

The World of Materials

News from the Department of Materials Science and Engineering
Virginia Polytechnic Institute and State University

Winter 1998

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Greetings From the Department Head Ronald S. Gordon

The Materials Science and Engineering Department experienced an eventful 1997. At the mid-point of the 97-98 academic year, I would like to share with you some of the recent developments in the MSE Department.

A departmental advisory board consisting of thirteen members was formed, and its inaugural meeting was held October 2 and 3. The next board meeting is tentatively scheduled for May 14 and 15, 1998 in Blacksburg. The charter of the MSE Advisory Board and its current membership are given in this newsletter.

The curriculum for the undergraduate B.S. degree program was reviewed and upgraded to expand coverage across all material types (i.e. separate courses including laboratories in metals, ceramics and polymers), reduce redundancy wherever possible, enhance the writing and communications program, increase student exposure to manufacturing processes, and to increase the number of credits for specialization in a materials concentration.

I am pleased to report that our efforts in recruiting undergraduate students to the department seem to be bearing fruit. The incoming sophomore class has approximately 30 students with the potential to increase to nearly 40 once all of the students declaring an MSE major have transferred officially from the Engineering Fundamentals Division (Freshman program). Currently, about a third of our undergraduate students are enrolled in the CO-OP educational program.

American Cameo Glass at Virginia Tech

During September and October, the Perspective Gallery at Virginia Tech hosted an exhibit of American Cameo Glass from Pilgrim Glass Corporation. This revival of Cameo Glass is the result of over a decade of experimentation, vision, and commitment on the part of Alfred E. Knobler (CERE '38), founder and CEO of Pilgrim Glass; Kelsey Murphy, artist and Pilgrim Glass art director; and the many artisans at Pilgrim Glass.

History

Traditionally, the term cameo refers to a technique of layering one material over another, so that a raised motif emerges as the artist carves away surrounding material, exposing the background layer. In cameo glass, two or more layers of glass of similar compositions are cased together while still molten. Cameo glass dates back to ancient Rome between 25 B.C. and A.D. 50. The most famous piece, the Portland Vase, was discovered in Italy during the 16th century. This vase depicts an elaborate scene carved in opaque white glass layered over blue glass. In 1876, John Northwood successfully reproduced the Portland Vase in England.



Photo courtesy Tom Butterfield

Cutaway Fish Aurora, four cased layers: green, topaz, crystal, white.

Greetings continued

Several faculty joint appointments were consummated this past year, including four (Richard Claus, Seshu Desu, Robert Hendricks, Guo-Quan Lu) with the Electrical and Computer Engineering (ECE) Department. The latest joint appointment, with Mechanical Engineering, is Professor Robert Crowe, who is profiled in this newsletter.

Professor Alexander Aning has accepted a full-time academic faculty position in the Engineering Fundamentals Division in the College beginning in the Fall of 1998. Recruitment is currently underway for a junior faculty member with research interests and/or experience in biomaterials research. This new faculty hire will complement existing faculty in the MSE and Engineering Science and Mechanics (ESM) Departments who are currently engaged in research in the general field of mechanics and materials for medical engineering.

The faculty completed the first draft of a five-year strategic (positioning) plan for the department in December. This plan will be finalized this spring, taking into account input from the Dean of Engineering and the MSE Advisory Board. As part of this plan, the decision was made for the MSE Department to begin participation in the pending Virginia Tech Alexandria International Research Institute (VTAIRI). Professor Crowe's base of operations will eventually be in Alexandria and Northern Virginia. Over the next few years, several departments in the College of Engineering, including MSE, ECE, ME, and others, will be establishing a graduate research center at VTAIRI where full-time faculty and graduate students will conduct research, participate in graduate degree programs, and interact with industry in the D.C. area.

In the strategic plan, the MSE faculty has identified three major thrusts for potential areas of significant growth in the research activities of the department:

1. Microelectronics and optoelectronics

- Materials for microelectronic chips, modules, and packaging
- Materials for optical generation/displays, detection, and modulation
- Quantum size effect nanodevices
- Materials for efficient energy storage devices

2. New multifunctional materials

- Novel sensor/actuator/structural materials
- Novel metals/ceramics/polymers/composites design and fabrication
- Advanced coating systems
- Computational methods in novel material analysis and design

3. Mechanics and materials for medical engineering

- Tissue interface materials engineering
- Materials for biosensors and bioinstrumentation
- Materials for repair of aging and diseased natural tissues
- Methods for computational-based non-invasive visualization

Considerable expertise exists already among the faculty of the MSE and ECE Departments in microelectronics and optoelectronics. This thrust ties directly into the anticipated growth of the microelectronics industry in the Commonwealth. It is also relevant to the objectives of the Virginia Microelectronics Consortium (VMEC), which is committed to interdisciplinary education and research in the microelectronics field across the Commonwealth. The MSE and ECE Departments are active participants in VMEC.

The second thrust area is in the field of new multifunctional materials. It is expected that this area will involve cooperative programs with the Center for Intelligent Materials Systems and Structures (CIMSS) in Mechanical Engineering and the Fiber and Electro-Optics Research Center (FEORC) associated with the ECE and MSE Departments. Significant expertise already exists on the faculty in this research field. It is anticipated that Professor Crowe, who served for many years as a program manager at DARPA, will be active in assembling interdisciplinary university/industry teams in technologies related to this thrust area.

The third area of mechanics and materials for medical engineering is in a formative stage in the MSE Department, although it has been an area of emphasis (primarily mechanics) in the ESM Department for several years. Three ESM faculty members are active in this area. At the present time, MSE has one junior faculty member (Brian Love) in the area and is proceeding with the recruitment of another with materials expertise. A critical mass of faculty is gradually being assembled at Virginia Tech. Strong ties are being developed with the College of Veterinary Medicine at Virginia Tech and the Medical College of Virginia (MCV) at VCU in Richmond. It is anticipated that this research thrust will grow gradually and steadily over the next few years and be a cooperative effort with the ESM Department and other organizations in the Commonwealth.

Renovations have begun to upgrade the air conditioning in space assigned to the MSE Department in Holden Hall. These renovations should be completed during the spring

Cameo Glass continued from page 1

Cameo Glass Today

Kelsey Murphy began experimenting with sandblasting and flat glass in 1981 and built a business using this technique to manufacture frames, furniture, windows, and other decorative accessories. In 1985, Ms. Murphy and her partner, Robert Bomkamp, joined forces with Pilgrim Glass to begin working on cameo ware. By its very nature, cameo glass represents a daily miracle of existence. Because of the layering or casing of glass over glass, thermal expansion and stress factors must be carefully matched. Even a tiny defect in the process can result in an explosion during creation or even after the piece is complete. The volatile nature of cameo glass is one of its many fascinating attributes, along with the beauty of the completed piece.

Carlos Suchicital, the Technology Manager for MSE, spent some time visiting the Ceredo plant and talking with Kelsey Murphy about the delicate process of creating cameo glass. Dr. Suchicital points out that, for the engineer, cameo glass represents an amazing phenomenon from the standpoint of the stresses that can build up between the glass layers. Of further interest is the extreme care that must be taken in working with melted glass. Dr. Suchicital compares molten glass to hot lava, chewing its way through anything in its path. This means facilities must be insulated against the high temperatures required to melt glass and against the molten glass itself. When the cameo blank is cooled and ready to carve, artisans must wear protective clothing and work in specially designed rooms. This increases the difficulty of trying to carve intricate detail into the glass, thus making the completed product even more of a miracle. From this union of shape, color, and light, stories emerge across vases, bowls, lamp bases, even jewelry.

Perspective Gallery Exhibit

Tom Butterfield, the Art Director at Squires Student Center, was responsible for bringing the Pilgrim Glass exhibit to Virginia Tech. He saw this exhibit as an opportunity not only to showcase a Virginia Tech graduate but to highlight the connection between art and other disciplines. "Art doesn't necessarily stand alone in the world." Cameo glass offers an excellent example of high quality glass art with a strong connection to engineering—a union of two worlds that seem miles apart at first glance.

Many hours went into planning the Perspective Gallery exhibit, beginning with a phone call from Mrs. Merle Vorster. Mr. Knobler had invited several faculty wives, including Mrs. Vorster, Mrs. J.C. Gordon, and Mrs. Sally Stephenson, to tour the Ceredo plant. Upon their return, Mrs. Vorster contacted Mr. Butterfield concerning a possible exhibit. From that initial idea, Mr. Butterfield can recount numerous telephone calls, faxes, and visits to



The Pilgrim Glass exhibit in the MSE Department features this multi-layered "Victorian" vase.

the Ceredo plant to discuss the exhibit and choose the pieces that would be included, some of which were still in the design phase while others were in production right up to the last minute. This posed special planning challenges for the exhibit, which finally included 72 works. Generally, there is time once the artwork arrives to decide how it should be displayed, Mr. Butterfield explained. However, because many of the cameo glass pieces were still in production until very close to the deadline, the entire plan for display and security had to be in place before the artwork arrived.

Mr. Knobler and Ms. Murphy were on hand on September 14 for a reception at the Perspective Gallery. Ms. Murphy spoke of the dedication and skill of the artisans at the Pilgrim Glass plant in Ceredo. She described the incredible difficulty of carving away the layers of glass, which can too easily lead to breakage, up to 95% in the early years of experimentation. Both Mr. Knobler and Ms. Murphy enjoyed discussing the challenges of creating cameo glass, but more importantly, they were quick to point out that each creation is a team effort, involving the talents and dedication of many Pilgrim Glass artisans. Squires Student Center has acquired several pieces from the exhibit that will be on permanent display in the near future.

Greetings continued from 2

break. Depending on the availability of funds, additional upgrades are planned for some of the laboratories in Holden Hall.

In this issue of the newsletter, you will find a feature article on Alfred E. Knobler, Class of '38 in Ceramic Engineering. Mr. Knobler, President and CEO of Pilgrim Glass, is a member of the MSE Advisory Board. During September and October of last year, the Perspective Gallery at Virginia Tech hosted an exhibit of American Cameo Glass from Pilgrim Glass Corporation. A permanent display of Pilgrim Glass wares has been established in the MSE Department in 213 Holden Hall per the courtesy and graciousness of Mr. Knobler. Mr. Knobler has also contributed an endowment for two undergraduate scholarships in the department this past year.

Profiled in this issue is Professor Diana Farkas, an MSE faculty member since 1982. Dr. Farkas' research expertise is in the field of computer simulation of important

materials phenomena (e.g. fracture and deformation of intermetallic materials). She teaches thermodynamics, computer simulation, and an introductory materials course to mechanical engineers.

Finally, I am pleased to announce that Dr. Charles Blankenship, also a member of the MSE Advisory Board and an alumnus of the MSE Department (Class of '88) has been selected as the Outstanding Young Alumnus from the College of Engineering for 1997-98. The award will be presented this spring at the time of the next meeting of the Advisory Board.

I wish all the alumni and friends of the MSE Department a happy and successful 1998. In the spring newsletter, we will summarize progress for the current year and give a listing of the 97/98 graduates at all degree levels. If you are in Blacksburg, please stop by, visit your department and see the Pilgrim Glass display.



Green Engineering Fall Recruitment

During the Fall semester, Professor Ron Kander, Director for Green Engineering in the College of Engineering, held a recruiting meeting for first-year students interested in Green Engineering. Sixty-five students from various departments participated in a group exercise focusing on the economics and environmental aspects of different beverage containers—glass, metal, plastic. They observed a software demonstration on life cycle analysis, and they learned about the new College of Engineering program that will allow them to earn a concentration (similar to a minor) in Green Engineering. Participants took home frisbees made from recycled polyethylene.

Beginning in 1998, courses will be in place for an 18-hour, recognized concentration in Green Engineering alongside a primary degree in the College of Engineering. Course requirements for this concentration will include 6 credits in identified Green Engineering courses, at least 6 credits each in interdisciplinary elective courses and required, in-major courses identified as containing substantial "green" content.

Green Engineering at Tech began in 1993 with the establishment of a committee chaired by Professor Malcolm J. McPherson of the Mining and Minerals Engineering Department. The initial task of this committee was to identify courses throughout the university curriculum that contained an environmental component.

Of the 70 courses identified, 56 were in engineering. As the new program director, Dr. Kander is overseeing continued course reorganization efforts to include an environmental component within a few courses in every engineering department. The program is funded by the Dean's office, and Raytheon Corporation recently made a donation as well.

The October 13 meeting offered the opportunity for freshmen to discover the mission behind Green Engineering, also known as sustainable engineering. The concept encompasses environmentally conscious values, principles, and attitudes, combined with science, technology, and engineering practices directed toward improving environmental quality locally and globally. All engineering disciplines fit into green engineering, which focuses on the design of materials, processes, systems, and devices with an ultimate goal of minimizing environmental impact throughout the life cycle of a process or product.

If you are interested in learning more about the Green Engineering Program at Virginia Tech, you can contact Dr. Ron Kander, Program Director (rkander@vt.edu) in the MSE Department. You can also visit the Green Engineering website:

<http://www.eng.vt.edu/eng/green/green.html>

Alfred E. Knobler, Class of '38

When Alfred Knobler arrived at the Virginia Agriculture and Mechanical College (Virginia Tech) in 1934, Julian A. Burruss was the President, Earle Norris was the Dean of Engineering, and John Whittemore was the department head for Ceramic Engineering.

Louis O'Shaughnessy was teaching Applied Mechanics and Samuel Pritchard was a professor in Electrical Engineering. The Huckleberry line was still in operation, and women were a fairly novel sight on campus.

Mr. Knobler recalls the culture shock of being a young Jewish northerner arriving in a small southern town, where, for example, the food was definitely not kosher. The son of Polish immigrants, Mr. Knobler grew up in the Bronx with two brothers and two sisters. Love and hope surrounded his childhood. He can remember his mother opening her home to two strangers newly arrived in New York during the Depression. "That's what working class people do for each other—they help people." He recalls his grandfather telling him at an early age, "You serve God by serving people." These memories have been a guide for him throughout his life.

Very early, he became aware of inequality and how money and power were used to keep average men and women down. He recalls the poll tax that prevented lower income citizens from voting. He remembers walking down Main Street in Blacksburg as an 18-year-old student and being surprised when a black couple stepped out into the street, leaving the sidewalk for him. This was one of many incidents that made an impression on him as a young man preparing to face the world.

A 1938 graduate of Virginia Tech, Mr. Knobler came of age during a dark time in our nation's history. He saw first hand the deep scars that resulted from the Depression. Fresh out of college with a degree in Ceramic Engineering, he was eager to try his wings. However, he faced failure and discouragement along with thousands of other Americans who were unable to find work. At one point, he hitchhiked from his home in the Bronx all the way to Chattanooga, Tennessee because he heard rumors that work could be found there. On his return trip, after

finding no job, he was advised by his traveling companion to consider a career in sales. He insisted that he was not interested in sales, that he was trained to be an engineer.



After sending out letters to every conceivable ceramics company, he was hired by Trenton Potteries in New Jersey, where he ultimately tried his hand at sales and discovered a new talent. The company, which manufactured porcelain bathroom fixtures, also designed high fire ceramics for the florist industry. When they gave some of these items to Mr. Knobler, he sold them out on the street for a nice profit. In no time he was earning a commanding salary of \$8400 a year and was able to purchase a new Plymouth automobile for \$600.

During World War II, he worked for the War Department as an inspector, traveling to various factories and writing reports. After the war, he decided it was time to take a chance on going into business for himself. With his talent for sales, he began buying and selling glass and pottery.

In 1949 he purchased a small factory in West Virginia called Tri-State Glass Manufacturing Company. It has since grown into the internationally renowned Pilgrim Glass Corporation, where specialty glass wares are produced such as cobalt and cranberry and the latest creation of American Cameo Glass.

Concern for others has been a way of life for Alfred Knobler. "I've always been an advocate of poor people—my purpose even now is to serve people." He recently "adopted" PS42, his former elementary school in the Bronx. He purchased a much needed piano, a baby grand, for the school, and he spends one day a week visiting with the students, who call him Grandpa Alfred. He has also funded two scholarships in the MSE Department that were awarded for the first time this year.

At 82, Alfred Knobler is still going strong. As CEO for Pilgrim Glass, he maintains an active interest in running the company. He enjoys traveling and meeting people from all walks of life. He finds joy in serving others. "It's been a marvelous life."

Meet Professor Diana Farkas

Professor Diana Farkas can trace her interest in metallurgy back to a lecture she attended during her sophomore year at the Physics Institute at Bariloche, Argentina, where she completed her B.S. in Physics in 1975. Prior to joining the Virginia Tech faculty, she earned a Ph.D. in metallurgy from the University of Delaware in 1980.

The only child of a chemical engineer and a traditional homemaker, Dr. Farkas believes some of the best advice she received while growing up came from her mother, who said, "Never leave your career." After leaving an accounting and secretarial position to stay home, Diana's mother advised that it is difficult to move back into the working world after being home for several years. While it is tempting to set aside a blossoming career when children are young and life becomes more hectic, Dr. Farkas believes the benefits of balancing work and family outweigh the difficulties. "I think this is an important message for our young women engineers."

Her current research focuses on atomistic studies of crack propagation, and she is enthusiastic about using computer simulation to study intergranular fractures. She has been working with Dr. Ron Kriz to include her research as part of a new virtual reality environment that Dr. Kriz is setting up for inclusion in the Advanced Communications and Information Technology Center (ACITC) being planned at Virginia Tech. The CAVE™, or Computer-Activated Virtual Environment, allows the user to experience a sense of total immersion in an environment. For Dr. Farkas' research, the user is surrounded by atomic structures and can watch a crack advancing.

In designing a simulation, her research begins with basic physics—a description of an interaction between two atoms. Based on this description, a simulation is set up of a block of material with a defect. The defect controls the



properties of the material. The simulation provides information on microscopic behavior which can be used to predict how a material will behave. This is "research that links the very basic principles of atomic bonding to the actual microscopic behavior of the materials so that we work on a material-by-design concept," Dr. Farkas explains. The research is "linked to the application on the one hand and to the very basic nature of material on the other."

Aside from her academic work, Dr. Farkas enjoys abstract painting, and her work was exhibited at the Miller Gallery in Blacksburg last summer. She is also looking for ways to interest children, particularly girls, in science. She has found that the Internet is a valuable resource for this purpose. A list of science websites of interest to children is available at Dr. Farkas' home page, along with further descriptions of her research in the MSE Department. You can visit Dr. Farkas' website at:

<http://www.eng.vt.edu/eng/materials/faculty/farkas.html>



Department News

New Joint Faculty Member/Mechanical Engineering

In January, **Dr. Robert (Bob) Crowe** officially accepted a joint appointment as a professor between the MSE and ME Departments. His base of operations will be primarily in Northern Virginia and eventually at the proposed Virginia Tech Alexandria International Research Institute (VTAIRI) in Alexandria, Virginia. He plans to be in Blacksburg frequently to teach and conduct research. Initially, he will work with Dr. Rick Claus in the Fiber and Electro-Optics Research Center (FEORC). Dr. Crowe is also affiliated with the Center for Intelligent Materials Systems and Structures (CIMSS) in Mechanical Engineering. His participation in the teaching program for both

departments will begin in the 98/99 academic year. We anticipate that Dr. Crowe will participate in the distance-delivery of MSE/ME courses over Net Work Virginia from Northern Virginia and Blacksburg.

Dr. Crowe served for nearly thirty years at the Naval Surface Weapons Center, the Naval Research Laboratory, and finally as a Program Manager for the Defense Advanced Research Projects Agency (DARPA). At DARPA he was responsible for developing and supporting programs in advanced materials, especially in polymer and metal matrix composites, smart materials, metals and alloys, and materials processing science. He was program

manager for programs valued at approximately \$110 million. Dr. Crowe has authored or co-authored more than 90 publications and government reports. He received B.S. and M.S. degrees in Metallurgical Engineering from the University of Tennessee and a Ph.D. degree in Materials from the University of Maryland. ❀

Professor Hasselman Receives ITC Award

In October, Professor D.P.H. Hasselman became the 21st recipient of the International Thermal Conductivity (ITC) Award. This award, established in 1965 and given in conjunction with the ITC Conference, was presented to Professor Hasselman in recognition of experimental and theoretical contributions made toward the understanding of thermophysical properties of materials, including thermal shock fracture, thermal conductivity, and thermal diffusivity. Dr. Hasselman was also elected to chair the Board of the ITC Conference.

Dr. Hasselman joined the Virginia Tech faculty in 1977 after spending many years as a research scientist at different locations throughout the United States. Born in the Netherlands, his studies took him to Canada, Germany, and finally the United States, where he completed his Ph.D. at the University of California, Berkeley, in 1966.

In addition to this most recent award, Dr. Hasselman has received many honors over the years. Most notably, he was elected to the International Academy of Ceramics in 1991, an organization whose membership is limited to 100 members. In 1993, he was named an ITC Fellow. Other honors include the Humboldt Prize, awarded by the German Government, and the Joseph Jeppson Gold Medal, awarded by the American Ceramic Society.

Dr. Hasselman's research focuses on mechanical and thermal properties and thermal stress fracture of structural materials for high temperature applications. ❀

Prof. Norm Dowling attended a meeting of the Society of Automotive Engineers, Fatigue Design and Evaluation Committee in October, where he gave a talk on "Materials Properties for Fatigue Crack Growth in Metals." The committee consists of members from industry and academia who work on developing methods for predicting life and preventing failures of mechanical parts in ground vehicles. ❀

MSE Visits Saturn

Last summer, MSE graduate and undergraduate students traveled to the Saturn Plant in Spring Hill, Tennessee. Faculty members Ron Kander, Guo-Quan Lu, Ronald Gordon, and Carlos Suchicital accompanied the group. Students participated in the general public tour, which took them through the entire car manufacturing process, and in the evening they enjoyed great music and food in downtown Nashville.

During the second day the group was given a behind-the-scenes tour of the Saturn plant. Plant engineers demonstrated operation of injection molding machines, used for plastic fenders, and the lost foam casting process for metal engine parts.

A visit to Howmet is in the works for this spring, and future trips are being planned. If your company would be interested in hosting an MSE tour at your facility, please contact Ron Kander (rkander@vt.edu) or Ron Gordon (gordonrs@vt.edu). ❀

Harry C. Dudley Passes Away

Harry C. Dudley, III, died suddenly Friday, August 1, 1997, at Montgomery Regional Hospital. Harry served Virginia Tech for more than 24 years, spending most of those years in the Materials Science and Engineering Department as a Laboratory Instrument Maker. In 1993, Mr. Dudley received one of five President's Awards for Excellence. His efforts on behalf of the University and the MSE Department many times stretched beyond the regular responsibilities of his job. He dedicated long hours to ensure that laboratory equipment necessary for teaching and research was kept in working order and replaced in a timely fashion. He played a major role in getting many Hancock Hall laboratories up and running during a time of serious budget cuts. He took on the responsibility of performing a variety of jobs, displaying expertise in planning, organizing, and implementing equipment installations.

Harry retired from Virginia Tech in 1995. He is survived by his wife, Reba Early Dudley; one son, Jerry Dudley of Richmond; his mother, Norina B. Dudley of Christiansburg; a brother and sister-in-law, Wilfred and Eunice Dudley of Christiansburg; and a sister, Charlotte Moses of Shawsville. ❀

Teaching Excellence Recognized

Congratulations to **Dr. Ron Kander**, who has been chosen to receive a University Wine Award for teaching excellence this year. ❀

Dr. Seshu B. Desu has been selected to receive a Certificate of Teaching Excellence this spring. This certificate is based on student evaluations of teaching. In addition, Dr. Desu will receive the distinguished University Alumni Research Award for 1998. ❀

Dr. Deidre Hirschfeld is now an associate professor in the Materials and Metallurgical Department at New Mexico Institute of Mining and Technology in Socorro, New Mexico. She is working on solid free form fabrication of ceramics. ❀

Materials Science and Engineering Department Advisory Board

Last fall the MSE Department created a thirteen-member Advisory Board composed primarily of representatives from industry. The inaugural Board meeting was held October 2 and 3. Plans include two Board meetings each year in the spring and fall.

The charter of the Advisory Board is to assist the MSE Department in the following ways:

- Act as a sounding board for new initiatives.
- Review the curricula and degree programs.
- Assist with fund-raising initiatives for instructional and research laboratory equipment, computer facilities, scholarships, chaired professorships, etc.
- Participate in the development of the strategic/positioning plan.
- Identify opportunities for outreach, short courses, industrial projects.

- Provide employment opportunities for graduates and provide leads on CO-OP employment and internship opportunities for our students.
- Participate in student and faculty recruitment.
- Help secure funding for students and projects in the Practice-Oriented Masters Degree Program (POMD).
- Help secure funding for senior capstone design projects.

The MSE Department is off to a good start with the Advisory Board. Input and advice from the Board is expected to be instrumental in the growth of the department in the years to come. Current Board members are listed below. In future issues of the newsletter we will profile Advisory Board members. In this issue, profiles are given for Mr. Alfred E. Knobler and Dr. Charles Blankenship, Jr.

Advisory Board Members

Mr. Warren White, Chairperson
Howmet Corporation
Hampton, Virginia

Mr. Ashok Bhambri
Saturn Corporation
Troy, Michigan

Mr. Thomas C. Bibby
Vice President
Quality and Technology
Acadia Polymers Corporation
Roanoke, Virginia

Dr. Charles (Chip) Blankenship, Jr.
Program Manager
General Electric Company
Marine and Industrial Engines
Cincinnati, Ohio

Dr. Jim DiAndreth
DuPont
Central Research and Development
Wilmington, Delaware

Dr. Amitiva Gupta
Vice President
Engineering, Research
and Development
Innotech
Roanoke, Virginia

Mr. Richard Helbling
General Manager
Intermet Corporation
Christiansburg, Virginia

Mr. Paul Huffman
Dominion Metallurgical, Inc.
Roanoke, Virginia

Mr. Alfred E. Knobler
CEO
Pilgrim Glass Corporation
New York, New York

Mr. John H. Kroehling
President
J.H. Kroehling Associates
Williamsburg, Virginia

Professor Dennis Manos
College of William and Mary
Williamsburg, Virginia

Mr. J. Brent McCombs
Technical Director
New River Castings Company
Radford, Virginia

Dr. Anthony L. Sparatorico
Vice-President Research
and Development
Anchor Continental
Columbia, South Carolina

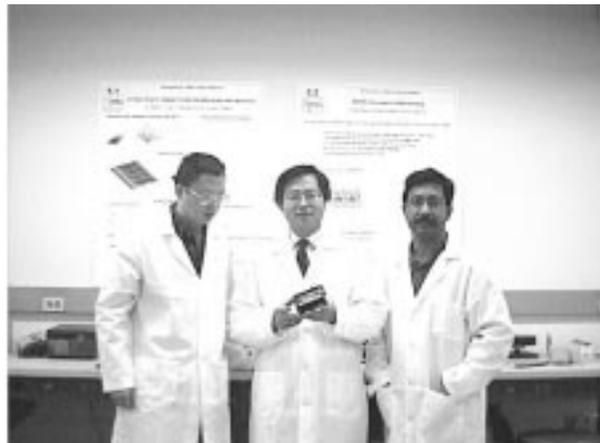
MSE, EE, and ME Team Up to Provide Innovative Solutions for Power Electronics Packaging

Shatil Haque

Power electronics building block (PEBB) packaging is part of a multidisciplinary research program of the Virginia Power Electronics Center (VPEC) funded by the Office of Naval Research. PEBBs are integrated power modules with standardized power electronic components and packaging techniques consisting of power semiconductor devices, power integrated circuits, sensors, and protection circuits. Packaging of integrated modules involves the solution of electrical, mechanical, and thermal problems; it requires a multidisciplinary effort, encompassing the areas of materials, power semiconductor devices, fabrication processes, circuits and control, magnetics, thermal design and analysis, packaging, computer-aided design integration, manufacturing as well as application considerations.

Consequently, VPEC has assembled a team of diversified researchers representing three major departments to address all issues critical to the successful implementation of PEBB: Materials Science and Engineering (Dr. Guo-Quan Lu, Shatil Haque, Dr. Carlos Suchicital, and Thomas Kuhr); Electrical Engineering (Dr. Fred C. Lee, Dr. Dusan Borojevic, Dr. Allan Ward, Kun Xing, and Ray-Lee Lin); and Mechanical Engineering (Dr. Douglas J. Nelson). Furthermore, Dr. Guo-Quan Lu is currently supervising two MSE honors students, Mike Craven and Justin Gravatt, on their senior design projects related to power electronics packaging.

This multidisciplinary packaging team has recently developed a low-cost approach, termed metal posts interconnected parallel plate structure (MPIPPS), for packaging high-performance modules of PEBBs. The new concept is based on the use of direct-bonding of



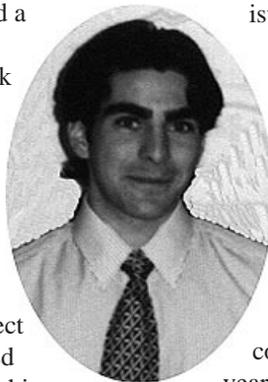
Members of the Power Electronics Packaging Team, left to right, Kun Xing (VPEC student), Dr. Guo-Quan Lu (MSE-EE faculty), Shatil Haque (MSE student)

copper posts, rather than wire-bonding of fine aluminum wires, to interconnect power devices as well as joining the different circuit planes together. This packaging approach requires less expensive equipment and has the potential to produce modules having superior electrical, thermal, and mechanical performance. We have demonstrated the feasibility of this approach by constructing PEBB modules consisting of two insulated gate bipolar transistors (IGBTs), two power diodes, some gate resistors and varistors, and a capacitor. The MPIPPS-packaged modules have been successfully tested at power levels over 6 kW. The Office of Naval Research recently granted a three-year research contract of 1.3 million dollars to further enhance the packaging program for higher power applications.

On the Move with Rob Becker

For Rob Becker (MSE '97), choosing Virginia Tech for undergraduate work seemed natural. "I wanted a good engineering school, and the mountain biking here is incredible!" Apparently, the rock climbing is decent as well. Rob founded the Climbing Club at Tech, and it is now one of the larger clubs on campus.

His interest in engineering most likely began with his father, who is a chemical engineer in Philadelphia. Rob chose materials engineering, he says, because he found the science aspect of the course work interesting, and he also liked being in a smaller department. Rob completed his undergraduate work in MSE with an honors senior design presentation for which he designed and built a vibrating



reed magnetometer to measure the magnetic characteristics of materials.

Following graduation, Rob paid a visit to Stanford and was immediately offered a fellowship. So in July, he packed up his car and headed for the West Coast. After a detour through Wyoming to tackle the Tetons, he arrived in Stanford to begin his doctoral studies in thin film stresses.

What does the future hold for Rob? The idea of starting a company is appealing, and athletics will continue to play a part in his life. For the next four years he plans to enjoy living and working in the San Francisco Bay area.

Cameo Glass continued from page 3

MSE Permanent Exhibit

In addition to the Perspective Gallery exhibit, a permanent display of Pilgrim Glass wares has been established in the MSE Department in 213 Holden Hall and is open to visitors. This exhibit includes several pieces of cameo glass, as well as cranberry, cobalt, and other glass wares for which Pilgrim Glass has become internationally known.

Dr. Suchicital designed the display case, and construction and installation were executed by Mac Traynham of Mac's Custom Wood Shop in Christiansburg, Virginia. The case, which covers one wall in the main MSE office, is constructed of safety glass and solid birch and maple woods. Dr. Suchicital noted that special considerations for the display case included lighting and temperature control. Twenty halogen swivel lamps illuminate the artwork. The lamps are connected in sets of two with separate dimming controls so that different areas of the exhibit can be enhanced. Heat removal was also a concern, as too much heat could cause the pieces to shatter. The display case includes louvered vents at the top and bottom with forced air cooling and dust screens.

The Materials Science and Engineering Department would like to thank Mr. Knobler for contributing these pieces for exhibition in the department. We are also indebted to Carlos Suchicital, Kelsey Murphy, Mac Traynham, and David Berry (electrical work) for their support and assistance in bringing the display together. In addition, MSE would like to thank Mr. Tom Butterfield and the Perspective Gallery for introducing Cameo Glass to Virginia Tech.

References

- Eige, G. Eason, "Pilgrim's New Cameo Glass," *Glass Collector's Digest*, Vol. IV, No. 3, October-November 1990, pp. 31-37.
- Grover, Ray & Lee Grover, *Nouveau Art Glass*, Charles E. Tuttle Company, Rutland, Vermont, 1967.
- Hajdamach, Charles R., *British Glass, 1800-1914*, Antique Collectors' Club Ltd., Suffolk, England, 1991, pp. 203-206.
- Layton, Peter, *Glass Art*, A&C Black Ltd., London, 1996, p. 114.

Outstanding Young Alumni Award

Dr. Charles Blankenship, Jr. (MSE '88) has been selected as the Outstanding Young Alumnus from the College of Engineering for 1997-98. Virginia Tech's national Alumni Association bestows this honor on one alumnus from each academic college who has graduated within the last 10 years. Selections are made by the Board of Directors based on career distinction and/or service to the university since graduation.

Dr. Blankenship received a B.S. in Materials Science in 1988. His undergraduate work included a year of co-op experience at Martin-Marietta Labs as a materials engineer in light alloys for aerospace applications. He earned a Ph.D. in Materials Science and Engineering from the University of Virginia in 1992 with research and dissertation focused on the processing, microstructure, and properties of Al-Li alloys for aerospace applications. He won the Allan T. Gwathmey Award for outstanding dissertation in a fundamental problem in physical sciences.

In 1992, Dr. Blankenship joined GE Corporate Research and Development Center as a staff scientist working on turbine disk alloy and process development. He served as the Manager for the Structural and Refractory Alloys Program from 1993 to 1996. This team of 25 researchers was responsible for alloy and process development for compressor and turbine disks for GE Power Generation

and GE Aircraft Engine businesses, diesel engine materials for GE Transportation business, rotating cathodes in catscan x-ray tubes for GE Medical systems, and filaments in advanced halogen infrared lamps for GE Lighting. He also led a technology acquisition effort focused on cultivating former Soviet military technology for commercial use, which involved both the technical assessment of the metallurgical processes and business aspects of the transfer.

He has authored 23 technical publications, co-authored a graduate textbook, and currently holds 6 U.S. and European patents on superalloy processing for gas turbine rotor applications. In 1996, Dr. Blankenship received the Alfred Geisler Award for "outstanding young metallurgist" from the New York chapter of ASM. During that same year he became a registered professional engineer in the state of Virginia.

Also in 1996, Dr. Blankenship transferred to GE Aircraft Engines to lead the LM9000 project, an advanced aeroderivative gas turbine development effort. He is currently the project manager for the LM5000 and LM6000 gas turbine product lines. This role encompasses leading a multifunctional team responsible for the marketing, sales, design, production, and service of these gas turbines in a global market.

1997-1998 MSE Scholarship Recipients

Alfred E. Knobler Scholarship

Adetola Abatan (2000)
Grace Tran (2000)

John H. Kroehling

Matt Gordon (1999)

Gilbert and Lucille Seay

Billy Abernathy (1998)
Kevin Cherry (1999)
Jason Midkiff (1999)
Allison Suggs (2000)
Craig Todd (2000)

Ellen Wheeler Scholarship

Brian Okerberg (2000)

Stubach Scholarship

Jeff Schultz (1999)

Young Family Scholarship

Billy Abernathy (1998)

Stroyan Scholarship

Joey Card (2000)
Janelle Combs (1999)
Mike Craven (1998)
Adam Goff (2000)
Justin Gravatt (1998)
Todd Heil (2000)
Shane Juhl (2000)
Kelly Leese (1999)
Joe Mix (1998)
Beth Oborn (1998)
Jireh Yue (1999)

Foundry Education Foundation

Jeff Haeberle (1998)
Garrett Storaska (1998)

TMS Scholarship

Brett Hull (1998)

MSE Faculty Scholarship

Tiffany Brunetti (1999)
Keith Knipling (1998)

MSE Supplemental Grant

Adetola Abatan (2000)
Billy Abernathy (1998)
Tiffany Brunetti (1999)
Kevin Cherry (1999)
David Ferguson (2000)
Jeff Haeberle (1998)
Brett Hull (1998)
Keith Knipling (1998)
Josh Luszcz (1999)
Jason Midkiff (1999)
Brian Okerberg (2000)
Garrett Storaska (1998)
Allison Suggs (2000)
Craig Todd (2000)

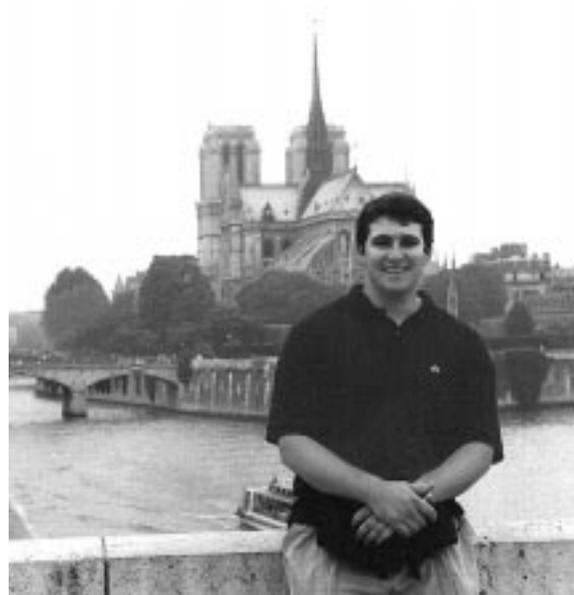
Engineering Scholarship

Adetola Abatan (2000)
David Ferguson (2000)
Josh Luszcz (1999)

MSE Graduate Student Spends Summer in London

Doctoral candidate, Judson Marte, spent his summer conducting research at the Imperial College of Science, Technology, and Medicine at the University of London. With the help of his advisor, Dr. Steve Kampe, Jud arranged to work with Dr. Leo Christodoulou in the Materials Department at the Imperial College.

Jud's goal was to study multilithic metal matrix composites (MMMCs) consisting of a Ti-6Al-4V reinforced by an intermetallic matrix composite (IMC), a composite within a composite. A major advantage of this material is that the intermetallic composite is strong like a ceramic at room temperature, but at a high temperature the material can act like a metal. Specifically, the material processes like a metal in that the deformation characteristics match up with intermetallic matrix of co-flow of materials as it extrudes. The basic extrusion procedure begins with IMC powder blended with Ti-64 powder, placed in a metal canister, and heated. At very high temperatures the IMC, which is normally a brittle material, becomes soft and malleable. This blended material is then extruded to form a solid titanium alloy matrix reinforced by the now elongated IMC phase. Jud's research is sponsored by MATSYS, Inc., a small business located in Springfield, Virginia. MATSYS is engaged in process modeling for intelligent manufacturing of materials (IPM).



Judson took a break from his London studies to spend a day in Paris.

Aside from research, Jud found time to see the sights, sample the food in Paris, and play lots of squash in London. He also toured Cambridge and experienced "punting on the Cam." Although he found London crowded and expensive, Jud enjoyed his time there immensely. "The beer was really good!"

Student and Alumni Notes

Brett Hull (B.S. '98) has been awarded the TMS Light Metals Division (LMD) scholarship of \$2000 for the 1997/1998 academic year. An additional \$500 stipend was granted so that Brett could attend the 1998 TMS annual meeting in February in San Antonio, Texas. The scholarship application required three letters of recommendation. Brett expresses his appreciation to Drs. Kampe, Aning, and Brown for writing these recommendations. He is especially grateful to Dr. Kampe, who was instrumental in pulling everything together while Brett was co-oping. In addition to the recommendation letters, Brett wrote a one-page essay describing his education so far and his future plans. ❀

Lauren Shea (M.S. '94) has completed her Ph.D. at the University of California at San Diego and is working as a materials scientist at Sandia National Laboratories in Albuquerque, New Mexico. She is involved in characterizing, lifetesting, and benchmarking of luminescent materials for flat panel displays; developing standards and protocols for cathodoluminescence measurements; and investigating light emitting materials for sending and monitoring applications. ❀

Qiang (Curtis) Liang (Ph.D. '97) is a process engineer for the semiconductor group at Texas Instruments in Dallas, Texas. ❀

Shari Feth (Ph.D. '97) has moved to Huntsville, Alabama, where she is working on crystal growth and characterization of ZnSe for Hughes STX at NASA/Marshall Space Flight Center. In addition, she and her husband have been renovating a Victorian house in Huntsville. ❀

Howard (J.R.) Nordby (M.Eng. '97) completed the new Practice-Oriented Masters Program in the College of Engineering last August and is working for Northrop-Grumman in Baltimore, Maryland. He is working in the Electronic Sensors and Systems Division and is currently an associate engineer in a rotational program where he is learning about the different areas. ❀

Mike Stawovy (B.S. '91, M.S. '94, Ph.D. pending) is a Senior Project Engineer at Aerojet Corp. in Jonesborough, Tennessee. ❀

Rebecca (Herrmann) Stawovy (B.S. '91, M.S. '95) is a Metallurgical Laboratory Supervisor at Aerojet Corp. in Jonesborough, Tennessee. ❀

Dave Cann (B.S. '91) completed his Ph.D. in Materials Science in August at Penn State and is now an Assistant Professor at Iowa State University in Ames, Iowa. ❀

Paul (Ike) Eichenlaub (B.S. '97) is working at Grede Foundries, Inc. in Cynthiana, Kentucky at their Perm Cast plant. ❀

Scott Wurzburger (B.S. '94) and **Julie (Prince) Wurzburger (B.S. '94)** are living in Abilene, Texas, where Scott is a 1st Lieutenant with the 28th Bomb Squadron at Dyess Air Force Base. He is currently training to fly the Rockwell B-1 Bomber. Julie is an engineering consultant with Bandag, a tire manufacturing plant in Abilene. ❀

Bryan Zimmerman (B.S. '96) is a research assistant at North Carolina State University in Raleigh, NC. ❀

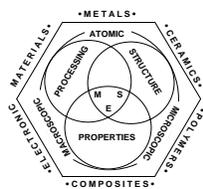
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