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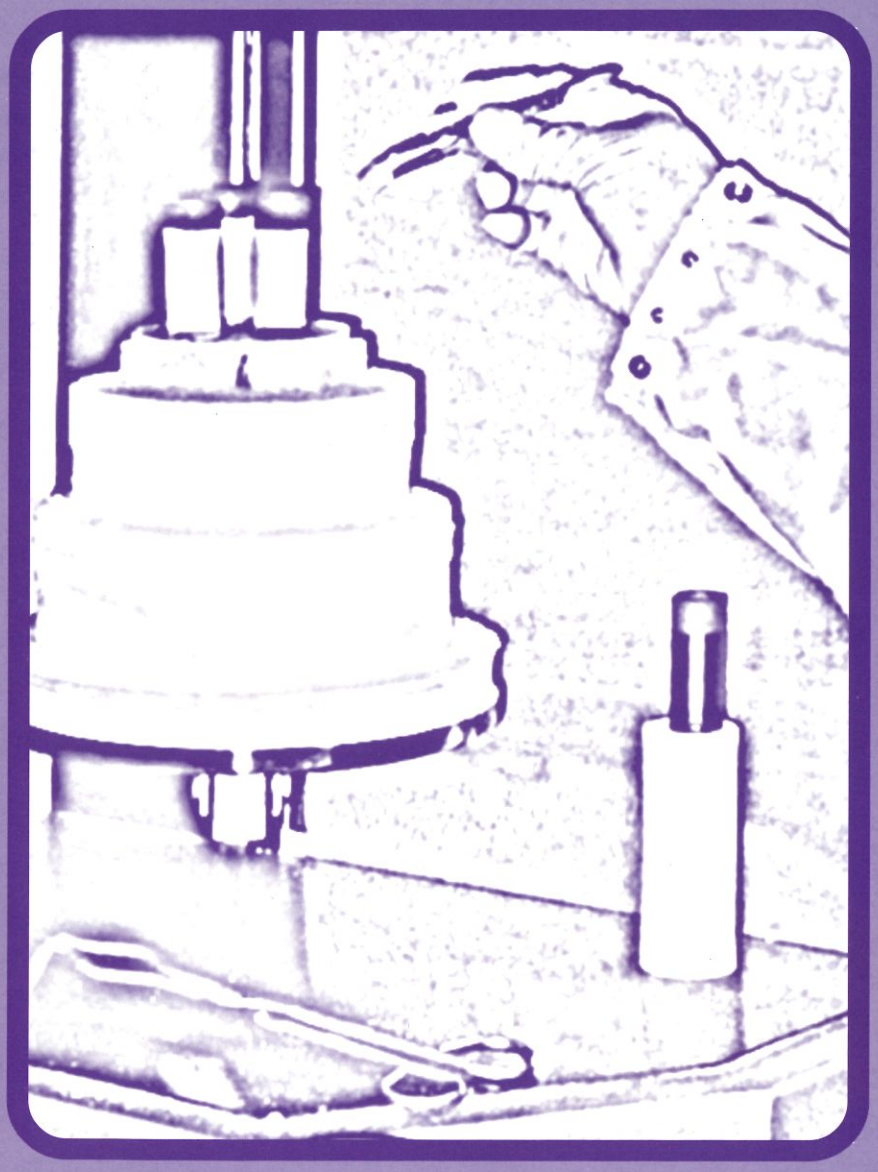
MATSE

PENN STATE



PENNSTATE

1855

ON THE COVER

A surgeon operating on a wedding cake? No, that's the hand of Rajendra N. Basu at work with the solid oxide fuel cells described in this issue's lead research story.

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A REORGANIZATION REPORT FROM THE DEPARTMENT HEAD...

Dear Alumni and Friends,

In our June 1999 newsletter, I wrote about the dynamic nature of our discipline and the need for us (Penn State) to adapt our administrative structure so that the emerging subdisciplines could flourish alongside the traditional ones. Mike Coleman headed a committee that studied models for the administration of large departments such as ours.

The committee members concluded that some form of reorganization would most likely be beneficial for our department, and suggested models that we should consider. From the discussions that ensued, a new administrative structure emerged. Effective January 1, 2000, we are operating under this new structure.

The essential features are as follows. The academic administration is organized into undergraduate and graduate programs with a coordinator overseeing each activity. The departmental committees are organized under these two administrative entities. A five-member executive committee functions as a policy making committee dealing with planning, finances and investments, faculty searches, promotion and tenure, space allocation and facilities, etc.

We continue to offer specialization in three subdisciplines as formal options within the Materials Science and Engineering degree as we have done for several years. We also continue with ABET accreditation for the subdiscipline options—Ceramic Science and Engineering, Metals Science and Engineering, and Materials Science and Engineering; the last one includes our Electronic and Photonic Materials specialization and our Polymer Science and Engineering specialization.

Donated funds and endowments earmarked for any of these specializations will continue to support the specific activity identified by the donor.

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RESEARCH ROUNDUP

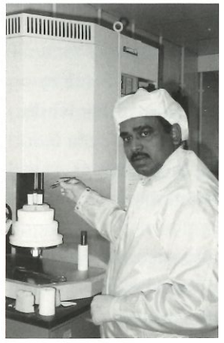
FUEL CELL TRIO DEVELOPS BREAKTHROUGH TECHNIQUE

Fuel cells can be thought of as batteries that never die as long as they are supplied with proper fuel. As with batteries, fuel cells use an electrochemical process involving two electrodes, an anode and a cathode, separated by an electrolyte. They convert the energy from hydrogen-rich fuels—natural gas, coal-derived gas, landfill gas, biogas, or alcohols—directly into electricity at an efficiency of 65 percent. In combination with gas turbines, the efficiency reaches 85 percent.

As-received ceramic tube sections (extreme left); tubes with unfired EPD zirconia coating (middle); and sintered tubes with a gas-tight zirconia coating (right). Dimensions: length-50mm, diameter-22mm, thickness-2mm. Tubes supplied by the Siemens-Westinghouse Power Corporation, which is using the same variety to produce gas-tight zirconia films with an expensive, sophisticated electrochemical vapor deposition technique for which Penn State now has a cheaper, faster alternative.

However, proponents for the use of fuel cells as an alternative, environmentally friendly technology that could help meet ever greater power generation demands from both the private and business sectors face a Catch-22. A major expansion in manufacturing capability would bring mass-produced fuel cells into a cost range that is competitive with traditional power sources, but putting that expanded capability within industry's grasp requires substantial manufacturing-related cost barriers to be overcome. It's a vicious circle: Can't make more fuel cells without lowering costs…can't lower costs without making more fuel cells.

THE PENN STATE CONNECTION



Rajendra N. Basu

Although it's not a solution to the overall problem, researchers in Penn State's Department of Materials Science and Engineering have invented a technique that offers the hope of making the manufacturing of one kind of fuel cell cheaper and more efficient than in the past. The team reports that the technique works better—and at less cost—than the typical alternative because it replaces a room-sized, high vacuum device involving complicated gaseous chemistries with a simpler arrangement of a beaker containing particles in acid and an alligator clip.

The trio that tackled the challenge includes **Rajendra N. Basu,** a postdoctoral scholar in the Materials Research Laboratory, and **Clive A. Randall** and **Merrilea J. Mayo,** both associate professors of materials science and engineering.

They used electrophoretic deposition (EPD), a process in which charged particles dispersed in a suitable suspension are driven to move towards an oppositely charged electrode under an applied electric field. The particles' deposition on the counter electrode results in a desirable particulate coating that is later sintered.

"The EPD technique is extremely simple and inexpensive," Basu explains. "It has been used for many years to fabricate high green density ceramic bodies/coatings with various shapes for industrial applications ranging from thin film phosphors coatings to bulk lamp envelopes."

However, the best efforts in the past five years of several non-Penn State groups to use EPD or similar, low cost

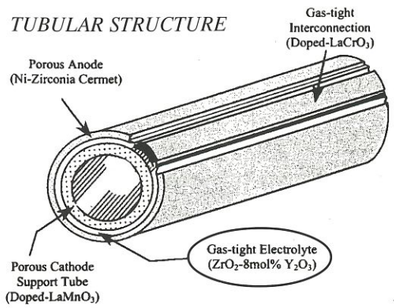
continued on next page

Research Roundup continued from previous page

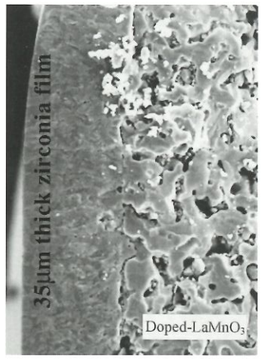
processes for tubular solid oxide fuel cell (SOFC) manufacturing turned in disappointing results. Porous substrates, such as the $LaMnO_3$ used for SOFCs, present a challenging deposition surface for the required dense zirconia electrolyte films—the applied electric field becomes inhomogeneous across a substrate surface with too many holes in it.

WHEN A VANISHING FUGITIVE IS A GOOD THING

The Penn State researchers' breakthrough concept was to homogenize the field and allow deposition to occur evenly by adding a fugitive conducting interlayer of carbon to the substrate prior to EPD. The carbon burns off in the subsequent sintering, leaving behind a dense, adherent zirconia electrolyte film with no trace of the fugitive material. The interlayer also prevents lanthanum diffusion from the $LaMnO_3$ substrate into the ZrO_2 film during sintering—eliminating the formation of an unwanted insulating phase, $La_2Zr_2O_7$, at the interface.



To make all of this work in the right order, the team devised a stable suspension by mixing commercial brand (Tosoh Corporation) TZ-8Y (ZrO_2-8mol% Y_2O_3) powder and glacial acetic acid. The zirconia particulates in the suspension are positively charged so that the electric field application allows them to deposit directly on the negatively charged ceramic $LaMnO_3$ tubes. Clocking in at one to two minutes, the technique is extremely fast and does not require any sophistication in either the suspension chemistry or the setup. If the cathode is allowed to move relative to the anode during deposition, then coatings several meters in length can be applied in a continuous process.



"The main hurdle in the tubular design is the high cost of the cell, largely a result of the expensive electrochemical vapor deposition technique generally used to make the 30-40µm thick gas-tight zirconia electrolyte film," Basu elaborates. "But our EPD technique has proven itself a quick way to prepare a gas-tight electrolyte layer at low cost."

A MAN WITH A MISSION

Basu earned his degrees in physics and materials science from the Indian Institute of Technology. He came to Penn State from India in 1998 to develop the EPD technique under sponsorship of the Gas Research Institute while on leave from the Central Glass and Ceramic Research Institute, a national laboratory of India. There has been a high level of interest in the Penn State technique from industry—for instance, scientists from the Siemens-Westinghouse Power Corporation, which supplied the cathode tubes for the project, recently visited the University Park campus to view the EPD technique being demonstrated.

With his work in the United States all but completed, Basu will tackle his next fuel cell challenge working for Forschungszentrum Jülich GmbH in Germany, where he will report to Prof. Dr. Detlev Stöver. There he will concentrate on developing brand new concepts for a completely new kind of SOFC—a sealless planar variety that would offer even greater commercialization possibilities than the tubular variety that he focused on at Penn State.

"Research efforts on SOFCs have been ongoing since the 1970s, but during the last ten years they have intensified, with the push being toward commercialization," he says. "For example, the Department of Energy is concentrating a lot of effort on ultra-high efficiency, zero emission fuel cells for the 21st century."

Meanwhile, Basu has presented the results of the Penn State work in several venues, including the Materials Research Society, the Joint Fuel Cell Technology Review meeting, and the 6th International Conference on SOFCs. The work is also described in forthcoming papers for several leading ceramics and materials journals, and Basu, Randall, and Mayo filed for a U.S. patent on the technique (Patent Application File No.: 09/408617) in 1999. ▲▼▲

Future of Fuel Cells for Consumer Use Remains to be Seen

Penn State's **Digby Macdonald,** professor of materials science and engineering, has an equal opportunity attitude toward the many varieties of fuel cells at large in the world today. He's worked on those whose technical challenges range from mostly overlooked to heavily researched.

For instance, Macdonald is currently involved in projects with Penn State colleagues **Harry Allcock,** an Evan Pugh professor of chemistry, and **Serguei Lvov,** associate professor of energy and geo-environmental engineering, studying proton exchange membranes for methanol-powered fuel cells using thermally stable polyphosphazenes. He is also interested in such non-hydrocarbon powered fuel cells as a zinc/air variety now under development.

However, he says that the day when the average consumer will use mass-produced fuel cells for anything as prosaic as automobiles or home heating is still in the future.

"We can probably get a fuel cell's cost down to maybe $1,000 per kilowatt, which is a tenfold higher cost than for internal combustion engines for a very dubious environmental benefit," he notes. "I say 'dubious' because all of the hydrocarbon-based fuel cells still put out carbon dioxide, even if at a somewhat lower rate than other power generating techniques."

All fuel cells, except those that use hydrogen directly or that employ the direct oxidation of the fuel in the fuel cell stack, must reform the hydrocarbon into hydrogen and waste products—such as carbon monoxide and carbon dioxide. Macdonald notes that reforming on board is a difficult technology that requires highly durable, cost effective catalysts.

"In my opinion, only the direct methanol, or some other direct liquid, fuel cell—which does not employ a separate reformer—makes any sense for vehicles as far as conventional fuel cells are concerned," he says. "But conventional reforming fuel cells will definitely find use in stationary applications. They have a bright future in medium scale power generation at fixed sites."

Meanwhile, one type of non-hydrocarbon fuel cell that appears close to being commercialized is a zinc/air device produced by the California firm Metallic Power. It may be the most advanced of its sort now available, says Macdonald, who is a member of the company's board of directors. The company claims to be on target for a 2002 launch of a recyclable, environmentally safe fuel cell that recharges within minutes. Current configurations of the product could be used for utility carts, forklifts, auxiliary power for trucks and recreational vehicles, and telecommunications backup power.

How *Thin* Can Things Get?

Research Reports by A'ndrea Elyse Messer—Penn State Science, Engineering & Research Communications

Circular Transformers May Lead to Thinner Laptops, TVs

Thinner laptop computers and flat-screen TVs may be possible with a simple change in the geometry of piezoelectric transformers. As an alternative to conventional electromagnetic transformers that are big, very heavy, producers of magnetic noise, a light-weight, circular configuration was made at Penn State with improved ceramic materials by **Kenji Uchino,** professor of electrical engineering, **Burhanettin Koc,** postdoctoral associate in electrical engineering, and **Yongkang Gao,** graduate student in materials science and engineering. Their circular transformer is made of a lead, zirconium, titanium ceramic doped with manganese and cerium. It provides a voltage step up ratio of about 60—compared to 40 for rectangular piezoelectric transformers—and takes up the same volume and weighs the same as rectangular designs. The team reported its findings to the Materials Research Society in December.

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Polymers Get Thinner and Thinner, But Act the Same

The boundary where thin polymer films no longer behave the same as bulk polymers is still unknown. Researchers including Penn State's **Ronald L. Jones,** graduate student in polymer science, and **Sanat K. Kumar,** professor of material science and engineering, studied the molecules of polystyrene ultra thin films measuring only 14 nanometers and found that while the film is much thicker than a single atom, the diameter of the polymer ball in the bulk material is larger than the film's thickness. They believe that the polymer spheres have a lot of space inside so that while the basic shape remains the same, the packing of the molecules inside the ball is more efficient. Jones and Kumar worked with **Derek L. Ho** and **Robert M. Briber** of the University of Maryland, and **Thomas P. Russell** of the University of Massachusetts. The team reported its findings in the July 8, 1999, issue of *Nature.*

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Department Details

Earth and Mineral Sciences Appoints Public Information Director

June Heywood, founding editor of *Penn State MATSE,* has left the Department of Materials Science and Engineering to serve as director of public information and alumni relations for the College of Earth and Mineral Sciences. In this position, she is responsible for all of the college's alumni programs, including its GEMS (Graduates of Earth and Mineral Sciences) Alumni Society. In addition, she directs communication strategy and produces publicity materials, including the *EMS Bulletin* and other college-level publications.

In her new duties, Heywood fills the position left vacant by the retirement of Judith Kiusalaas. Heywood joined the Department of Materials Science and Engineering as its first writer/editor and alumni coordinator in 1996. A graduate of Penn State's English program, she had also earlier worked with the Penn State Materials Research Institute.

New Writer/Editor and Alumni Coordinator for Department

Following June Heywood's promotion, **Gary W. Cramer** is the new writer/editor and alumni coordinator for the department. A former newspaper journalist in Lancaster, Pennsylvania, Cramer joined Penn State in 1989 as a writer/editor promoting faculty research topics to the media for the Department of Public Information. He later worked in the Department of Development Communications and Special Projects. In that capacity, he wrote and edited publications involving Penn State's history and contributions to society, and private gifts to the University's Grand Destiny fund-raising campaign. He earned his bachelor's degree in journalism from Penn State in 1987.

Hellos, Goodbyes

Since the last issue of *Penn State MATSE,* the department staff has had some other hellos and goodbyes, as well. **Deb Brown** joined our financial office to concentrate on grants and proposals after working for the Materials Research Laboratory on campus for several years. Deb replaced **Patty Prestash,** who joined the University's Office of Sponsored Programs. **Cindy Lake** became the new staff assistant in the metals science office, replacing **Shelly Kachik,** who went to the College of Engineering to work for the Department of Electrical Engineering. Also going to our sister college to work in the Department of Mechanical Engineering was staff assistant **Jenny Houser,** who helped throughout our department as needed.

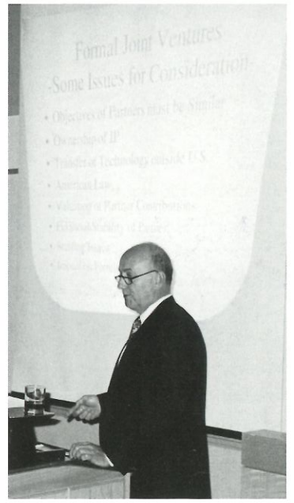
Bradt Receives Award for Work at Alabama

Last spring, former department head and ceramic science faculty member **Richard C. "Dick" Bradt** received the Burnum Distinguished Faculty Award for 1998 from his current academic home at the University of Alabama. Bradt heads the Department of Metallurgical and Materials Engineering at UA, which he joined in 1994. In an article in the UA faculty/staff newsletter, *Dialog,* Bradt cited a new corporate-funded scholarship endowment, a surge in freshman enrollment, and an alumni-led modernization effort for the university's metalcasting laboratory as highlights during his tenure in the UA department. He first joined Penn State in 1967, and led Materials Science and Engineering from 1979 to 1983.

At right, Richard C. Bradt examines ferroelectric ceramics with an electron microscope in a scene captured for a 1968 issue of the Earth and Mineral Sciences *newsletter.*

In September, the annual forum of the Pennsylvania Ceramics Association attracted attendees from nearly 20 firms and speakers from industry and academia to the University Park campus. Above, the audience prepares for the next speaker during an afternoon of presentations. At right, ***Vito Russo,*** *president and CEO of the Ben Franklin Technology Center of Central and Northern Pennsylvania, delivers the keynote lecture. Below, conversation ensues at the forum banquet amongst Concurrent Technologies'* ***Arthur Gurson*** *and* ***Kathryn Carr,*** *center, ceramics science and engineering student* ***Lisa Friedman*** *and professor* ***David Green,*** *right, PPG Glass Technology Center's* ***Jeffrey Yigdall,*** *left, and Alcoa's* ***Doug Weirauch.***

1999 Pennsylvania Ceramics Association Forum: Ceramic Process Technologies for Manufacturing Efficiencies



Hirth Puts Nelson Taylor Lectures' Focus on Dislocations

Dislocation theory was the featured topic when **John Hirth,** professor emeritus of materials science and engineering at Washington State University, presented the 1999 Nelson Taylor Lectures in October at the University Park campus. Hirth's expertise in the defects that form in crystalline solids, captured in the textbook *Theory of Dislocation,* attracted appreciative audiences of faculty, staff, and students. In addition to earning numerous awards from professional societies throughout his career for his teaching skills, Hirth was elected to the National Academy of Sciences in 1994.

The Nelson Taylor Lecture Series, sponsored by the Department of Materials Science and Engineering, was established in 1969 to honor the memory of Professor Nelson W. Taylor (1899–1965) who was head of Penn State's Department of Ceramics from 1933 to 1943.

Alumni Annals

Halchak Named McFarland Award Winner for 2000

John A. Halchak ('62 Metals) will receive the 2000 David Ford McFarland Award for Achievement in Metallurgy from the Penn State chapter of ASM International at an award lecture/banquet on April 15, 2000, at University Park.

A native of Pennsylvania, Halchak is director of material applications at Rocketdyne Propulsion and Power, a part of the Boeing Company, in Canoga Park, California. He has been a leader in the employment of several titanium based alloys to construct modern rocket engines, and has worked on such high-profile projects as Apollo-Saturn V, the Delta launch vehicle, Peacekeeper, and the Space Shuttle. He currently leads a variety of liquid rocket engine, high-energy laser, and Space Station electrical power systems projects.

The McFarland Award is named in honor of the head of the Department of Metallurgy at Penn State from 1920 to 1945.

National Academy Honors MacChesney

Although **John B. MacChesney** got his Ph.D. in geochemistry from Penn State, it is his years of work in materials that earned him a spot in the first trio of materials engineers to win the Draper Prize for outstanding engineering contributions to the welfare and freedom of humanity last fall. MacChesney received the prize from the National Academy of Sciences in recognition of his invention of the modified chemical vapor deposition process, which led to the manufacturing of practical, low-cost optical fiber systems to carry voice, data, and images via light pulses encoded with digital information. He developed the process with his Bell Laboratories colleague, P. B. O'Connor, in the early 1970s. While at Penn State, he studied under such faculty members as **E. F. Osborn, A. I. Muan,** and **Rustum Roy.** In November, he was on campus to present a lecture on "The Optical Fiber Revolution" and attend a reception in his honor.

Spriggs Receives Alumni Achievement Award in Ceramics

Richard M. Spriggs ('52 Ceramics), an internationally renowned contributor to ceramics research and instruction, received the 1999 Penn State Alumni Achievement Award in Ceramics during the September meeting of the Pennsylvania Ceramics Association at University Park. A native of Washington, Pennsylvania, Spriggs began his studies at the Penn State Mont Alto campus. He is a professor emeritus of ceramic engineering at Alfred University in New York; a past president of the American Ceramic Society; director of the Western New York Technology Development Center; and author of many publications on such topics as ceramics microstructure, sintering, and forging by thermomechanical processing.

Laura Davis Bittle ('92 Polymers) is a senior chemist at Engineered Polymer Solutions, Inc., in Los Angeles, California, a division of the Valspar Corporation. She recently received her M.B.A. from Webster University in Irvine, California.

John Manko ('95 Ceramics) is a metallurgical engineer with Armco Specialty Flat-Rolled Steels in Butler, Pennsylvania. Much of his work has been focused on product development for TCH, a grain-oriented silicon steel used in the manufacture of stacked power distribution transformers.

Devang Jashubhai Naik ('98 Metals) is working for the heavy engineering complex of Larsen & Toubro Ltd., in Hazira, India, and living in the nearby town of Surat. The complex manufactures equipment for nuclear and thermal power projects; chemical, petrochemical, and fertilizer industries; and aerospace, oil exploration, and marine-related sectors.

Erik O. Wagg ('90 Ceramics) was installed as vice president for member services of the American Ceramic Society last spring. He is technical services manager at Reusche & Co. of Greeley, Colorado, where he oversees new product and design development and manages raw material and finished product quality control. He also serves on the ASTM Subcommittee on Test Methods for Ceramic Whitewares and Related Products.

George R. White ('94g Metals) is at 493 Scott Drive, West Chester, PA 19380. He works for Beemer Precision Inc.

Paul T. Stecko, *right, receives a 1999 Alumni Fellow Award from* ***Dean John Dutton*** *during the College of Earth and Mineral Sciences' Obelisk Society Dinner, held in September. Stecko earned his bachelor's degree in metallurgy from Penn State in 1966, and is chairman and CEO of the Packaging Corporation of America. The award is the most prestigious granted to alumni by the Penn State Alumni Association.*

Weber Named New Assistant VP

As of January 17, **Gary Weber** ('65, '74g Ceramics) is the new assistant vice president for research and director of technology transfer in Penn State's Office of the Vice President for Research. Formerly senior vice president for science and technology at PPG Industries, he is administratively responsible for the Ben Franklin Technology Center of Central and Northern Pennsylvania, the Industrial Research Office, Intellectual Property Office, Penn State Research Park, Pennsylvania Technical Assistance Program, and Research Commercialization Office. He will also hold a faculty appointment in the College of Earth and Mineral Sciences.

USX Endows Scholarships for Earth and Mineral Sciences

The **USX Foundation** has given $1.25 million to the College of Earth and Mineral Sciences to attract academically talented students to Penn State. The gift will endow support for one graduate fellowship and more than 20 merit-based undergraduate scholarships. Each of these will be awarded for one year, with the possibility of refunding. The endowment will be divided equally among three areas: petroleum and natural gas engineering; metals science and engineering; and other energy related programs such as fuel science, geology, and geophysics. The first awards will be given in fall 2000.

Upcoming Events

March 6–10, 2000
Penn State Spring Break

March 25, 2000
College of Earth and Mineral Sciences Expo (EMEX)
University Park

April 15, 2000
52nd Annual McFarland Award Lecture and Banquet
Featuring John A. Halchak ('62 Metals)
Metals Science Program
University Park

Blue/White Game
University Park

April 28, 2000
Spring Semester Classes End

May 13, 2000
Undergraduate Commencement for
College of Earth and Mineral Sciences
7 p.m. in Eisenhower Auditorium
University Park

May 14, 2000
Graduate Commencement
5:30 p.m. in Eisenhower Auditorium
University Park

May 15–June 23, 2000
First 6-week Summer Session Classes
University Park

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

Faculty Facts

Professors of polymer science **Michael M. Coleman** and **Paul C. Painter** have been granted leaves of absence to gather historical information on polymer science in both Europe and the United States in order to develop new instructional resources.

Tarasankar DebRoy, professor of materials science and engineering, is a co-editor of *Trends in Welding Research: Proceedings of the 5th International Conference,* now available from ASM International and the American Welding Society. The publication includes the keynote addresses and technical presentations of the 1998 event, which was held in Georgia. Topics include heat and fluid flow modeling, solidification behavior, phase transformations, welding processes, weldment properties and residual stresses, sensing and control, and automation.

Zi-Kui Liu, assistant professor of materials science and engineering, has earned a National Science Foundation Faculty Career Development Award. The award will fund Liu's project on "Integrated Teaching and Research Activities on Computational Thermodynamics and Systems Materials Design of Magnesium Alloys" for four years. The goal of the research is to combine thermodynamic calculations with phase transformation calculations to design magnesium alloys with tailored properties for the automotive industry. Together with other faculty members in the department, Liu will develop three graduate courses on computational thermodynamics, kinetics, and materials design, and will involve undergraduate students in the effort.

Gary L. Messing, director of the Materials Research Laboratory and professor of ceramic science and engineering, has been elected to the international Academy of Ceramics in recognition of his scientific contributions in the area of seeded solid state phase transformations and templated grain growth.

Suzanne Mohney, assistant professor of materials science and engineering, received the J. B. Wagner, Jr. Young Investigators Award of the Electrochemical Society, Inc. in October during the society's High Temperature Materials Division meeting in Honolulu, Hawaii. She presented her award address on "Oxidation and Metallization of Group III Nitrides for High Temperature Devices" at the society's III-V Nitride Materials and Devices symposium.

Robert E. Newnham, professor emeritus of solid state science at the Materials Research Laboratory, delivered the keynote lecture on "Ceramic Engineering in the 21st Century" at the International Symposium on Current Global Status of Ceramics in Tokyo; received the International Prize of the Japan Fine Ceramics Association in recognition of a U.S.-Japan student exchange program that he initiated and his contributions to the technical literature of electroceramics; delivered the ASME Adaptive Structures and Materials Systems Prize Lecture at the American Institute of Aeronautics and Astronautics Conference in St. Louis, Missouri; and lectured on "Domains in Smart Materials" at the Workshop on Dynamics of Interfaces held at the Los Alamos National Laboratory.

Principal investigators on projects recently approved for funding by the National Science Foundation's Industry-University Center for Glass Research include **Carlo Pantano,** professor of materials science and engineering, on "OH in Silica: Effect on Bulk and Surface Structures" (with Alfred University's **Alastair Cormack**),"Monomeric and Polymeric Organofunctional Silanes on Glass," and "Chemisorbed Water on Commercial Glass Surfaces"; **David Allara,** professor of polymer science and engineering, on "Analysis of Chemical Interactions and Effects of Water and Additives at the Polymer-Multicomponent Glass Interface"; and **David Green,** professor of ceramic science and engineering, on "Flaw-Tolerant Tempered Glasses." Thirty-four corporations aid the CGR.

Jerzy Ruzyllo, professor of electrical engineering, has been elected a fellow of the Electrochemical Society, an international

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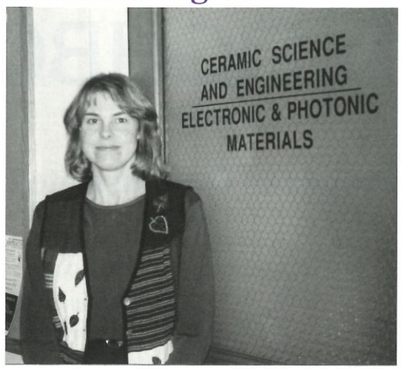
Pennsylvania Calls New EPM Faculty Member Home Again



It's a good thing that the intense football rivalries between Penn State and certain other universities do not extend into the institutions' laboratories, or else **Joan Redwing** might not be calling herself a Penn Stater these days.

Thirteen years after leaving Pennsylvania with a bachelor's degree in chemical engineering from the University of Pittsburgh in hand, and five years after earning a Ph.D. in the same field from the University of Wisconsin, Redwing arrived in Happy Valley last fall as Penn State's newest assistant professor of materials science and engineering. Along the way, the Pittsburgh area native worked for General Electric in Schenectady, New York, and for Advanced Technology Materials in Danbury, Connecticut, and Phoenix, Arizona.

Her teaching is concentrated on the electronic and photonic materials area, and much of her current research delves into the epitaxial growth of gallium nitride and related wide bandgap materials. Redwing's previous work on such topics as metalorganic vapor phase epitaxy of compound semiconductors, gas phase and surface chemistry of epitaxial growth, and growth and characterization of heterojunction devices has resulted in more than 40 articles in refereed journals and conference proceedings as author or co-author. She has also presented four invited talks, including one at the Spring 1999 Materials Research Society Meeting. She co-owns patents on high brightness ultraviolet-green electroluminescent devices, the formation of non-columnar deposits by chemical vapor deposition, and articles having coatings of fine grained and/or equiaxed grain structure. ▲▼▲

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nonprofit educational organization. He was recognized for his professional contributions and service to the society, which focuses on phenomena related to electrochemical and solid state science and technology.

Darrell Schlom, associate professor of materials science and engineering, recently received the Young Author Award from the American Association for Crystal Growth. The award recognizes his achievements in developing molecular beam epitaxy techniques for oxide thin films, and in depositing epitaxial films of ferroelectric and superconducting oxide materials with atomic layer control.

Richard E. Tressler, professor and head of materials science and engineering, has been appointed to the National Research Council's (NRC) Committee on Materials Research for "Defense-After-Next." The twelve-member committee includes researchers with a wide range of expertise in the military, corporate, and academic environments. It will undertake a three-year study to identify the kinds of materials and processing research and development that are crucial for addressing 21st century defense needs, based on Department of Defense requirements. Tressler was chosen for his work in structural ceramics and ceramic composites, as well as his knowledge of Army and aerospace systems. A former Captain in the U.S. Air Force, he has served on several other NRC committees and on a review panel for Air Force materials research projects.

Susan Trolier-McKinstry, associate professor of ceramic science and engineering and associate director of the Materials Research Laboratory at Penn State, will receive the 2000 Robert L. Coble Award for Young Scholars from the American Ceramic Society at the society's annual banquet in May. The award recognizes outstanding scientists who are conducting ceramics research in academia, industry, or government funded laboratories. Trolier-McKinstry focuses much of her research on the areas of bulk and thin film ferroelectrics for piezoelectric and dielectric applications and optical characterization. She was also recently elected secretary/treasurer of the society's Ceramic Education Council.

Neighborhood Notes

Project to Demonstrate Ironmaking's Importance to Region

Metallurgy was an important part of life in the University Park campus area long before there was a College of Earth and Mineral Sciences to offer a degree in the subject. In 1855, land and money donated by Moses Thompson, a Centre Furnace ironmaster, and his partner James Irvin, led to the establishment of the Farmer's High School, which eventually became Penn State. To educate people about this facet of the Centre Region's history, Penn State students and professors are working with the Centre County Historical Society to develop a walking path that will demonstrate the scope of local ironmaking during the 19th century. The project is part of a grant recently given to the society by the Pennsylvania Historical and Museum Commission. One point planned for the path is the site of the Centre Furnace, near the eastern edge of the campus along Route 26. The path will eventually link the furnace site and the nearby Centre Furnace Mansion with a natural greenway being developed throughout Centre County's most heavily populated watersheds.

High School Science Teachers Learn About New Materials

High school science teachers from across the state learned about advanced materials such as new kinds of plastics and liquid crystals—and ways to incorporate advanced materials into their curricula—at a week-long workshop last summer at University Park. During the workshop, the teachers explored the science of materials discovered, invented, and developed during the past two decades, and new materials expected to be developed during the next two decades. Applications the teachers studied included body implants that can carry out medical tests and release appropriate doses of medication, house windows that control the flow of heat and light in response to weather and human activity, tennis rackets with automatic adjustments for overhead smashes and drop shots, and dental braces made from materials that automatically return to their original shape if they are bent. The summer workshop was one of four for Pennsylvania teachers sponsored by three Penn State organizations: the Pennsylvania Space Grant Consortium, the Eberly College of Science, and the College of Earth and Mineral Sciences.

Enrollment Flat, According to Plan

Honoring its commitment to slow enrollment growth, Penn State recently announced that its official enrollment for the 1999 fall semester was 80,873, with undergraduate enrollment virtually identical to the previous year. Even though Penn State received a record number of applications for the year, and continues to be a popular choice with prospective students, the University is following a plan to control enrollment growth, as announced when it reorganized its campuses in 1996. The 1999–2000 undergraduate enrollments came in on target, with a small reduction in new freshmen offset by a small increase in upper-division students. Graduate enrollments—including enrollment at Penn State's College of Medicine and The Dickinson School of Law of The Pennsylvania State University—are up by 105 students.

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Reorganization Report continued from page 2

Each of these specialties will have a subset of our faculty (a panel) identified with it, and a chairperson of each panel will act as the "spiritual leader" to be sure that we maintain our contacts with the relevant professional society(ies), industrial firms, alumni groups, and student groups.

Since our committees will now function as department-wide committees (curriculum committee, for example), we expect a more unified set of requirements to emerge for the various specializations. We expect more courses to be taught in common (for example, laboratory courses), and we expect new subdisciplines to be organized (e.g., biomaterials).

When you next visit Steidle Building, you will find all department offices located on the first floor with the undergraduate and graduate offices flanking the main entrance to the building. We are also renovating and expanding the student computer laboratory and the student commons room contiguous to the department offices.

The faculty members who have previously agreed to serve in these roles identified above are listed in the box below. Our staff has embraced our new structure and is busy designing new workspaces and realigning the critical functions that only a dedicated, competent staff can perform.

I'm personally confident that we can now change and evolve to meet the challenges of education and research in the 21st Century with our new structure. I welcome your comments and advice as we move along this new path.

Richard E. Tressler, Professor and Head
Department of Materials Science and Engineering

Who's Who in the Reorganized Department

Department Head: Richard E. Tressler
Undergraduate Coordinator: Paul C. Painter
Graduate Coordinator: Long-Qing Chen
Executive Committee: Richard E. Tressler, Paul C. Painter, Long-Qing Chen, Digby D. Macdonald, Susan A. Trolier-McKinstry
Panel Chairpersons:
Ceramics – John R. Hellmann
Electronic and Photonic Materials – Altaf Carim
Metals Science and Engineering – Kwadwo Osseo-Asare
Polymer Science and Engineering – James P. Runt

Student Scoops

COOP Puts Spotlight on Student Research Projects

In October, the 1999 annual meeting of the Cooperative Program in Metals Science and Engineering (COOP) brought company representatives, faculty, and students together to exchange a wealth of technical information. COOP serves as a resource for businesses in need of access to a broad range of knowledge and activities related to the processing, properties, and uses of metals and alloys. A highlight of the meetings was the presentation by graduate students of their research results. What follows is a list of the winning projects in the oral and poster presentation categories for 1999, as voted on at the meeting by COOP members. For more information on any of these research efforts or the program in general, please contact the Metals Science and Engineering office at (814) 865-5446 or by E-mail at coop@ems.psu.edu; or visit the COOP website at http://www.ems.psu.edu/Metals/coop.html.

ORAL PRESENTATIONS

First Place—Andre L. Wilson, "Sub-Solidus Liquation in Aluminum Age-Hardenable Alloys: A Microstructural and Kinetic Study"; Second Place—John DeLucca, "Pt Electrical Contacts to n-Type GaN" (sponsored by the National Science Foundation); Third Place—Tabbetha A. Dobbins, Thermal Spray Yttria-stabilized Zirconia (YSZ) Coatings for Optimal Thermal Barrier Coating Performance and Life" (funded by the Office of Naval Research).

Among the winners of the COOP events for oral and poster research presentations were, from left, graduate students ***Bernd Wittek, Tabbetha A. Dobbins,*** *and* ***Ashraf T. Al-Hinai.***

POSTER PRESENTATIONS

First Place—Ashraf T. Al-Hinai, "Chemical Mechanical Polishing of Copper"; Second Place—Thomas J. Yurick Jr.,"Optimization of Ni-Ti Shape Memory Alloy to Enhance Automotive Electrical Connectors" (further work sponsored by Ford Motor Company); Third Place—Bernd Wittek, "Surface Alloying and Dealloying in the System Cu-Au" (sponsored by the National Science Foundation).

Corporate representatives at the COOP presentations included, from left, ***Rick Gleixner*** *and* ***Michael Schmidt*** *of Car Tech, and* ***James Salsgiver*** *of Allegheny Teledyne. COOP member firms enjoy privileges in the University's materials labs.*

Senior Receives Woodside Founder's Scholarship

Peter A. Kirkham, a senior in metals science and engineering, received the 1999 William Park Woodside Founder's Scholarship, awarded through ASM International. A member of the University's ASM International chapter, Kirkham notes that "Metals engineering...meets all of the criteria I have for a career: a challenging technical field, an established and dynamic industrial setting, expanding international business opportunities, and a broad range of job choices."

The scholarship was established by Sue Woodside Shulec in honor of her grandfather, whose vision led to the founding of ASM International.

1999–2000 Scholarship Recipients

Many generous alumni have endowed scholarships in the Department of Materials Science and Engineering that provide support for our talented students. What follows is a list of awards made for the 1999–2000 academic year. The awards are mainly merit based. The availability of endowed scholarships aids the department's recruiting efforts and helps 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
Levi Abrino
Stephen Chatfield
Mark Losego
Michael Tristani
Nathan Werkheiser

C. Philip Cook, Jr. Memorial Scholarship in Ceramic Science and Engineering
Charles Battle
Obiefune Ezekoye
Melvin Gottschalk
Daryl Kuban
Vorrada Loryuenyong
Jamie Morley
Francis Nicholas
Craig J. Stringer

Richard P. and John N. Davis Scholarship in EMS
Christopher Long

Glass Container Industry Research Corporation Scholarship
Patrick Donahue
Tarah M. Pecora

George Gleason Memorial Scholarship
Jeffrey Wozniak

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

Hommel Scholarship in Ceramic Science and Engineering
Robert Cooley
Matt Hollenbeck
Norman B. Phelps

Floyd A. Hummel, Jr. Scholarship in Ceramic Science and Engineering
Jamie Morley
Jeffrey K. Murray

GM Scholar
Briama Cooper
Obiefune Ezekoye
Kevin Urman
Stefan Williams

Harvey P. Kocher Memorial Scholarship
Peter Imbrogno
Peter Kirkham
Ryan Wolf

Thomas M. and Eleanor W. Krebs Scholarship in Metallurgy
Carl Brubaker
Kirstin Hemphill

Helen R. and Van H. Leichliter Metallurgy Scholarship
Justin Greco
Melissa Marshall
Darren Verlato

Mr. and Mrs. Frank D. Lovett, Sr. Memorial Award
Ian W. Scrymgeour

Penn State Metallurgy Alumni Scholarship
David Crouch
Timothy DeHennis
Thomas Esgro
Tonya Faust
Joseph Kalp
Mitchell Rudman
David Whitcomb
Ryan Wolfe

Pennsylvania Ceramics Association Scholarship
Amy L. Kushner
Brent Miller

PPG Industries Minority Scholarship in Materials Science and Engineering
Obiefune Ezekoye

Anthony J. and Alberta L. Perrotta Scholarship in Materials Science and Engineering
Ryan Carr
David Comstock
Andrew Glendening

James and Mary Ellen Tietjen Scholarship in EMS
David Comstock
Evan Pickett

George H. and Madeleine Hager Todd Scholarship
David Berry
Briama Cooper
Shawn Holmberg
Dennis O'Leary
Matthew D. Smalley
Ricki Stevenson
Ta Kwan Woo

William and Estelle Turney Scholarship in Ceramic Science and Engineering (new for 1999–2000)
Charles Battle
Lisa Friedman

Virginia S. and Philip L. Walker, Jr. Scholarship in Materials Science and Engineering
Jacob Brandspigel
David Comstock
Diana Del Toro
Thomas Pribicko

Sam Zerfoss Memorial Scholarship
Jody Crampo
Melvin Gottschalk
Matt Hollenbeck
Varrada Loryuenyong
Mathew R. Opitz
Jennifer Parker
Nicholas Smith
Kyle Zarambo

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