MATERIALS SCIENCE AND ENGINEERING DEPARTMENT

IOWA STATE UNIVERSITY

MSE ELEMENTS

Vol. 9, No. 2

"The FBI sent us pipe bombs actually used by wackos," said Scott Chumbley.

FBI Asks for Bomb Identification Assistance

Oklahoma City bombing. The Unabomber. U.S. Embassy bombing in Kenya. The FBI never runs out of bombing incidents to investigate. But with the help of Associate Professor Scott Chumbley and his colleagues, the agents' job might get a little easier.

Scott, Assistant Professor Alan Russell, and Ames Lab Scientist Francis Laabs, received a $150,000 grant from the FBI to study the effects of explosive pressure patterns found on pipe bomb fragments. Using a Scanning Electron Microscope (SEM), the team will study patterns before and after an explosion.

"We hope those patterns will help us determine the pressure force of the blast," said Scott. "Once we have that information, we should be able to tell what the bomb was made of...dynamite, plastic explosives, TNT, or black powder."

He said that will provide evidence the FBI uses to narrow a list of suspects. Since the government tightly regulates explosives, records exist as to who manufactured and/or purchased them.

"The FBI sent us pipe bombs actually used by wackos," he said. "The bombs are evidence the FBI has collected over the years. The cases pertaining to these fragments are no longer active and therefore aren't important to the FBI."

Scott keeps the various pipe bomb fragments in plastic bags. After detonation, some bombs shatter into tiny pieces while others blow a hole in the side. The scientists scan the surface of the metal using the SEM. Electron dif-fraction line patterns, indicative of the metal's crystallographic texture, appear on a 25-inch color television screen.

In addition to the FBI's used bomb fragments, Scott's group also is working with Sandia National Laboratories in Albuquerque, New Mexico, to study bombs that the group made.

Using various explosives, the Sandia scientists will blow up aluminum and steel test pieces that Scott's group sends them. "They'll send us back the fragments and we'll study the patterns," he said.

Scott said, "The entire research project, which is just in the early stages, is pretty cool. The FBI and the people down at Sandia talk about bombs like we talk about nuts and bolts — like it's just a normal, ordinary topic of conversation."

Photo credit: Richard Hail

Faculty Troubleshoot for Iowa Companies

Few small companies can afford their own research departments, but thanks to funds from the Iowa legislature, small businesses are able to take advantage of Iowa State's modern research facilities and metallurgical experts.

Iowa Companies Assistance Program (ICAP), one of the industrial outreach programs offered by ISU's Institute for Physical Research and Technology, provides 40 hours of free materials-related research assistance.

"ICAP projects are interesting and cover a wide range of materials problems. And they keep us old profs from getting 'stuck in a rut' by working only on our favorite little research topics," said Assistant Professor **Alan Russell**, who worked on one that dealt with titanium. "It was rolled to a thickness of three microns, the thinnest titanium sheet ever made. But it kept wrinkling during thermal cycling and the company couldn't figure out why. I was able to measure the crystallographic orientation of the foil to explain why it was

Continued on page 6

Greetings from the MSE department!

What an exciting and busy six months since the last ELEMENTS issue.

We held our first Industrial Partnership Open House in September, the only engineering department to host such an event. Nearly 40 industry representatives from seven states attended the open house. We showcased our current interactions with industry, which range from design projects to collaborative research contracts. We also displayed more than 30 posters describing our current research efforts. Students benefited from the open house because they could explore employment and co-op/internship opportunities with our guests. During a panel discussion, we addressed industry members' concerns and suggestions regarding enhanced interactions with our department. We are very pleased with the response we received to our open house and look forward to forging long-lasting, multi-faceted partnerships with industry. You can read more about the open house on page 5 in this issue.

This fall, we begin full implementation of the new materials engineering curriculum. Current students may opt to remain in the existing ceramic engineering and metallurgical engineering programs or switch to the materials engineering program. Most students have indicated that they will switch to the new program, which supports our belief that it is better aligned with our clients' needs.

Concurrently with implementation of the new program, faculty are laboring to develop and fulfill the ABET 2000 criteria. The curriculum committee spent countless hours creating program and course objectives, as well as desired outcomes. The new curriculum, including a detailed description of each course, is posted on our Web page at **<mse.iastate.edu/handbooks Newprogram6.html>**. Please check it out and let us know what you think. We are very interested in your input, and Professor **Kristen Constant**, who is leading this effort, welcomes feedback.

We hope to see all of our ceramic alumni at the American Ceramic Society's annual meeting in Indianapolis. Our reception will be from 6 to 7:30 p.m. on Monday, April 26, 1999, at the Crowne Plaza Hotel's Garden Room. Come and join us!

INTEREST STILL HIGH IN DAMASCUS STEEL

Last year, Distinguished Professor **John Verhoeven**, known for his research that solved the mystery behind the ancient Damascus sword, published articles in two extremely different genres.

John and his co-author **Alfred Pendray**, a bladesmith from Florida, wrote articles for the April issue of *Muse*, a magazine geared toward 12-year-olds. The nine-page spread explained the mystery behind the Syrian sword, including a tongue-in-cheek piece titled, "How to Make a Damascus Blade in 22 Easy Steps."

Damascus swords, prized in the 16th-18th centuries for their strength and sharpness, were famous for their ability to cut a silk scarf in half as it fell to the ground. But no one had been able to reproduce the swords after the art of making them died out. John and Alfred spent years trying to unlock the secret, eventually discovering that an impurity in the steel ingots from India played an integral role in recreating the swords.

"It was a real challenge writing for this age group," said John, who profusely thanked the patient *Muse* editors for their help.

Two articles were published in typical scientific journals. The first article, which appeared in the September issue of the *Journal of Metals*, is titled, "The Key Role of Impurities in Ancient Damascus Steel Blades." You can read the article by logging onto <www.tms.org/pubs/journals/JOM/9809/Verhoeve9809.html>. The second article, "Microsegregation and Banding in Hyper-eutectoid Steel: Damascus Steel," appeared in the transactions section of *Iron & SteelMaker's* November issue.

Distinct surface patterns on Damascus blades are the result of impurities in steel ingots.

Akinc Named Curriculum Chair of National Technological University

A new appointment helps ISU engineering college play a significant role in shaping the future of distance education.

The National Technological University (NTU) recently named Professor and Chair **Mufit Akinc**, chair of its materials science and engineering degree program.

NTU, a cooperative effort among 50 major universities, offers master's degrees and continuing education needs to engineers, technical professionals, and managers. Member universities, including Iowa State, are linked by satellite telecommunications and compressed digital video technology to more than 1,000 work locations internationally.

Using instructional television, students at their job sites tune into technical and managerial courses offered by top faculty and experts from the nation's leading engineering schools and other organizations and institutions.

Mufit, as curriculum chair until 2001, will be responsible for student admission decisions, curriculum review, student advising, and general program management.

"The future of continuing education and graduate education will be very different from what is available today," he said. "There is a revolution going on with information technology and how information is being disseminated. With courses being broadcast from any site in the world, education can be delivered to students no matter where they are.

"This will mean a real globalization of education with many more alternatives available to people to learn from. Some of these alternatives are not even known today," said Mufit.

He said Iowa State's College of Engineering not only wants to be a part of this new delivery method, but would like to play a significant role in shaping the future of distance education.

NTU, accredited by the Commission on Institutions of Higher Education of the North Central Association of Colleges and Schools, offers 14 master's degree programs.

Eight MSE Professors Issued Patents in 1998

Professor Steve Martin: Method of making a surgical laser fiber from a monolithic silica titania glass rod.

Distinguished Professor Karl Gschneidner: Active magnetic refrigerants based on Gd-Si-Ge material and refrigeration apparatus and process. Karl and Associate Professor **Vitalij Pecharsky:** Active magnetic regenerator and method of low-level heating for climate control in buildings, homes, automobiles, and chemical processing.

Assistant Professor Alan Constant: Integrated thin film transistor on an insulator circuit made up of a number of thin film transistors formed with small feature size and densely packed to allow interconnection as a complex circuit.

Professor and Chair Mufit Akinc and Ames Lab Associate Scientist Andrew Thom: Carbon or boron modified titanium silicide.

Adjunct Professor Iver Anderson: Environmentally stable reactive alloy powders and method of making same; Atomizer with liquid spray quenching.

Adjunct Professor R. William McCallum: Production method of rare earth compounds.

Distinguished Professor John Verhoeven: Air melting of Cu-Cr alloys.

First Wilder Recipient Overjoyed

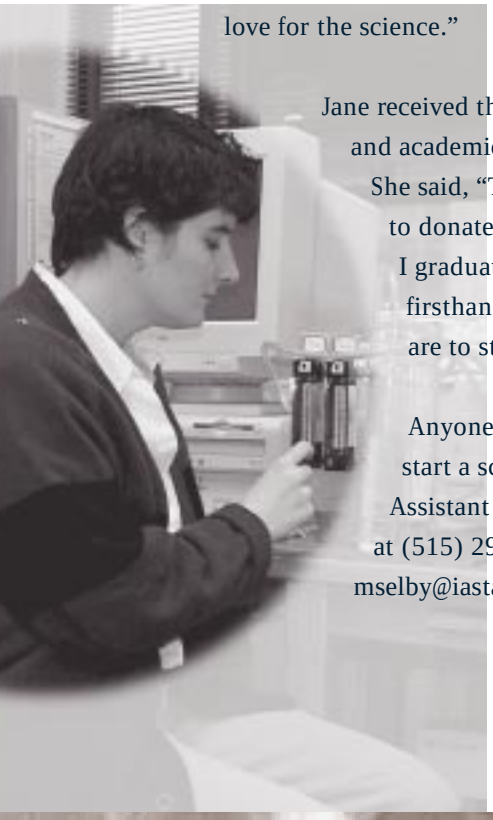
MSE junior Jane Clayton, the first student to receive the David R. Wilder Scholarship, said, "People just can't imagine how important these awards are to students — especially nontraditional students like me."

The 31-year-old, studying ceramic and electronic materials, said, "Without scholarships, I never could have made it."

Jane said scholarships make a huge difference in the quality of grades a student gets as well. "You don't have to work at a job like the third shift at Quik Trip. This way students are able to really focus on their studies. It's also a positive reinforcement of all the hard work you've been putting in."

Funds for the Wilder Scholarship were given by an anonymous donor in honor of **David R. Wilder**, who served as MSE chair for decades. "It was frustrating when I wrote the thank you letter. I had to address it to 'Dear Anonymous Donor.' This was a sizable gift and I really wanted to thank the person who did it."

Jane, who received the first of two $1,300 installments last fall, hopes to go on for her master's and doctoral degrees. "I want to do what Drs. **Kristen Constant** and **Steve Martin** do — teach. And the research side interests me as well simply because of my love for the science."



Jane received the award for her financial need and academic performance. She said, "This has encouraged me to donate to a scholarship after I graduate because I understand firsthand how important these awards are to students."

Anyone wishing to donate to or start a scholarship should contact Assistant Professor **Martha Selby** at (515) 294-0195 or mselby@iastate.edu.

Schilling
CO-EDITS CERAMICS BOOK

Associate Professor **Chris Schilling** and **Joseph Gray**, adjunct professor of mechanical engineering, co-edited the book *Ceramic Transactions*, a collection of papers presented at the 1997 American Ceramic Society's conference in Cincinnati, Ohio.

"These papers highlight new advances in nondestructive instrumentation for the processing of techni-calceramics," said Chris. "The potential applications of these techniques are varied and include prosthetic implants, dental ceramics, and micro-electronic devices."

The book is dedicated to the late Professor **Otto Buck**, who mentored Chris and Joseph. Otto, who died in 1997, worked at Ames Lab and the MSE department for nearly 20 years.

The book can be purchased from the American Ceramic Society at <www.acers.org>.

3M

Amana Appliances

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First Industrial Open House a Success

Engineering Dean **Jim Melsa's** "Blueprint for Excellence" calls for the college to form 50 strategic industrial partnerships by 2003. Professor and Chair **Mufit Akinc** said faculty from his department decided to take a proactive approach to fostering these partnerships by hosting an Industrial Partnership Open House.

Last September nearly 40 industrial representatives from around the United States attended the open house, the only engineering department to host such an event.

"We told them about our department as well as our commitment to long-lasting partnerships," said Mufit. "We also showed them, with specific examples, that we have successfully interacted with industry in the past and will continue to do so more vigorously in the future."

Nearly 100 students, faculty, administrators, and industrial advisory council members shared ideas with industry representatives on how the college and department could address industry's concerns and meet their needs.

"We learned that the biggest need in industry right now is for co-op students and interns," said Mufit. "Also high on the list is providing workshops and courses to practicing engineers."

Participants surveyed after the event responded positively to it. Many expected to contact the MSE department for partnering opportunities within six months, some expected to do so immediately.

Mufit sees the open house as a win/win situation. He said, "We will do our best to meet the needs of industry. And once we establish meaningful partnerships with them, we know they will provide us with real-world and significant design projects for our students; research grants to faculty; co-op and internship opportunities for students; permanent employment for our graduates; student scholarships; lectures and seminars to our students by practicing engineers — the list goes on and on."

Kayser's memory lives on...

"The mere mention of his name gives me an overall warm feeling," said former student Jean (McGregor) Johnson.

Professor **Frank Kayser** touched so many students' lives, it seems only appropriate that he would continue to do so even after his death.

A Frank Kayser Memorial Scholarship fundraiser, organized by current MSE students, will assist undergraduates who declare an interest in metallurgy.

Kayser, who died of a brain tumor in 1998, was so highly thought of by his students that he received the Outstanding MSE Professor of the Year Award 10 times.

Jean (McGregor) Johnson, BSMetE'78, who does metallurgical consulting for medical device companies out of the San Francisco Bay area, is just one of those students. "The mere mention of his name gives me an overall warm feeling," she said. "His introduction to metallurgy class was fabulous. He engaged everybody in the class by breaking everything down so it was interesting for students from any discipline."

To honor Frank, Jean is offering a $5,000 challenge to all of her classmates who graduated between 1977 and 1983. "For every contribution to the memorial scholarship fund, I'll match it until we hit the $5,000 mark," she said. "This is a wonderful way to honor such a terrific professor who identified so closely with his students."

Scott Haines, BSMetE'92, MSMetE'94, also is contributing to the scholarship. Scott, who currently works at LTV Steel Tubular in Ohio, said, "I'm glad to see that Dr. Kayser's name will continue to stand for and recognize hard work, commitment to scholastic achievement, and the advancement of metallurgy and materials science. He will always be remembered as a man who cared about people."

Assistant Professor **Martha Selby**, a former student of Frank's, said, "As an undergraduate engineering student at Iowa State, I took Frank's introduction to materials class, and he was the main reason I chose metallurgical engineering as my major. Now, many years later as a faculty member of the MSE department, it is an honor for me to be involved in such a worthy cause as fundraising for a memorial to Frank. He truly cared about the students and he is certainly missed."

Anyone wishing to donate to the memorial scholarship should contact Martha at (515) 294-0195 or mselby@iastate.edu.

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Faculty Trouble-shoot for ICAP

wrinkling, but there was no easy fix. The project study did, however, lead to a nice *Scripta Materialia* paper."

Alan's most unusual project involved the Iowa State track team. "The coach asked me to improve the weight throw implement, a weighted ball with a handle. I studied the NCAA rules and saw that it would be legal to replace the 20 pounds of lead shot in the commercially available ball with tungsten powder. This improved the implement's rotational moment of inertia so much that the ISU athletes were throwing several feet farther with it," he said. "I'm afraid the improvement was a little too good, though. Within a month the NCAA banned it!"

Assistant Professor **Brian Gleeson** is testing new steel compositions for a trowel company. "Projects like this keep us in contact with industry," he said. "As professors and researchers, we need to stay at the forefront of technology to address industry's needs. Plus, it's gratifying to know we're helping small Iowa companies solve problems and save money."

For more information about ICAP, contact program administrator **Tom Lograsso** at (800) 884-8548 or icap@iastate.edu.

HONORS AND AWARDS

Associate Professor **Chris Schilling** received the 1998 Outstanding Young Engineering Researcher Award from the College of Engineering for his achievements in the powder processing of ceramic materials. Chris is nationally recognized for his research in the shape forming of colloidal ceramics.

David Jiles, professor of MSE and EE and a senior scientist at Ames Lab, was elected a Fellow of the United Kingdom's Institute of Mathematics and its Applications. David, who has a double honors bachelor's degree in mathematics and physics, said the honor surprised him because he has not been very active in the mathematics field for years. David also was elected to a second three-year term of the Magnetics Society's administrative committee.

Doug Bailey, BSMetE'91
Doug is leaving Boeing to work as a metallurgist at Textron Lycoming Engines. He'll send his new e-mail address as soon as he gets it.

Brian Brandel, BSCerE'94
bpbrandel@students.wisc.edu
Germantown, Wisconsin
Brian currently is a full-time graduate student in materials science at the University of Wisconsin-Madison.

Glenn Cerny, BSCerE'84
glenn.cerny@dowcorning.com
Midland, Michigan
Glenn recently joined Dow Corning as an applications specialist for the Semiconductor Fabrication Materials group. His work centers around 3MS, a gas precursor for CVD dielectric films used in the semiconductor industry.

John Gajda, MSCerE'90
JGajda@C-T-L.com
Arlington Heights, Illinois
John is a materials engineer for CTL in Skokie, Illinois.

Honey Goel, MSMSE'97
h-goel@ti.com
Dallas, Texas
Honey works on state-of-the-art defect detection technologies and data analysis methods in semiconductor manufacturing for Texas Instruments.

Alan Haass, BSMetE'80
alan.haass@valmet.com
Seymour, Wisconsin
Alan is a fluids design engineer for papermaking machinery at Valmet Inc.

Jong Her Loke, BSCerE'97
jhloke@hotmail.com
Seri Kembangan, Selangor
Jong is the creative director of CY Multimedia Lab in Malaysia.

Greg Hughes, BSCerE'97
ghughes@spawar.navy.mil
Santee, California
Greg works for Space and Naval Warfare Systems Center in San Diego as a civilian employee of the Dept. of the Navy. He is the project manager and lead engineer for a $25 million Navy program and specializes in satellite communications.

Seong Tcho Kim, MSMetE'93
skim@ussposco.com
Antioch, California
Seong is a metallurgical engineer at UPI Steel at Pittsburg in California.

Glenn W. Ledder, BSCerE'77
gledder@math.unl.edu
Lincoln, Nebraska
Glenn is an associate professor in the Department of Mathematics and Statistics at the University of Nebraska-Lincoln.

Matt Millard, BSCerE'97
go.cyclones@ibm.net
Altoona, Iowa
Matt serves as the IBM and Sun UNIX system administrator at Principal Financial Group.

Greg C. Ojard, PhDMetE'91
ojardgre@pwfl.com
Jupiter, Florida
Greg is a senior materials engineer for Pratt & Whitney and tests ceramic matrix composites.

Antonio Sabariz, MSMetE'88
sabariz@funrei.br
João del Rei, Brazil
Antonio is the scientific director of Fundação de Ensino Superior de São João del Rei (FUNREI) in Brazil.

James E. Steinwall, BSMetE'85
steinwll@gateway.net
Scottsdale, Arizona
James, an engineer/scientist, works in a chemical and surface analysis lab for Motorola's Semiconductor Products Sector.

Cybercontacts

Materials Science and Engineering Department
Iowa State University
3053 Gilman Hall
Ames, Iowa 50011-3114

JOIN US IN INDIANAPOLIS!

Reception
for ISU CerE alumni
and friends

Monday,
April 26, 1999

6:00 - 7:30 p.m.
Crowne Plaza Hotel's Garden Room

MSE will have an exhibit on University Row at the Indianapolis Convention Center for the American Ceramic Society's 101st Annual Meeting & Exposition, April 25 to 28, 1999.

The American Ceramic Society

MSE ELEMENTS

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Send comments, questions, and news items to :

Alan Russell
MSE Department
Iowa State University
3053 Gilman Hall
Ames, IA 50011-3114

Phone: (515) 294-1214
Fax: (515) 294-5444
e-mail: mse@iastate.edu
Web site: http://mse.iastate.edu/

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ISU ALUMNI DAYS '99

Reunion Classes - '49, '44, '39, '34, '29, '24

June 3-5, 1999
Iowa State University Campus

Engineering Alumni Days Social and All University Alumni Dinner with Deans to be announced.

Engineering Alumni Days tours the morning of June 4 in engineering buildings.

Engineering college and departmental receptions and tours. Contact Krista Briley at (515) 294-1214 or kbriley@iastate.edu.

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