says. Like the layers of a BLT, they lay down the elements one at a time in precisely controlled layers to make perfect sandwiches of superconductor, insulator, superconductor—a Josephson Junction sandwich. In addition to superconductor structures, Schlom is working on other perovskite structures like ferroelectric materials. Using this controlled MBE technique, Schlom and his students have been able to grow lead titanate structures that are 700 Angstroms thick and as smooth as the substrate they are grown on.

Smoothness is important for all the perovskite structures, and even more so for the Josephson Junctions. Schlom wants smooth layers—the smoother the better because he doesn't want any reactions between the layers. Just smooth, thin, surfaces for his Josephson Junction sandwiches. So far the smoothness of Schlom's MBE grown superconductors isn't great. The surface gets rougher as the layers grow. But Schlom thinks it's still just a matter of control. The structure of a high temperature superconductor is much more complex than that of other perovskite oxides that he has been able to grow. As more analysis equipment is added into the growth equation, Schlom expects that it will become easier to reach the smoothness levels required for superconductor sandwiches.

Ask Schlom what he plans to do with the Josephson Junctions, and he explains that what he is trying to do is find the growth conditions for these sandwich structures that will yield the smoothest possible surfaces—a "sandwich recipe" so to speak. And after he's found it, he'll move on to another type of sandwich. "We're in the sandwich making business. We're not in the sandwich manufacturing or sandwich selling business," says Schlom. The market

Continued on page 10

How do you move things?

—Susan Trolier-McKinstry

We're in the sandwich making business.

—Darrell Schlom

Penn State Materials Puzzle

by June Heywood

Materials science and engineering, like the pieces of a puzzle, is a complex melange of disciplines that when snapped together form a complete picture.

At Penn State, the materials science and engineering puzzle is gigantic. Nearly 200 faculty work on materials or materials related research. A rough approximation of the research dollar value places it at $50 million per year. Putting together a puzzle of such complexity is like the double-sided "impossible" puzzles. Over the years, people gathered pieces of the Penn State materials puzzle together into labs and centers, but an overall image never emerged.

In 1992, the University established the Materials Research Institute (MRI). Chaired by then senior vice president for research, David Shirley, the MRI brought together representatives from the "completed sections" of Penn State's materials puzzle. These representatives were charged with establishing a method to obtain the big Federal block grant funds. For the next five years MRI tried various methods to get these big contracts without success.

What did MRI accomplish? It outfitted a new materials research building in the Penn State Research Park. It opened up new channels for communication. It helped us see our weaknesses and strengths. But it didn't get new funding.

With Shirley's departure at the end of 1996, the MRI was reorganized and slightly more than a year later has emerged with a new focus and new goals. Its new director, Carlo Pantano, professor of materials science and engineering and director of the Materials Characterization Lab, says "we can't do everything together, but what can we do to make the sum greater than the parts?" He is focusing on the common ground: students and facilities.

First, it is obvious to everyone at Penn State that being one of the largest and most diverse materials research universities is not always a blessing. Although it all makes sense from the inside, Penn State's organizational structure can be confusing for potential students and faculty. Many can't find their niche and so opt for other universities with more defined boundaries and smaller programs. Pantano proposes that one function of the MRI should be presenting the entire Penn State materials community in a way that makes sense to the outside eliminating the need to explain the relationships over and over again at every faculty interview or student visit.

Secondly, "facilities are a pain," Pantano says bluntly. "Access to them needs to be more straightforward." In addition, many of Penn State's facilities are no longer on par with what's available elsewhere; especially in key areas that are becoming much more important in the materials arena. Discussions across campus suggest that there are three key areas in which Penn State could capitalize on its considerable capabilities if it has the proper support in terms of facilities and faculty expertise. These areas are materials for medicine, materials for telecommunications and computers, and materials for transportation and energy conversion.

By identifying technologies—instead of specific materials—that will require the combined research efforts of scientists and engineers across disciplinary boundaries to solve complex problems, Pantano hopes that new beneficial linkages will be formed. To begin the process, and at the same time improve Penn State facilities and attract new research dollars, Pantano suggests simply looking at what current faculty need right now to enhance their research and where new faculty appointments could help nucle-

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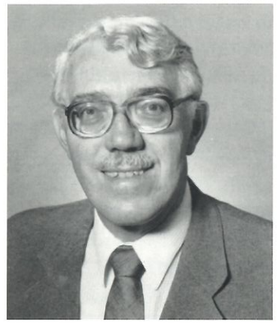
department news

Two Retire from the Faculty



Robert E. Newnham, Alcoa Professor of Solid State Science and associate director of the Materials Research Laboratory, has retired from the faculty as professor emeritus. He has been a member of the faculty since 1966, when he came to Penn State from MIT as an associate professor. He was appointed as professor in the Department of Materials Science and Engineering in 1970, and served as chairman of the Solid State Science Program of the Graduate School from 1972 to 1990. He was named Alcoa Professor in 1987, and elected to the National Academy of Engineering in 1989.

Newnham is known worldwide for his work in ferroelectric materials, particularly electroceramics, composite materials for electronic applications, and currently, smart materials. Among many other achievements, he discovered polar glass-ceramic pyroelectric sensors, and a new class of composite thermistors and chemical sensors, and pioneered the development of composite piezoelectric transducers.

He is author or co-author of more than 500 research papers and three books: *Structure-Property Relations* (1975), *Classic Crystals* (1987), and *Piezoelectricity* (1992). For his research contributions he received the Citation Classic Award in 1987, the American Ceramic Society's E. C. Henry Award for the Best Paper of the Decade 1979-1988, the Distinguished Merit Award of the University of Illinois in 1989, the Real Advances in Materials Award of the National Association of Technical Societies in 1994, numerous 'best paper' awards, and 13 patents.

Professor Newnham's teaching ability was apparent from the start of his Penn State career, and was recognized by the Wilson Award for Outstanding Teaching from the College of Earth and Mineral Sciences in 1972. In 1985 he received a distinguished speaker award from the Institute of Electrical and Electronic Engineers, and in 1990 the Outstanding Educator Award of the Ceramic Education Council. In addition, Newnham has served as a distinguished speaker at numerous universities.

He served as vice chair of the U.S. National Committee for Crystallography and as a member of the National Research Council Solid State Sciences Committee, as president of the American Crystallographic Association, and counselor of the American Ceramic Society, and served as co-editor of the *Journal of the American Ceramics Society* for ten years.

Among his honors are Penn State's Faculty Scholar Award (1984), the John Jeppson Medal (1991), the International Ceramics Prize of the Academy of Ceramics (1992), the Centennial Award of the Ceramics Society of Japan (1991), and the Albert Victor Bleininger Memorial Award (1995). He received the Humboldt Senior Scientist Award in 1994 and was named a Distinguished Life Member of the American Ceramic Society.

Newnham received a B.S. in mathematics from Hartwick College, M.S. in physics from Colorado State University, Ph.D. in physics from Penn State, and Ph.D. in crystallography from Cambridge University (U.K.). He served as a research fellow at the Cavendish Laboratories, Cambridge, and subsequently as assistant and associate professor at the Massachusetts Institute of Technology.

In retirement he continues his research at the Materials Research Laboratory.

Peter A. Thrower has retired from Penn State as professor emeritus of materials science. He has been a member of the faculty in the Department of Materials Science and Engineering for twenty-nine years, and since 1980 has served as coordinator of the department's graduate program. Thrower received B.A., M.A., and Ph.D. degrees in physics from Cambridge University, U.K., and served as a scientific officer at the U.K. Atomic Energy Authority at Harwell from 1960 to 1969, before joining the Penn State faculty as an associate professor.

He is a specialist in carbon materials, graphite, and carbon composites. Thrower has served

Upcoming Events

August 8, 1998
Summer Commencement Ceremonies
Undergraduate Degrees: Bryce Jordan Center
The Graduate School: Eisenhower Auditorium

October 1–2, 1998
Industrial and Professional Advisory Committee (IPAC) Meeting
Department of Materials Science and Engineering

October 8–9, 1998
Annual Cooperative Program in Metals Science and Engineering
For more information contact the metals program office: (814) 865-5446.

October 15–17, 1998
Penn State Ceramics 75
PCA 53rd Annual Ceramic Forum and Ceramic Science and Engineering 75th Anniversary Celebration
For registration materials contact:
Ms. Carey Shuey, (814) 865-4992

December 20, 1998
Winter Commencement Ceremonies
Undergraduate Degrees: Bryce Jordan Center
The Graduate School: Eisenhower Auditorium

as editor-in-chief of the international scientific journal *Carbon* since 1983, and will continue in this position following his retirement. From 1973 to 1998 he also supervised the production of volumes 8 to 26 of *Chemistry and Physics of Carbon*, serving ten years as joint editor and fifteen years as editor of these volumes.

Professor Thrower has an outstanding reputation for his undergraduate instruction, and taught the basic introductory course in materials science for twenty years, in addition to advanced classes in electron microscopy and carbon and graphite materials. His general education course on materials regularly drew one of the highest enrollments at the University. In 1991 he turned his class notes into a textbook, *Materials in Today's World*, published by McGraw Hill; a second edition was printed in 1992. His teaching achievement was recognized by the College of Earth and Mineral Sciences in 1991 with the Matthew J. and Anne C. Wilson Award for Outstanding Teaching, and in 1998 he received the University's Milton S. Eisenhower Award for Distinguished Teaching.

Thrower served as a member of the University Faculty Senate from 1979 to 1998, and since 1992 as a member and subsequently chair of the University Promotion and Tenure Committee. He also serves as a member of the Executive Committee of the American Carbon Society. In retirement he will return to his family home in Cambridgeshire, England.

Excerpted from the EMS Bulletin, *Volume 67, No. 2.*

New Undergraduate Departmental Scholarship

Charles and Donna Carson have pledged $25,000 to endow a new undergraduate scholarship in the Department of Materials Science and Engineering. The "Charles G. and Donna H. Carson Scholarship in Materials Science and Engineering" will provide recognition and financial assistance to outstanding undergraduate students who enroll in the department. Only students who have achieved superior academic records and manifest promise of outstanding academic success will be eligible for the scholarship.

Charles Carson received his M.S. and Ph.D. degrees in metallurgy from Penn State in 1966 and 1970. He is the vice president for environmental affairs at U.S. Steel in Pittsburgh, Pennsylvania. His wife Donna is also a Penn State alum. Their support of the undergraduate materials science and engineering students is greatly appreciated.

Metals Centennial Fellows Show their Appreciation

The graduates of the Metals Science and Engineering Program who were recognized as Centennial Fellows of the College of Earth and Mineral Sciences have established an endowed fund to acknowledge the special honor they were afforded in being recognized during the College's Centennial Celebration. The fund, which shall be known as the "Metals Science and Engineering (Metallurgy) Centennial Fellows Fund," is intended to provide money that will enrich the Metals Science and Engineering Program within the Department of Materials Science and Engineering. The Metals Science and Engineering Centennial Fellows have contributed an initial amount to the fund. Additional contributions may be made by any interested persons or organizations.

The fund is designated for activities that will enhance the Program, and appropriate expenditures will include student attendance at and travel to conferences and seminars, equipment purchases for metals laboratories, stipends for visiting lecturers and speakers, or to support faculty development especially in promoting industrial interactions.

EPM Program Receives First Scholarship

The Hamer Foundation has pledged its financial support for a new undergraduate scholarship in the Department of Materials Science and Engineering. The scholarship will be called the "Donald W. Hamer Scholarship in Electronic and Photonic Materials in the College of Earth and Mineral Sciences," and will provide financial support and recognition for undergraduates who have proven academic success.

This pledge of support is the first endowed scholarship for the Electronic and Photonic Materials Program that was established in 1995 to provide students with the skills to succeed in the industries that depend on materials scientists for advances in devices that we rely upon everyday. This scholarship is a great step forward for the program and its ability to educate students in this expanding, and interdisciplinary, area of materials science.

Donald Hamer, who heads The Hamer Foundation, founded State Of The Art, Inc. in State College which is a manufacturer of thick and thin film resistive products. It employs many graduates of Penn State's materials programs.

75th Anniversary of Penn State Ceramics

This year the Ceramic Science and Engineering Program is celebrating its 75th Anniversary. The original Department of Ceramic Engineering was established in 1923 deriving from courses taught by metallurgy and geology professors as early as 1911. Since then it has evolved to its current state within the Department of Materials Science and Engineering.

In honor of the 75th Anniversary, the ceramics program and the Pennsylvania Ceramics Association will co-sponsor the 53rd Annual Ceramic Forum—an event that dates back to the early days of Penn State Ceramics. This year's forum will highlight Penn State's current ceramics facilities and expertise. The second day will feature Penn State affiliated materials scientists and focus on Advances in Ceramics Technology. The day will culminate with Dr. Robert E. Newnham's inaugural address and the presenation of the Alumni Achievement Award in Ceramics.

Saturday morning has been set aside for a tailgate party before the 1998 Homecoming Game vs. Purdue University. It will be held behind the Materials Research Lab for all those who attended the meeting. For additional information, or registration materials, contact Ms. Carey Shuey in the ceramics program office at 814-865-4992.

Golden Anniversary McFarland Award Recipient Richard Shultz (second from right) and his wife Betty (center) talk with students Rachel Schwartz and Keith Williams at a reception just prior to Shultz's presentation of the annual McFarland Lecture.

McFarland Award Golden Anniversary Celebration Held

In 1920, David Ford McFarland arrived at Penn State and served as head of the Department of Metallurgy from 1920 to 1945. During that time McFarland had a profound influence on the department and the more than 400 students who graduated under his guidance. His influence is still felt today as many of these graduates have gone on to become leaders in the world metals industry.

It was fifty years ago this year that the David Ford McFarland Award for Achievement in Metallurgy was first conceived and bestowed upon a Penn State alumnus by the Penn State Chapter of ASM International. The award was named for McFarland not only to honor him, but also to lend the activity the dignity of his name. H. M. Davis, who suggested that the award bear McFarland's name, wrote, "It is a measure of the esteem in which Dr. McFarland was held, that no other name was ever suggested." In the winter of 1948–49, David McFarland presented the first award to George V. Luerssen ('15), and annually another Penn State alumnus has been honored for his contributions to the metals industry.

In celebration of the Golden Anniversary of the McFarland Award, ASM International and

the Metals Science and Engineering Program hosted a full day symposium on Friday, April 24, featuring Penn State alumni and focusing on *Metals Into the 21st Century*. Professor K. Osseo-Asare, chair of the Metals Science and Engineering Program, opened the symposium with an African proverb. "You can see the moon from your own back yard, so why do we come together to look at the moon? It is to let our visions interact." He encouraged everyone to use the symposium as a family reunion. And indeed it was much like a family reunion for many of the previous McFarland winners, alumni, former faculty, current faculty, students and staff who had a chance to visit and reacquaint themselves with people they had not seen for many years.

The symposium covered the economics of today's metals industry, trends in metals processing technology, applications for metallic materials, and the environment and the metals industry. Materials science and engineering department head, Richard Tressler commented on the appropriateness of the symposium as a guide for the department as it structures its educational and research agendas in response to the future needs of industry.

The Golden Anniversary McFarland Award recipient was Dr. Richard Shultz who received his Ph.D. in metallurgy from Penn State in 1970. Shultz is presently the vice president of technology for Cleveland Cliffs Reduced Iron Corp. and director of ironmaking technology for Cleveland Cliffs, Inc. Prior to joining Cleveland Cliffs, Shultz spent 24 years (right out of graduate school) with Armco Steel Corp—first in research and development and later as general manager of technical services for the Corporate Business Development Group. Shultz is active in several professional societies and is a recipient of the prestigious Ironmaking Merit Award from the Ironmaking Division of ISS. He is an EMS Centennial Fellow and has been an active member of his community.

The 50th Anniversary Weekend concluded with Schultz's presentation of the Annual McFarland Lecture titled "Raw Material Challenges of the Dynamic New Steel Industry, Will They Be Met?" and the annual McFarland Banquet that evening where Shultz was officially presented with the award.

Graduate Study Fellowship

People who have been working in industry and now desire to return to school for graduate study on a full-time basis in metals science and engineering, may be especially interested in the Helen R. and Van H. Leichliter Graduate Fellowship. The fellowship supplements the normal graduate assistantship to provide a total stipend of $20,000 per year. Active areas of research in the program include aqueous processing, corrosion, crystallography, deformation and fracture, electrochemistry, electronic materials, laser processing, metallization, nanocrystalline materials, numerical simulation of transport processes, phase transformations, and welding. For additional information on the Leichliter Fellowship, contact Professor Suzanne Mohney via e-mail at mohney@ems.psu.edu.

BETTER.
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for these sandwich recipes is huge. The military is already using low temperature superconductors for highly sensitive detectors, but it would rather use high temperature superconductors. The commercial sector want to use them for very fast electronics and digital devices. Superconductors may no longer be, as Schlom calls it, "pie in the sky," but someday you might just find one in a sandwich.

The Future

Over the next century the need for better materials for electronic applications will continue to grow. The materials subspecialties of ceramics, metals, and polymers will all be tapped as the world's desire for smarter, thinner, faster, and better materials draws on all areas of materials. Penn State's Department of Materials Science and Engineering has recognized the need in this area and several years ago established an undergraduate specialization option within the department called the Electronic and Photonic Materials Program (EPM). Randall, Mohney, McKinstry, and Schlom are core faculty within the program. Along with other faculty from the Ceramic Science and Engineering Program and new faculty to be jointly appointed between the new program and the Polymer Science and Engineering Option, they will form the basis for Penn State's continued materials science excellence and leadership throughout the Information Age.

PUZZLE.
Continued from page 6

ate the linkages. Then, with financial support from MRI, new faculty would be hired and given the responsibility of establishing new multidisciplinary programs and facilities. Facilities that could be shared by all the faculty across campus who need them to do their research. It is important to note that the new faculty would be hired as joint appointments between "whichever departments make the most sense," says Pantano. Like a many-tentacled octopus reaching out to work with faculty in multiple areas, the new joint appointments and shared facilities would be the foundation from which a new Penn State strength could grow.

It is a different approach than Penn State's usual method of combining everyone in a big pot, stirring it up, and waiting to see what emerges. But with a proposed $2.5 million budget that would provide support for everything from joint faculty salaries, graduate fellowships, and facilities support, this plan could uncover the pieces that are needed to complete the Penn State materials puzzle.

alumni news

Eighties

Mari Lou Balmer-Millar ('89 Ceramics) is a senior research scientist at Pacific Northwest National Laboratory. She studies catalyst characterization and development, phase diagram determination, crystal structure, and zeolite development.

Peter F. Baumann ('81 Metals) is a senior materials engineer with Keane Inc., in North Haven, Connecticut. He is working on a Ph.D. in materials science at Polytechnic University, and is chairman of the ASTM B07 Committee on Light Metals and Alloys.

Craig M. Berkey ('83 Ceramics) is an operations manager at AVX.

Jim Bienemann ('87 Ceramics) is an account manager with Betz Dearbon, Inc.

Andrew K. Birchenall ('84 Metals) is a senior research engineer at DuPont Central Research in Wilmington, Delaware. He has received the Westinghouse Signature Award and the DuPont Engineering Excellence Award.

Darryl P. Butt ('84, '91 Ceramics) is a section leader at Los Alamos National Laboratory. He received the American Ceramic Society Robert L. Cable Award for Young Scholars in 1997, and the Distinguished Performance Award from Los Alamos National Lab in 1995.

Robert J. Butera ('82, '83 Polymers) received his Ph.D. in 1988 from Case Western Reserve. He is employed by DuPont.

Gary M. Carinci ('85 Metals) is a product metallurgist working with customers on applications of stainless steel. He is employed by Allegheny Ludlum Corp.

C. C. Charma ('83, '86 Metals) is a senior lecturer in physical metallurgy at the University of Zambia School of Mines. Formerly he was head of the Department of Metallurgy and Mineral Processing and assistant to the dean for graduate studies.

Denise A. (Stockunas) Clayton ('83 Polymers) works as a product assurance quality engineer in aerospace on the space shuttle program for Lockheed Martin Manned Space Systems in New Orleans, Louisiana. She received a "Silver Snoopy," the highest award the Astronaut Corps gives to shuttle contractor personnel.

Phil D'Annibale ('81 Metals) is a product engineer with Central Sprinkler Co.

Sandra (Pifer) Davis ('85 Polymers) has worked at Quantum Chemical Corp. for nine years doing technical service support for the colors and compounds business area. She was the Society of Plastics Engineers' (Colors and Appearance Division) Technical Program Committee Chair for 1997 RETEC.

Melanie Kramer DelleCurti ('87 Polymers) is the computer projects coordinator for

1998 Hosler Medal Awarded to Ceramics Alumnus

Charles Greskovich, has been named the 1998 recipient of the Charles L. Hosler Alumni Scholar Medal. The Hosler Alumni Scholar Medal is the highest honor given by the College of Earth and Mineral Sciences. It was established in 1992 to honor the career achievements of Dr. Charles Hosler, the College's eleventh dean, and to recognize "an alumnus who has made outstanding contributions to the development of science."

Greskovich received his B.S. in ceramic technology in 1964, and his M.S. and Ph.D. degrees in ceramic science in 1966 and 1968, respectively—all from Penn State. After graduating he was awarded an NSF post-doctoral fellowship to study with Professor Schmalzried at Clausthal Technical University in Germany. In 1969 he became a staff ceramist at GE's Corporate Research & Development Center in Schenectady, New York.

Greskovich's research has been in optically transparent, polycrystalline ceramics that are useful in a number of applications. He is co-inventor of the first efficient ceramic scintillator composed of multicomponent rare earth oxides that are now used in nearly all CT-body scanners sold by GE. The uniqueness of this ceramic scintillator and his work resulted in twelve U.S. patents and several awards.

Greskovich has also worked on non-oxide ceramics and been recognized for his scientific achievements in the area including receiving the Ross Coffin Purdy Award of the American Ceramic Society for the paper "Sintering Covalent Solids." His continued work on these solids including Si_3N_4 resulted in a novel densification process called "gas pressure sinter process" that is used by several materials companies.

Greskovich is a Fellow of the American Ceramic Society and a member of the Electrochemical Society and Materials Research Society. In 1991 he was selected as a Coolidge Fellowship winner—GE Corporate Research and Development Center's highest honor—for his development of technologically important ceramic materials and his outstanding contribution to the advancement of ceramic science and engineering. Greskovich has published more than fifty refereed papers and been awarded 43 U.S. patents.

PLASTIKOS, Inc., an injection molding company. She was married to John DelleCurti, Jr., in 1994.

James A. DerKacy ('86 Ceramics) is employed with Weirton Steel Corp. He received his MBA from the University of Pittsburgh in June 1995.

Gregory Dries ('77, '80 Metals) is developing steel alloys at U.S. Steel for heavy product operations. He has previous experience in the nuclear fuel industry and in composite materials for satellite applications at NASA. He has recevied several awards and holds two patents.

Brady R. Dunbar ('80 Metals) has worked at the Ravenswood Aluminum Corp. since 1980. Currently he is the metallurgical section manager of 5000 series alloys.

Kenneth J. Fioravanti ('83 Metals) received a Master's in materials science from Rensellaer Polytechnic Institute in May 1985. He is employed by Air Products and Chemicals as an account director and handles all issues related to Alcan, Alcoa, Alumax, Allegheny-Teledyne, Ameristeel, Reynolds, Steel Dynamics, and USS. He holds three U.S. patents and has authored or co-authored twelve technical publications.

Chris Fiorilla ('89 Ceramics) has been a patent examiner in the ceramic and plastic molding and treating art areas with the U.S. Patent and Trademark Office since 1989.

Francis J. Fitz ('81 Ceramics) received his MBA from Penn State in 1986 and is working as a process engineer in the ferrite department of Magnetics—a division of Spang & Co.

Frank E. Fonner ('81 Metals) is currently on the staff of the Association of Iron and Steel Engineers where he is "deeply involved in producing the 11th Edition of *The Making, Shaping, and Treating of Steel*."

Robert S. Gallagher ('88 Ceramics) is a member of an internal operation at Texas Instruments that is responsible for glass–to–metal sealing and chemical plating for applications in pressure sensors and motor protectors.

James Gill ('89 Ceramics) is an engineer with Heraeus-Electro-Nite in Philadelphia.

William E. Griffith ('85 Ceramics) is the vice president and owner of Innovative Molding Products.

Mary E. Hancock ('84, '86 Polymers) is the technical director and ISO management representative at Insultab, Inc. in Woburn, Massachusetts. She was married ten years ago in the Penn State Chapel to **Lawrence Hancock** ('83, '85, '88 Polymers) who is a senior manager of biomaterials at Circe Biomedical in Lexington, Massachusetts. They have two children: Morgan and Seth.

Michael J. Hanner ('87 Polymers) has been working as a product development engineer in styrenic polymers for Chevron Chemical Co. since June 1993.

John E. Havrilla ('89 Polymers) works in the designed plastics manufacturing division of Gencorp. He recently received certification as a Six Sigma Blackbelt.

Clyde C. Hepner, Jr. ('82, '84 Metals) has been employed by Texas Instruments since leaving Penn State. He works in the semiconductor division supporting wafer manufacturing.

Jeffrey E. Hoyle ('81 Metals) is a manufacturing manager with Lin Engineering in Santa Clara, California. He was married in September 1996 to Catherine St. Pierre of San Jose, California. While a U.S. Naval Officer (1981–1994) he received three Navy Commendation Metals, two National Defense Medals, and a Humanitarian Service Award.

Dave Hrinak ('80 Ceramics) is a senior sales representative for Fisher-Rosemount in Pittsburgh.

Thomas J. Jesberger ('80 Metals) is the director of engineering for Abbot Furnace Co., primarily designing industrial furnaces for sintering, brazing, annealing, or other processes using atmospheres of nitrogen, hydrogen, argon, etc., up to temperatures of 2400°F.

Herb Johnson ('89 Ceramics) is a technical development manager at AFG Industries, Inc., specializing in pyrolytic low emissivity coated glass.

David W. Koller ('82, '84 Metals) is a senior process metallurgist and laboratories manager with Standard Steel.

David M. Kophazi ('84 Polymers) is a molding department manager and management representative for quality assurance with Scientific Systems, Inc. in State College.

Cynthia J. Labant ('85 Ceramics) is a R&D engineer for incandescent lamp manufacturing at Osram Sylvania, Inc. She holds two patents.

Brian Lacey ('89 Ceramics) is a process engineer at Plastek Industries. He was married on September 14, 1996.

David Lach ('80 Metals) is in energy and product engineering at Air Products and Chemicals, Inc. He holds one patent and has co-authored four technical papers on steelmaking and combustion.

Paul Laverty ('82 Metals) left his day job as an environmental engineer to make pottery full-time.

Keith B. Lew ('88 Ceramics) has been a ceramic engineer and a supervisor of the glaze line and glaze preparation at American Marazzi Tile.

Robert B. Longwell, III ('88 Metals) is a metallurgist with Phelps Dodge Specialty Copper Products.

Lee M. Luckasevic ('84 Polymers) is a technical manager at Polycom Huntsman, Inc. He has three children: Lee, Jr., Bobby, and Stephanie.

Steve Lytle ('79, '81 Ceramics) is in integrated circuit development at Lucent Technologies, Bell Labs. He was promoted to technical manager in 1996.

Susan (Weaver) Manchester ('87 Polymers) is a part-time artist, manager of her husband's art business, and gallery manager. Which she says is "a little divergent from polymer science."

Brian G. Martin ('86 Fuels) is the director of power boilers for Kvaerner Pulping, Inc. and is responsible for product management and pre-contract activities for the fluid bed boiler product line.

John Henry Mazza ('87 Polymers) is a synthesis and formulation chemist for packaging epoxy-based coatings for the beer, beverage, and food can market at The Valspar Corp.—"the number one packaging coating supplier in the world."

David J. McGhee ('83 Metals) is a QA manager of finishing at J&L Specialty Steel, Inc.

Arlene K. McMahon ('83 Ceramics) has worked for Corning, Inc. for fourteen years in the area of melting and glass technology. She and her husband recently had a daughter, Stephanie.

Daniel S. Minehan ('86 Polymers) has been a polymer specialist at the American Cast Iron Pipe Co. for the past four years.

Dawne Moffatt-Fairbanks ('85, '89 Ceramics) is a development scientist in advanced display products at Corning, Inc. She studies glass substrates for flat panel displays—specifically liquid crystal displays. She was married to Ted Fairbanks in July 1996.

Kenneth J. Nalwasky ('87 Metals) is a sales manager for Engineering Metals Co.—a specialty steel distributor.

Kathleen O'Donnell ('81 Polymers) is the European consumer products R&D manager for Johnson and Johnson in Dusseldorf, Germany. She is married to **Thomas Weaver** ('81 Polymers) who is employed by Dow Chemical.

Robert W. Owsiany ('85 Ceramics) purchased a division of Ferro along with other investors in 1993 and formed FMP, Inc.

Mark Pavlik ('82 Ceramics) is the head coach of the Penn State mens volleyvall team. He writes, "all that refractory work prepared me for dealing with all the brickheads I now have on my team!"

Sandra Peden ('83, Metals) is a certified quality engineer and manager at Wheeling–Pittsburgh Steel Corp.

Edward Pisowicz ('85 Polymers) is the national accounts manager for Tensar Environmental Systems, Inc., a manufacturer of geosynthetic materials used in the waste containment industry.

Joel Reed ('82 Ceramics) is a program director at Nortel for implementing new processes and systems to support the millennium. He has been married for thirteen years to his "wonderful wife Kim" and has two sons. He holds three U.S. Patents, and has received three awards from Nortel.

Kevin D. Regan ('81 Ceramics) is a senior sales representative to the iron and steel market with Harbison-Walker Refractories in Pittsburgh, Pennsylvania.

Greg Ross ('89 Polymers) is employed by Air Products and Chemicals, Inc., and is working on his MBA.

Steve M. Rowles ('87 Polymers) was promoted to the eastern regional manager (sales) for Church & Dwight Co., Inc. (better known as Arm & Hammer) on 7/23/96—the same day his first child was born: Benjamin Austin Rowles, 6 lbs. 14 oz. His wife is Susan Rowles ('89 HPA).

Mark S. Schindler ('84 Polymers) is a high school chemistry teacher at the DuBois Area High School.

Richard A. Shelleman ('83, '88 Ceramics) works on ceramic packaging development (especially in lamination, sintering, and distortion measurement for multilayer ceramic substrates) at IBM in the microelectronics division.

Gary T. Shipe ('82 Ceramics) is employed at Air Products and Chemicals. He received the Stockpole Corporation's Presidents Award for Technical Innovation.

Frank M. Simonutti ('87 Polymers) is a senior polymer chemist with Wilson Sporting Goods, and works on developing golf balls and other sporting goods products. He holds three U.S. Patents and has eight others pending.

Scott Snyder ('80 Metals) has been an electroacoustic development engineer, currently at the senior position, with Shure Brothers, Inc. He designs, builds, and tests microphones and related audio products.

Michael E. Starsinic ('80, '82, '84 Polymers) is a project manager at Montell, USA, Inc., developing polypropylene applications and coordinating technical programs with large customers. He is also part owner of a small company specializing in developing applications for hydrodegradable polymers. He established the Mike Starsinic Award in Polymer Science in 1995, and was an EMS Centennial Fellow.

David J. Stecko ('83 Metals) is the director of corporate purchasing with Fina Oil and Chemical Co.

Yukihiro Sugimoto ('84 Fuels) is the assistant general manager of the materials production department at Sumitomo Metal Industries, Ltd.

Joseph A. Sychterz ('82, '84 Metals) is the deputy regional maintenance officer at Norfolk Naval Shipyard. He is enrolled in the Educational Specialist Program at the College of William and Mary in pursuit of a doctoral degree in Higher Education and Leadership.

Izumi Takeuchi ('80 Metals) is the general manager of the pipe and shape department at Sumitomo Metal Industries, Ltd.

Cathy A. (Kreutzer) Taylor ('85 Polymers) is working in coatings and resins R&D for PPG Industries, Inc. She received a U.S. patent for "Automotive Refinish Primer Surfacer."

Philip H. Taylor ('84 Fuels) is supported 100 percent by research grants at the University of Dayton Research Institute. He received an EPA STAR Award in 1994.

Julius Thomas ('83 Metals) is a quality control metallurgist with National Roll Co.

Carol T. Thompson ('88 Ceramics) worked as a rubber-to-metal adhesive chemist at Lord Corporation in Erie, PA, for nearly eight years, and has one patent. She was married to Scott Thompson in 1994.

David J. Thompson ('83 Polymers) is employed at Chevron Chemical Co. with experience in application and product development. He has received recognition from Chevron for three development products that have accounted for 25MM pounds/year in new sales volume.

Jill Fritz Thompson ('87 Polymers) is a senior development engineer with Tenneco Packaging in Canandaigua, New York. She holds three patents for microwavable deli container design and improved microwave heating.

Thomas F. Vezza ('81 Ceramics) is a refractories specialist with North American Refractories Technical Center. He develops and improves refractories used in steel, glass, aluminum, metals handling, and cement applications. He holds three U.S. Patents.

Gary R. Walters ('85 Polymers) is the senior systems analyst and PC guru at Cytec Industries. He and his wife, Adrienne, are the proud parents of two daughters, Melissa and Katherine.

David E. Wert ('81 Metals) is a metallurgist with Carpenter Technology Corp. focusing on tools and alloy grades research and development. He received an R&D 100 Award and a NASTS Award for developing AerMet, 100 Alloy.

Michael Yard ('89 Polymers) works at Mannington Resilient Floors in the area of vinyl compounding, epoxy and polyester compounding.

Michael Zientek ('86 Ceramics) is a research engineer with Schuller International, Inc. in the filtration division and is involved in the development of glass microfiber.

Nineties

Ronald A. Andrekanic ('95 Polymers) studies polyester, plasticizers, and PVCs at Aristech Chemical Corp.

Ruth Ann Dudenhoefer Bambauer ('87, '90 Ceramics) is a project leader for developing refractory coatings at Ashland Chemical Co.

Francis D. Barney ('95 Polymers) is a quality assurance auditor for ISO9000 and ISO14000 at Quality Chemicals.

Peter J. Beckage ('91 Ceramics) received his Master's from RPI in 1993 in materials engineering. He is a senior process engineer at Advanced Micro Devices in the chemical-mechanical planarization group.

Blake Q. Belding ('93 Ceramics) is employed with Guardian Industries Company. He has worked as a research chemist for the anti-counterfeit industry and in glass furnace design for float glass.

Andrew J. Bonser ('96 Ceramics) is a project engineer with Premier Refractories and Chemicals, in King of Prussia, PA.

Christopher P. Bowen ('92 Ceramics, '96 Materials) is working on composite dielectrics for organic flip chip electronic packages at W. L. Gore and Associates.

Kirk Cantor ('90 Polymers) is an associate professor of plastics and polymer technology at the Pennsylvania College of Technology in Williamsport, PA. He is currently on sabbatical and working on a Ph.D. in polymer science at Penn State.

Larry Carinci ('90, '93 Ceramics) is the head of the fabrication department at Zircoa, Inc. He has received three Zircoa Achievement Awards.

Andy Dailey ('91 Metals) is a plant metallurgical engineer and QA manager for Webco Industries.

Brian D. DeHaut ('94 Polymers) is a regional sales director for a video retail chain and is taking master's degree credits at Penn State Great Valley.

Todd M. Dougherty ('91 Ceramics) is attending Georgia State University pursuing a master's degree in decision sciences. He is employed by United Parcel Service as manager of a team that designs and implements strategic costing tools.

Priya J. Dwivedi ('94 Ceramics) joined Corning Inc. in 1995 and is currently working as a senior scientist in the environmental products division researching environmental applications of materials like cellular ceramics.

Stephen A. Dynan ('90, '92 Ceramics) is working at Norton Electronics on Si-SiC diffusion components.

Jeffrey Eckert ('91 Metals) received his M.S. in industrial engineering from Binghamton University in January 1995. He is a process engineer in charge of molybdenum reduction at Osram Sylvania.

George Felder, III ('93 Polymers) studies polyether urethanes as blood-contacting polymers in artificial heart/ventricle assist pumps. He and Dr. James Runt have involved polymer graduate students in this ongoing medical research.

Eric N. Fischer ('95 Metals) is the supervisor of a metallography lab at AMP Inc.

Paula D. Freyer ('92 Materials Science) is a senior research engineer studying high temperature super alloys at Westinghouse Science and Technology Center. She received the 1995 ASM Outstanding Young Member award, the Westinghouse Outstanding Performance Award in 1994, 1995, and 1996, the ASM President's Award in 1996, and was the ASM Member of the Month in August 1996.

Eric E. Gallo ('93 Metals) is a project engineer with National Steel in R&D of motor lamination steels.

Timothy E. Geiman ('85, '92 Metals) is the director of engineering for Zenith Sintered Products in Germantown, WI.

Ralph M. Gigantelli ('90 Ceramics) is working at Rhone-Poulenc in the area of PVC plastics and inorganic pigments. He is a member of SME.

Petra Gill ('87 Ceramics; '90 Materials) is working at PQ Corporation in Valley Forge, PA. She holds three patents.

Chi-Yuen Huang ('86, '90 Ceramics) is an associate professor of ceramic science in the Department of Mineral Engineering at National Cheng Kung University in Taiwan.

James J. Hummel ('95 Polymers) is a supervisor of Specialty Films at AEP Industries, Inc.

Suresh Kumar ('93 Ceramics) is working in R&D of nickel hydroxide powders for high energy density Ni-Metal Hydride EV batteries at Energy Conversion Devices in Troy, Michigan. They are scaling up the R&D work to a pilot plant facility.

Bryan P. Livengood ('92 Polymers) is a toner technology team leader with Lexmark International, Inc. He received the 1995 Perkin Elmer Thermal Analysis Award and the NCTAS Award, and the 1994 Plastics Institute of America Fellowship.

Steven W. Martz ('94 Ceramics) is a ceramic process engineer with Advanced Cerametrics, in Lambertville, New Jersey.

Stephen G. McQuoun ('91 Polymers) works on R&D of automotive powder coatings at PPG Industries.

M. Sean Ness ('93 Polymers) is a sales and marketing manager for the medical, dental and retail products of Tekscan, Inc. He covers the West Coast, Canada, and Mexico, and is presently taking on management of Latin America. Tekscan manufactures tactile pressure measurement systems.

Jon M. Poole ('80, 96 Metals) is a senior metallurgist at Inco Alloys International.

William U. Pursell ('62 Metals) is the general manager of U.S. Bolt—a small hot forge bolt company with a "turn around" opportunity. He has been active in the American Production and Inventory Control Society.

Alessandro Rengan ('74, '88, '92 Metals, Ceramics, Materials) is an assistant professor in the manufacturing engineering department at Central State University in Dayton, OH.

Brian J. Roberts ('93 Ceramics, '95 Materials) is a senior reliability engineer at Harris Corp. in the semiconductor section. He is responsible for reliability issues of semiconductor devices.

David R. Sample ('90, '92 Ceramics) is a patent examiner at the U.S. Patent and Trademark Office. He is enrolled in the George Mason University School of Law as a part time student. He plans to become a patent attorney.

John Seidensticker ('90, '94, '96 Metals) received a National Research Council Fellowship in 1997 for postdoctoral work at NIST.

Edward A. Sobota ('94 Metals) is a process metallurgist for TechSpec, Inc.

Continued on page 20

faculty facts

James H. Adair, associate professor of ceramic science and engineering and director of the Particulate Materials Center, has been named a fellow of the American Ceramic Society.

Paul W. Brown, professor of materials science and engineering, has been named executive editor of *The Journal of Materials Education*, and been elected to the Materials Education Council.

Long-Qing Chen, assistant professor of materials science and engineering, was recently awarded a National Science Foundation "Special Creativity Extension," for his research activities on microstructural evolution. The award is granted by NSF program directors to principal investigators who are carrying out notable research. The Special Creativity Extension will lengthen Chen's current NSF grant by two years and increase the funding by more than ten percent. The extension will allow Chen to continue his current work or to pursue new directions.

Chen's research involves using computer simulation techniques to investigate microstructural evolution during solid-solid phase transformations.

T. C. (Mike) Chung, professor of polymer science, has been made an honorary scholar in the Institute of Chemistry of the Chinese Academy of Science.

Michael M. Coleman, professor of polymer science, was named a fellow of the American Physical Society this year.

Tarasankar Debroy, professor of materials science and engineering, received the 1998 Warren F. Savage Memorial Award from the American Welding Society. This award recognizes the paper published in the *Welding Journal* that best represents "innovative research resulting in a better understanding of the metallurgical principles related to welding." The American Welding Society is the largest organization in the world dedicated to advancing the science, technology and application of welding. It serves more than 48,000 members internationally.

Ian Harrison, professor of polymer science, received the PENNTAP Award of Special Recognition for his service to the organization. The Pennsylvania Technical Assistance Program (PENNTAP) is an organization that specializes in providing free assistance and expert advice to small Pennsylvania businesses.

Photo courtesy of the College of Communications.

Professor Peter Thrower, who retires this year, is captured here expounding on the virtues of materials to a Materials Science and Engineering 81 course in 1996. Thrower taught nearly 10,000 students in the introductory course over ten years.

1998 Wilson Research Award

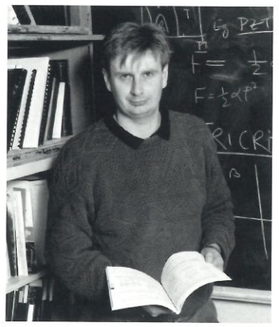
Mike Chung, professor of polymer science, has been awarded a 1998 Wilson Research Award for his groundbreaking research on polyolefins. Chung studies these inexpensive, easily recyclable, and widely available materials, that are commonly used in milk jugs, garbage bags, tires, and bullet proof vests, in search of new applications for them. The problem with these particular "nonpolar" polymers is that they don't like to mix with or stick to other, more "polar" materials. This makes them virtually useless in any application that involves chemical or physical interaction with other materials including pigments, paints, glass fibers, carbon fibers, wood, or metal.

Because polar units will "kill" the catalysts that must be used to make polyolefins, mixing small amounts of polar units with the polyolefin monomer is ineffective in producing a more mixable polymers. As Dr. Richard Tressler puts it in his nomination letter, "this is where Mike's work comes in; he devised a beautiful and chemically elegant method for copolymerization using some very clever Boron chemistry. Essentially, the trick is to attach Boron units to a monomer and polymerize." After polymerization the Boron group can be removed and replaced with the desired functional group making the polymer much more useful.

This research has led to nearly twenty patents with four more submitted, and 100 papers. Chung has been with the Department of Materials Science and Engineering since 1989—first as associate professor and now as professor. He is a member of the American Chemical society, the American Institute of Chemists, and the Society of Plastics Engineers. His work in this area has kept him in much demand as an invited speaker.

The Wilson Research Awards were established in 1989 to honor significant research achievement by faculty in the College of Earth and Mineral Sciences. The award is made possible by the bequests of Matthew J. Wilson, Jr. ('18 mining engineering) and Anne Coghlan Wilson.

1998 Wilson Teaching Award



Clive Randall, associate professor of materials science and engineering, received a 1998 Wilson Teaching Award from the College of Earth and Mineral Sciences. Randall teaches the Introduction to Materials Science and Engineering course that is required for all students in the major. It is an especially important course because it is the foundation upon which other materials science and engineering principles are built. Even more important is that someone with great enthusiasm teach the course as it is scheduled for Monday, Wednesday, and Friday at 8:00 a.m.!

Randall is enthusiastic about teaching and is willing to go the extra mile to make sure that his students understand the concepts that he presents. For those who don't get it the first time around, Randall is available after every class to go over concepts, help with homework problems, or delve deeper into subject areas of particular interest to students. As one students puts it, "Dr. Randall is concerned that his students understand the information presented in his class." Many mornings his office is filled with several students receiving the additional help they need to grasp the difficult concepts.

The Wilson Teaching Award was first given in 1969 to recognize outstanding teaching activity within the College of Earth and Mineral Sciences. The Wilson Awards are made possible by the bequests of Matthew J. Wilson, Jr. ('18 mining engineering) and Anne Coghlan Wilson.

Harrison has also been selected to participate in the Fulbright Scholar Program. He will visit Thailand from October to December as a visiting scholar at the National Metal and Material Technology Center, National Science and Technology Development Agency. During his visit, Harrison will be based in Bangkok, but will be traveling throughout Thailand visiting universities and companies and lecturing and consulting on the general topic of polymers. "Incidentally," says Harrison, "one of the universities in Thailand is also known as PSU, but this one is Prince Songkla University." The Fulbright is timed to fit in with a sabbatical leave—Harrison's first in 27 years!

John Hellmann, associate professor of materials science and engineering, was named program chair of the Ceramic Science and Engineering and Electronic and Photonic Materials Programs. He assumed his new responsibilities on January 1, 1998 after **David Green**, professor of ceramic science and engineering, stepped down to return to teaching and research full time.

Hellmann has been with the Department of Materials Science and Engineering since 1986. He has served the department as chair of the Undergraduate Recruiting Committee and the Scholarship Committee, is the former associate director of the Center for Advanced Materials, and is currently president-elect of the Ceramic Education Council of the American Ceramic Society. Hellmann's research interests focus on new materials development for use in structural and thermally intense high-performance applications.

Digby D. Macdonald, professor of materials science and engineering and director of the Center for Advanced Materials, was elected an honorary fellow of the Royal Society of New Zealand. The honor is given to New Zealand scientists working overseas, who have significantly contributed to New Zealand science. Dr. Macdonald is currently on a leave of absence from the department.

Robert E. Newnham, professor emeritus of solid state science, was recently cited for his invention of a hydrophone that is the first Penn State patent to generate more than $100,000 in royalties for product sales. The sales helped Penn State reach the $1 million revenue mark for inventions in 1997.

The hydrophone is used as an underwater listening device to locate oil deposits underneath the ocean floor. Newnham stated in an interview with the *Centre Daily Times* that the device, which he developed with former research associates Shoko Yoshikawa and QiChang Xu, "improved the sensitivity of earlier devices by a thousand times."

Carlo G. Pantano, professor of materials science and engineering and director of the Materials Characterization Lab, has been named chair of Penn State's Materials Research Institute. For more information on the Materials Research Institute, see the article "Penn State Materials Puzzle."

Darrell G. Schlom, assistant professor of materials science, is co-editor with C. B. Eom, M. E. Hawley, C. M. Foster, and J. S. Speck on Volume 474, *Epitaxial Oxide Thin Films III*, published by the Materials Research Society, Pittsburgh, PA.

Chunshan Song, assistant professor of fuel science, received a Specialist Invitation Fellowship from the Japanese government's New Energy and Industrial Technology Development Organization (NEDO) to lecture on fossil energy research and development at national labs and universities in Sapporo, Kyoto, and Osaka, Japan, during March 1998.

Peter A. Thrower, professor emeritus of materials science and engineering, received a 1998 Milton S. Eisenhower Award for Distinguished Teaching. The award recognizes outstanding efforts of tenured faculty who have undergraduate teaching as a major part of their responsibilities. The award was presented by John Brighton, executive vice president and provost, at the Faculty/Staff Awards Recognition ceremony on March 22.

Over the last ten years, Thrower has enlightened and entertained more than 10,000 students in the popular introductory materials science and engineering course "Materials Science and Engineering 81." His creative methods of illustrating the materials world have included "describing the nuts and bolts of airplanes, the similitude of atom movement to beer bubbles, and choosing the perfect diamond." The textbook Thrower authored for the course, *Materials in Today's World*, has become widely used at universities in materials science courses for non-specialists.

Materials Science and Engineering 81 is now being taught by **Paul Howell**, professor of metallurgy.

Richard E. Tressler, professor and head of the Department of Materials Science and Engineering, has been awarded the International Prize from the Japan Fine Ceramics Association (JFCA). The International Prize is given to a person who has made a remarkable contribution to the fine ceramics industry through international business development, technological development, and cooperative research. Tressler was cited for educating many fine scientists and engineers in the field of ceramics, for his leadership of the Center for Advanced Materials at Penn State, and his contributions while president of the American Ceramic Society.

Leaves of Absence

Leaves of absence at Penn State are granted for purposes of intensive study or research that will increase the quality of the individual's future contribution to the University. Leaves of absence have been granted to the following individuals in the department:

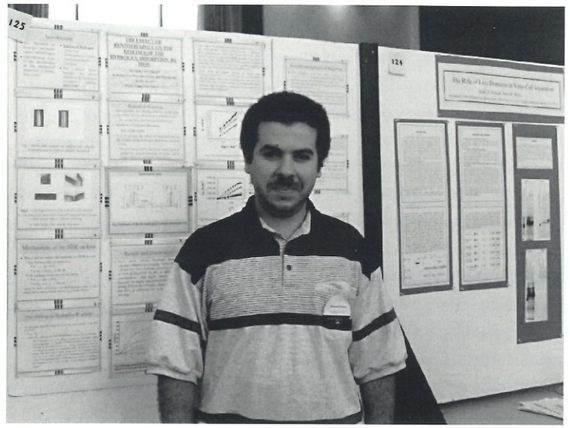
Altaf H. Carim, associate professor materials science and engineering, to conduct collaborative research on crystallographic analysis of novel materials and related topics.

Sanat K. Kumar, professor of materials science and engineering, to conduct collaborative research on the characterization and modeling of macromolecular systems.

Merrilea J. Mayo, associate professor of materials science and engineering, to serve as a Congressional Fellow in a program that pairs scientists with congressmen to work on matters of science policy at the federal level.

Ljubisa R. Radovic, associate professor of fuel science, to conduct collaborative research on environmental applications of carbon-based materials and to complete a textbook on energy and fuels.

student scoop



Mahmoud Abd Elhamid standing by his poster at the 1998 Graduate Research Exhibition. He received an honorable mention.

Student Receives Honors

Mahmoud Abd Elhamid (Howard Pickering, advisor), received an honorable mention at the Thirteenth Annual Graduate Research Exhibition held on March 27–28. Abd Elhamid's poster was titled "The Effect of Benzotriazole on the Kinetics of Hydrogen Absorption by Iron." The exhibition is a showcase for the wide range of research activity that is conducted at University Park, mostly by graduate students, and totals more than $350 million per year.

Abd Elhamid has also been awarded an Energy Research Summer Fellowship from the Electrochemical Society. The fellowship, which is funded by the Department of Energy, was established to assist students in carrying out their summer research in areas of particular interest to the Electrochemical Society.

Weber Receives First Place at IMS Poster Competition

Christoph J. Weber (Howard Pickering, advisor), received the first place award in the IMS Graduate Student poster Competition. His poster, "In Situ STM Study on the Effect of Cyanide on Electroless Copper Plating," was displayed at the 1997 IMS Convention in Seattle. He also presented a paper at the technical meeting. The paper, "Scanning Tunneling Microscopy Investigations During the Electroless Deposition of Copper," will be published in *Microstructural Science*, the proceedings of the convention. Weber has completed his doctoral studies and graduated from Penn State this May.

Two Students Receive Evan Pugh Scholar Awards

Richard A. Wolf (junior—ceramic science and engineering) and **Monica I. Woodward** (graduating senior—polymer science and engineering) were awarded 1998 Evan Pugh Scholar Awards. The awards, which are named for Evan Pugh, Penn State's first president, were initiated in 1933 and were originally awarded to the top five students in both the junior and senior classes. Today the Evan Pugh Scholars are the juniors and seniors who fall into the top 0.5 percent of their classes at the end of the fall semester of the year the award is given. All the students who receive the award have been full-time undergraduate students for at least four semesters prior to selection. This year's junior recipients have cumulative grade point averages of 3.96. The seniors, 3.95.

Students Honored at the 1998 Wilson Banquet

Monica I. Woodward, (graduating senior—polymer science and engineering) received the 1998 Dean Edward Steidle Memorial Scholar Award. Each year the College recognizes an advanced standing student who intends to continue their studies in graduate school for their outstanding scholarship with the Steidle Award. Woodward is a senior in the polymer science specialization of the department. She is also minoring in chemistry, Spanish, and geography, and plans to attend graduate school in either materials science or biomedical engineering.

The George W. Brindley Award in Nonmetallic Crystal Chemistry went to **David MacMahon** (junior—electronic and photonic materials). The award is given each year to recognize outstanding undergraduate scholarship in crystal chemistry. The award is named for Professor George Brindley—teacher, researcher, and internationally recognized scientist. Brindley's studies in clay minerals and ceramics formed the basis of modern understanding in these fields.

Kevin McHenry (graduating senior—metals science and engineering) was the 1998 recipient of the Robert W. Lindsay Award in Metallurgy. The Lindsay Award is given each year to recognize undergraduate scholarship in physical metallurgy. McHenry received this year's award for excellent performance in the metallurgy 405 and 406 courses and for his manifest professional aptitude as a metallurgical engineer. The Lindsay award is named in honor of Professor Lindsay for his 27 years of teaching and research in metallurgy at Penn State.

Melissa Roan (André Boehman, advisor) is the 1998 recipient of the Frank and Lucy Rusinko Graduate Fellowship in Fuel Science. The fellowship is awarded each year for demonstrated excellence in fuel science and engineering course work.

Best Paper Prize Awarded

Todd Palmer (Tarasankar DebRoy, advisor) was the American Council Winner in the Granjon Prize Competition sponsored by the International Institute of Welding. His paper, "Nitrogen Dissolution into the Weld Metal During Arc Welding," was judged best among U.S. contestants in the arc welding category.

Special Scholarships Awarded

Troy Taylor, (graduating senior—electronic and photonic materials) has been awarded $1,000 from the Robert and Mary Buttle Scholarship Fund of the Southwest Section of the American Ceramic Society.

Christopher Theis, (Darrell Schlom, advisor) received the 1998 International Centre for Diffraction Data (ICDD) Crystallography Scholarship Award for his research on ferroelectric superlattices.

Hoechst Celanese Awards in Polymer Science

Two materials science and engineering students are recipients of the 1998 Hoechst Celanese Awards. Each year the award recipients are nominated by their peers and selected by the polymer specialization faculty based on research achievements and service to the Polymer Science and Engineering Program.

Graduate student, **Ronald Jones** (Sanat Kumar, advisor) presented his work on "Phase Behavior of Thin Film Polymer Blends," at the award ceremony that was held April 30. **Monica Woodward** (graduating senior—polymer science and engineering) was presented with the undergraduate student award.

The annual Earth and Mineral Sciences Exposition is held each spring as a way for high school students from across Pennsylvania, New Jersey, and New York, to discover what the College of Earth and Mineral Sciences has to offer. Faculty and students in the Department of Materials Science and Engineering were on hand April 4, during the annual Expo to answer questions and provide demonstrations of amazing materials properties for high school students interested in materials science and engineering as a career.

Continued from page 14

Jonathan P. Solomond ('93 Ceramics) is a process engineer at Chrysler Corp. and is responsible for design and development of automotive glass and accessories for Chrysler vehicles.

Erik A. Spitzer ('91 Metals) is employed by the U.S. Navy in the Sea Control Squadron. He was awarded the Navy Achievement Medal.

Matthew Stahley ('96 Ceramics) is an engineer with Lanxide Corp. He works in the applied composites technology group making prototype parts using Lanxide's PIMEX process for fabricating metal–matrix composites.

Matthew A. Stough ('92, '94 Ceramics) is finishing his Ph.D. research as a graduate fellow at the ORNL High Temperature Materials Laboratory in Oak Ridge, Tennessee.

Greg Terchick ('93 Ceramics) is in charge of operating eight furnaces and rebuilds at PPG Industries in Lexington, NC.

Alan Then ('90 Ceramics) is a fiber optics manager at Karl Storz-Endovision. He holds four patents.

James F. Tressler ('91, '93, '97 Ceramics) is a CORE postdoctoral fellow in the Physical Acoustics Branch at the Naval Research Laboratory in Washington, D.C.

Louis M. Troilo ('90 Ceramics, '91 Materials) is a patent examiner at the U.S. Patent and Trademark Office. His "significant rewards" include the birth of his son Stefano Louis on December 4, 1995.

Eric Trumbauer ('91, '94 Ceramics) is employed as a plasma etch process engineer at a Texas Instruments CMOS wafer fabrication facility.

Juan H. Vazques ('93 Metals) is a tooling engineer with Cutler-Hammer.

Hari Venugopalan ('96 Materials Science) is a post-doctoral scholar at Penn State.

Joe Wallen ('92 Polymers) implemented the ISO 9002 quality system at Nicofibers Co.

Michael J. Walter ('90 Metals) was married in June 1996 to Charlene. He is a regional metallurgist (Southern District) for Carpenter Technology Corp., providing technical support to the sales force and customer base.

Cynthia Ward ('90 Polymers) worked for Olin Chemicals for five years in various positions. She received an MBA in marketing and is now an account manager (sales) for General Electric Plastics in the silicones division.

George A. Wildridge ('93 Metals) was promoted to engineer–metallurgy at Borg Warner Automotive in September 1996.

Kiran Yadalla ('92 Ceramics) received an MBA from the University of Albany in May 1995, and is working for Anderson Consulting as a systems consultant.

Alumni Info Submission via the WWW

The Department of Materials Science and Engineering World Wide Web site is now set up for you to submit changes in your personal information directly to the department via the internet.

If you would like to change your personal information, or submit news for publication in the *Penn State MATSE*, visit our web site and follow the "Alumni Info" link. Or get there directly using http://www.ems.psu.edu/MATSE/alumniform.html.

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