The World of Materials

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

Spring 2000, Vol. 5, No. 1

Hokies Go Global!

Julie Martin is one of several MSE Hokies who are seeing the world this year. Stories begin on page 14.

MSE Keeps Moving Forward

Prof. Norman Dowling

The MSE Department is moving ahead on several fronts, while at the same time anticipating the hiring of a new department head. Advertisements and announcements of this position brought 18 applications, including a number of excellent candidates. The Search Committee for this position, chaired by Steve Kampe, narrowed the field to the top three candidates, all of whom have been interviewed. We expect to make a decision by midsummer.

We also have two open faculty positions, one for a senior faculty member at the professor or associate professor level, and the other for a junior position at the assistant or associate level. The emphasis of these searches is to fill a gap in the ceramics area resulting from recent retirements. Over 140 applications were received, again including a number of excellent candidates. Six candidates have been interviewed and are under consideration for the positions. This Search Committee is chaired by Jess Brown, who recently retired and has been granted Emeritus status.

We continue to seek donations of funds, in large or small amounts, and of equipment, for upgrading our undergraduate instructional labs. A number of significant donations have been received, but these fill only a part of the need. The initial emphasis is on equipment for sample preparation and optical microscopy, and equipment is also being sought for polymer labs and for a metal casting foundry. Additional detail is given in an article by Carlos Suchicital found on page 2. Our major developmental effort in materials for microelectronics is described in a second article by Bob Hendricks on page 6.

MSE needs additional space and renovation of some existing space. A detailed plan to satisfy this need has been crafted by a committee led by Bob Hendricks and Brian Love. Progress has been made toward finding additional

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MSE Facilities Renovations and Equipment Upgrades

Carlos Suchicital

Research Prof. Carlos Suchicital

An active campaign began in 1997 to renovate and upgrade the undergraduate teaching laboratories and several of the graduate research laboratories within the MSE Department at Virginia Tech. Extensive restructuring has taken place and the undergraduate teaching laboratories have been relocated to the first floor of Holden Hall (Figure 1). With this centralization of the teaching laboratories, students can 'do their shopping' all in one spot; that is, they can process a sample, prepare it for further tests, and do most of those tests all on one floor. These laboratory facilities have a companion equipment repair shop and supply storage located on the same floor, thus optimizing the maintenance and supervision of all facilities. Metal, polymer, and ceramic laboratories are accommodated, with composites utilizing facilities as determined by the nature of the material under study.

Further upgrades are expected to occur as funds become available for remodeling and equipment purchase. SCHEV funds have made possible the purchase of an extruder for ceramics, a freeze dryer, a large volume forced air dryer, an image analysis system, a programmable high speed saw, and a stereoscope. In addition, equipment has been obtained from other facilities on campus, including a 50-ton press, a belt furnace, high temperature furnaces, a hammer mill, a low-speed saw, and a scanning acoustic microscope. Efforts are underway by several of our faculty to obtain equipment donations for our teaching and research laboratories from industrial friends. A new foundry lab is being built with the support of industry and the Piedmont Chapter of the American Foundrymen's Society (AFS). The facility will include equipment for designing castings, making patterns and molds, melting and handling molten metal, and finishing cast components. Production of small castings will be possible via commercially important processes such as green sand casting, investment casting, and shell molding.

The lab will serve a variety of users and purposes. It will provide manufacturing lab experience for MSE majors, be used for senior project work, and serve as a recruiting tool to attract students to the MSE major. In a research context, the facility will make it possible for Virginia Tech to compete for metal casting research funding available from the U.S. Department of Energy and from industry.

On the aesthetic side of materials, the Art and Art History Department is planning to use the facility to cast sculptures.

To date, the Piedmont Chapter of AFS has generously donated $25,000 to help build the facility, and companies have committed to donating materials, supplies, and $20,000 of new spectroscopy and thermal analysis equipment to the project. Paul Huffman, Education Chair of the Piedmont Chapter, is organizing industrial support for the project. Bill Reynolds is the point of contact in the MSE Department.

These fund raising activities are greatly enhanced by the parallel fund raising activities of our advisory board in collaboration with MSE faculty and the College of Engineering Development Office. Although this effort is expected to be a long term activity, its initial targets are the Metals Processing, the Metallography, and the Microscopy laboratories.

MSE teaching facilities promote close interaction between undergraduate and graduate students.

Our undergraduate teaching facilities are also an integral part of the graduate research program, thus promoting the close interaction between both student bodies. Indeed, a large percentage of our undergraduate students actively participate in graduate research projects and likewise, our graduate students actively collaborate with the faculty in teaching undergraduate senior projects. The department finds this interaction beneficial, healthy, and rewarding for all involved.

In addition to the above, the MSE and ECE Departments have embarked on a close collaboration to spearhead a program for microelectronics education and research at Virginia Tech. As a result, commonly shared undergraduate teaching and graduate research facilities are being set up in Whittemore, Hancock, and Holden Halls. The program has among its goals to provide a source of highly educated and trained graduates to the microelectronics industry in Virginia and the nation.

Several research laboratories in the department have also benefited from the remodeling and restructuring efforts. The Thin-Films laboratory is now located on the third floor of Holden Hall in newly upgraded rooms 306 and 312 and is also open to undergraduate teaching. This facility forms an integral part of microelectronics education and is known as the Device Characterization Laboratory (DCL). Here the students will learn to assemble sophisticated systems for the controlled deposition of

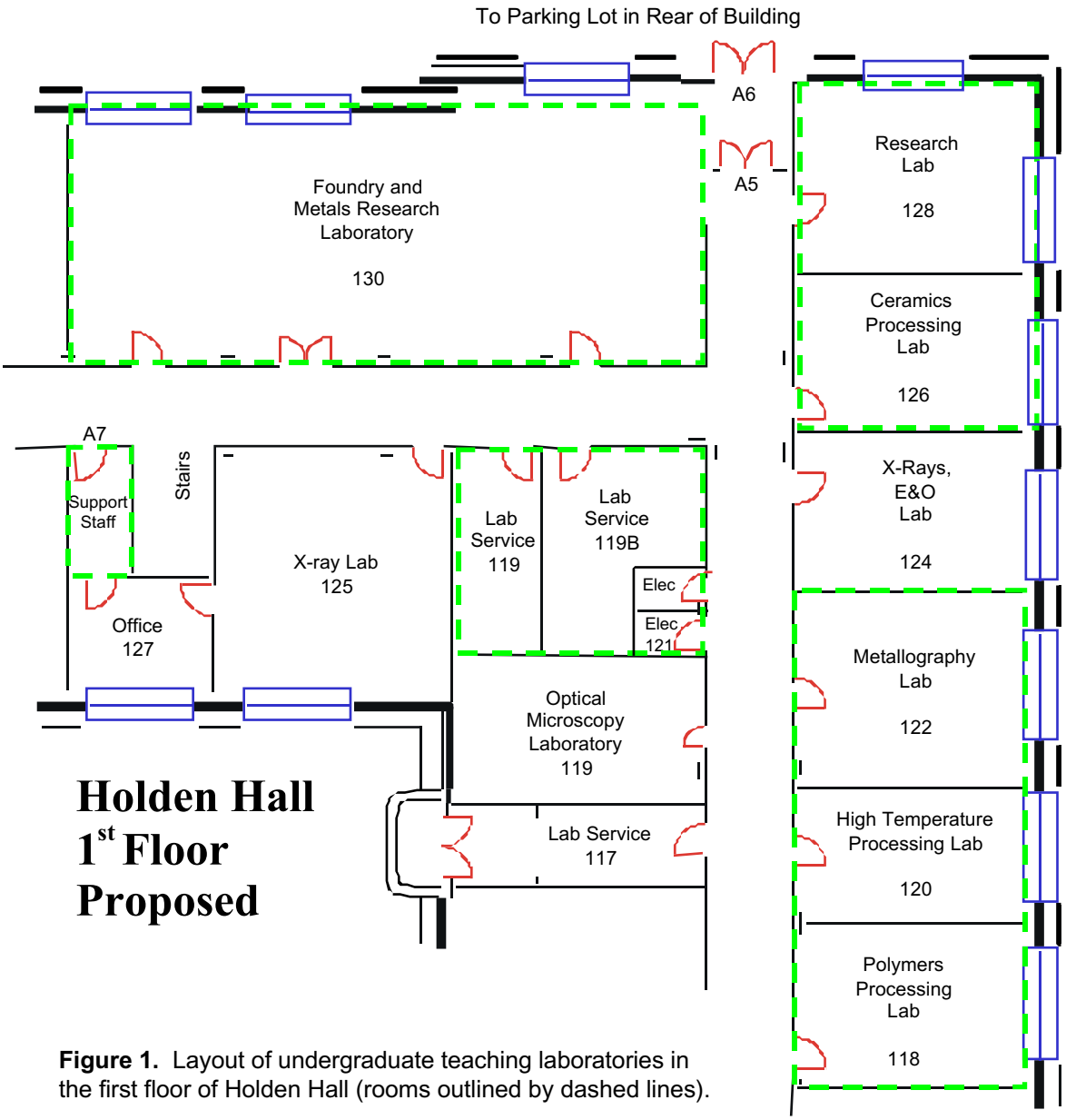

Figure 1. Layout of undergraduate teaching laboratories in the first floor of Holden Hall (rooms outlined by dashed lines).

films or coatings by several techniques including screen-printing, sputtering, evaporation, and chemical vapor deposition. The laboratory also has capabilities for testing and evaluation of the properties characteristic of the deposited material. This laboratory operates in conjunction with other graduate research facilities that have further capabilities for materials development and processing of films/coatings, including laser ablation, sol-gel, photo-lithography, etc.

The interdisciplinary research groups in Hancock Hall have welcomed a new member into their community: the Microelectronics Materials and Processes group. This group is composed of a highly interdisciplinary selection of faculty and their students. At this early stage, seven departments are represented, and more are expected to join in the effort. The research and teaching facilities are being set up in Holden, Hancock, and Whittemore Halls with a total of 9,840 sq. ft. and include a materials analysis laboratory with an array of analytical equipment. This analytical facility has become possible through the joint efforts of the Departments of ESM, MSE, ECE, ChemE, and Chemistry and will render services to the broader campus community. The analytical facility will be managed by an interdepartmental committee formed by Professors R. Hendricks, committee chair (MSE/ECE), W. Reynolds (MSE), C. Suchicital (MSE), and G. Wilkes (ChemE). This effort in microelectronics is Virginia Tech's response to the statewide effort of the Virginia Microelectronics Consortium and includes the task of

continued

Renovations Continued

developing a comprehensive combined education and research program in microelectronics that will be rated among the top programs in the United States within a decade. More detailed information about this effort can be found in "Microelectronics Education and Research at Virginia Tech" on page 6.

On another front, Professor Brian Love, on behalf of a larger group of faculty associated with the Center for Biomedical Engineering (CBME), was allocated space (566 sq. ft.) in 106 Hancock Hall last spring. The laboratory, which is the physical infrastructure associated with the Center, started as an empty shell that the faculty have been working hard to fill up. Among the acquisitions are a ZM Model Coulter Counter for cell blood count analysis and for particle aggregation studies, an HP model 1050 High Performance Liquid Chromatography (HPLC) Workstation for protein characterization and other cell and materials characterization, and a Perkin Elmer DSC-7 and TGA-7 for more materials analysis. Professor Love has also purchased a couple of computers for the laboratory, and the students have found effective use for the instrumentation since acquisitions began in April. Professor Tom Diller in the Mechanical Engineering Department has provided a blood gas analyzer which needs some minor refurbishing to put it into working order. The group is working hard to obtain other relevant imaging equipment necessary to maintain a full-fledged laboratory dedicated to bioengineering. To learn more about the CBME, feel free to visit the Center's website, www.bme.vt.edu.

Finally, Professor Sean Corcoran has established a nanomechanical and electrochemistry laboratory in 125 Holden. This research laboratory is equipped with a Hysitron Nanoindentation Instrument, which is used to make mechanical measurements such as micronewton sensitivity in load and nanometer sensitivity in displacement. It also performs elastic modulus and hardness measurements of surfaces at depths as shallow as 10nm. There is also an atomic force microscope (AFM)/scanning probe microscope manufactured by Digital Instruments. This instrument consists of a scanning tunneling microscope, a magnetic force microscope, and an electrochemical scanning tunneling microscope. This AFM permits imaging of the surface of anything from an angstrom (atomic resolution) up to 100 microns in size. It is used to study electrochemical processes in the early stages of corrosion.

Dr. Carlos Suchicital is a Research Professor in the MSE Department, and he serves as the Facilities and Technologies Manager.

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space for MSE, but a few details remain to be finalized before the added space is finally allocated. A major funding request to the university has also been made for the needed renovations.

Enrollments at both the undergraduate and graduate levels have increased steadily but have not yet reached desired levels. We currently have 78 sophomore through senior undergraduate students, 19 of whom graduated this May. The quality of our undergraduate students is also increasing, as evidenced by the numbers of Honors Program students, currently 2 seniors, 4 juniors, and 5 sophomores. Our undergraduate program has been ably led for the last few years by Ron Kander. This work has recently been taken over by Lou Guido, freeing Ron to lead the major effort of preparing for the ABET undergraduate program accrediting visit coming up in the fall of 2001.

The new MSE Ph.D. program, replacing the former interdisciplinary materials Ph.D. program, began its first year in August of 1999 and is progressing well under the leadership of Bill Reynolds. The initiation of this program is a major step forward by the MSE Department. Graduate student enrollments have increased to 19 M.S. and 28 Ph.D. students.

If you should contact the MSE Department, and we hope you will, you are likely to talk to Tracey Keister, our Executive Secretary, who has been with us since August as a welcome addition to the staff. (The MSE main office phone number is 540-231-6640.) Two other key office staff members have been with us for several years: Amy Hill, Fiscal Technician Senior, and Jan Doran, Student Services Specialist. Amy has an assistant, Sharon Proffitt, who recently joined us. These capable staff keep the department office running smoothly. Research Assistant Professor Carlos Suchicital, our Technology and Facilities Manager, and David Berry, Technician Senior, provide critical expertise in developing, maintaining, and operating laboratories.

We have also recently added a part time instructor, Kathy Rohr, who will teach the metallurgy laboratory course, and other courses as well. Many alumni may remember Kathy, as she did similar teaching for MSE several years ago. She rejoins us after working as a metallurgist in industry during the intervening period. Kathy is available on a fee basis to do small jobs of materials testing and analysis, using any of several laboratories in MSE and elsewhere on campus. Contact her at phone 540-231-3577, or e-mail krohr@mse.vt.edu. ❖

Department News

Alfred E. Knobler Honored
This spring, Alfred E. Knobler (CERE '38) was among the seven inductees into the Academy of Engineering Excellence for 2000. This academy was established in 1999 by the College of Engineering and the College's Committee of 100 Advisory Board. Academy membership is reserved for individuals who have a Virginia Tech Engineering degree and who have made "sustained and meritorious engineering and/or leadership contributions during their careers."

Mr. Knobler is the CEO of The Pilgrim Glass Corporation, which he purchased in 1949 when it was a small hand-blown-glass factory in West Virginia. Today, Pilgrim Glass stands "at the forefront of technological advances in glass production and is the only producer worldwide of American Cameo Art Glass."

Mr. Knobler with his children, Peter, a writer and Joanna, a psychiatrist. All three reside in New York City.

Mr. Knobler is a man who acts on his convictions, evidenced early in his life when, at age 15, he and his friends picketed Yankee Stadium to demand that the major leagues admit black baseball players in 1930. Today, he is "Grandpa Alfred" at New York City Public School 42, his elementary alma mater, where he visits weekly and has provided funding and even a much needed piano. At Virginia Tech, he has endowed scholarships in the English Department and in Materials Science and Engineering. He has also recently contributed funds toward the purchase of lab equipment in the MSE Department. He serves on the Committee of 100, the MSE Industry Advisory Board, and he is a member of the university's Ut Prosim Society. ❖

Alfred E. Knobler (center) with MSE Department Head Norman Dowling (left) and College of Engineering Dean Bill Stephenson

Graduate Recruiting Day 2000
Prof. Brian Love reports that MSE participated in the second official College of Engineering Graduate Recruiting Day on March 25. The idea for a recruiting day arose from discussions between the Departments of MSE, ME, ChemE, and ESM. These four departments flew in a pool of approximately 60 candidates from all over the nation to meet department representatives. The MSE contingent of 14 included Virginia Tech undergraduates who are considering Tech as well as students from Northwestern, Syracuse, The Colorado School of Mines, St. Joseph's College, The University of Virginia, Indiana University of Pennsylvania, Mount Holyoke University, and Dartmouth. A serious effort is underway to improve the level of recruiting in order to increase the size of the graduate program through an increase in U.S. applicants. Prof. Bill Reynolds gave a presentation on the workings of the graduate program, as well as highlighting faculty who have current or future research openings. Current graduate students organized tours of the campus and the town. Overall, the group seemed well satisfied with the presentations and the program. This type of event reflects very well on all who helped to make it a reality. A good number of graduate recruitments are expected to result from this event. ❖

Sean Corcoran was honored on April 5 with an Outstanding New Assistant Professor Award presented by the College of Engineering. This was one of three such awards in the College for the year 2000. In less than two years, Sean has obtained four research grants totaling over $700,000, is advising undergraduate and graduate students, and receives excellent ratings in teaching evaluations. ❖

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Microelectronics Education and Research at Virginia Tech

(http://www.microelectronics.vt.edu)

Robert W. Hendricks

Prof. Robert Hendricks

Introduction

In 1994, Motorola, IBM/ Toshiba, and Motorola/Siemens announced plans to locate major semiconductor fabrication plants in Virginia. Since then, two facilities have opened and are both now undergoing significant expansions of production. These plants will eventually employ several thousand engineers and technicians with many more in supporting industries. This has the potential to create a strong demand for enhanced science and engineering education in K-12 all the way up through the doctoral degree as well as a need for industry-academic partnerships.

The Virginia Microelectronics Consortium (VMEC), which includes The College of William and Mary, George Mason University, Old Dominion University, The University of Virginia, Virginia Commonwealth University, and Virginia Tech, was established to collaborate on the delivery of high quality microelectronics undergraduate and master's level educational programs. The Commonwealth of Virginia has committed $9 million and Motorola has pledged $1 million toward establishing educational programs in support of the semiconductor industry.

New Virginia industry creates demand for expanded curriculum in microelectronics

The Virginia Semiconductor Educational Endowment, in recognition of the need for program leadership and the creation of basic facilities at participating schools, authorized these actions in 1998:

- The creation of endowed chairs at each of the initial VMEC institutions to guide each school's VMEC program. Funding for these chairs, totaling $6 million, began in 1999 and will be completed by 2002, when each school will receive endowment income of $50,000 per year. The endowment professors will provide highly visible, senior leadership to implement the collaborative program developed by VMEC.
- The funding of $2.5 million in infrastructure to establish modest clean room facilities for undergraduate and Master's level microelectronics fabrication laboratory experiments.
- The allocation of $750,000 to establish an endowment for student scholarships. Additional allocations will result in a final endowment of $1.5 million by 2002.

Virginia Tech seeks prominence in microelectronics by 2010

In response to this statewide initiative, Virginia Tech has undertaken the task of developing a comprehensive combined education and research program in microelectronics that will be rated among the top programs in the United States within a decade.

Mission

The Microelectronics program at Virginia Tech will focus on designing and developing an undergraduate and graduate microelectronics program that will meet the following criteria:

- Excellence in education, research, and outreach
- Broadly inclusive across the university
- Undergraduate laboratories and research will follow a carefully designed curriculum
- Graduate research will build on the strength of diverse faculty interests yet capitalize on well-designed and maintained central processing and analytical facilities
- Synergistic with sister VMEC schools and meets state requirements
- Will lead Tech into national prominence in microelectronics within a decade.

To fulfill our mission and achieve our goal of national prominence in the field of microelectronics within a decade, our program should have the following capabilities:

- A faculty of 25-30 whose primary teaching and research interests are microelectronics;
- Fully equipped clean rooms with state-of-the-art processing and characterization equipment for a wide range of materials types including

- an 1800 sq. ft. Class 10,000 introductory processing and device characterization clean room designed to handle 500 entering students per year,
- an advanced undergraduate and graduate packaging teaching laboratory, and
- the creation of centralized (common) advanced undergraduate and graduate fabrication and characterization teaching and research laboratories including
  - a crystal and thin film growing laboratory with state-of-the-art PVD, CVD, and MOCVD capabilities;
  - a supporting materials characterization laboratory with AFM, SAM, SEM, TEM, XRD, and other advanced capabilities;
  - a 5000 sq. ft. Class 100 to Class 10,000 clean room facility with state-of-the-art processing and equipment and instrumentation suitable for the fabrication of microelectronic devices in compound semiconductors, silicon carbide, and silicon; and
  - a laboratory for semiconductor device and thin film characterization.

Further, from a pedagogical standpoint, we must

- provide a common introductory IC fabrication laboratory for teaching 500 students per year from three departments* offering four degrees;
- provide advanced undergraduate and graduate education through high-quality research utilizing carefully designed common processing and characterization facilities;
- capitalize on existing advanced courses in
  - Semiconductor materials and devices
  - Solid state physics
  - Analog and power electronics
  - Hybrid and thick film microelectronics
  - Radio/microwave engineering
  - RFIC design
  - Digital/analog VLSI design
  - Fiber-optics
- participate in the statewide junior summer program; and
- provide outreach to community colleges and other VMEC institutions through distance education.

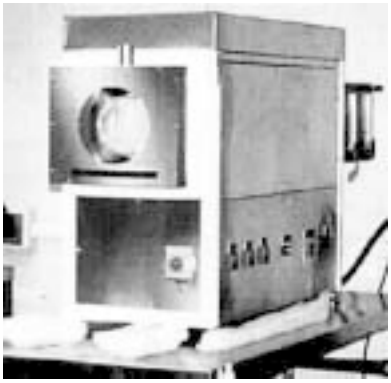
Table 1. Microelectronics-Related Faculty

Name	Affiliation	Area of Interest
James A. Armstrong	ECE	VLSI design
Peter Athanas	ECE	VLSI design
Richard O. Claus	ECE/MSE	Self-assembled materials, optical sensors
John C. Duke	ESM	Non-destructive evaluation
Stephane Evoy	ECE	MEMS, nanomechanical systems, confined optoelectronic systems
Festus G. Gray	ECE	VLSI design
Louis Guido	MSE/ECE	GaN, SiC, optoelectronic materials & devices
Wilhelm Graupner	PHYS	Organic optoelectronic materials
Dong S. Ha	ECE	VLSI low-power/mixed-signal design
James R. Heflin	PHYS	Optoelectronics, nonlinear optical devices, polymer electro-optics
Robert W. Hendricks	MSE/ECE	Semiconductor materials, education
Alex Q. Huang	ECE	Power semiconductor devices
Mark T. Jones	ECE	VLSI design
Guo-Quan Lu	MSE/ECE	Electronics packaging, microelectronic materials processing
Kent A. Murphy	ECE	Optical fibers and sensors
Douglas J. Nelson	ME	Heat-transfer in microelectronic circuits
Sanjay Raman	ECE	High-frequency microelectronics, mixed-signal, MEMS
Sedki Riad	ECE	Processing, measurement and modeling
Ravi Saraf	CHE	Nanotechnology
Subhash Sarin	ISE	Semiconductor manufacturing
Carlos T. A. Suchicital	MSE	Thin-films, packaging, ceramics, free-forming, devices & instrumentation
Anbo Wang	ECE	Optical materials and sensors, thin-films, MEMS

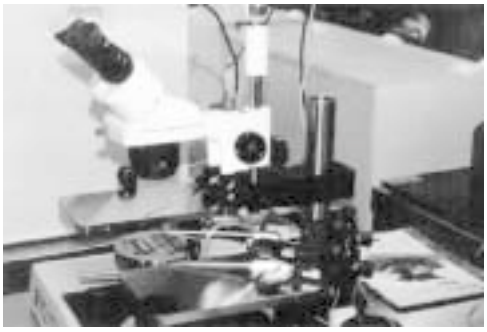
*The ECE, MSE, and Physics Departments have determined that students seeking degrees in their respective departments must be exposed to semiconductor processing at some point in their education. This accounts for the target of 500 students per year in the introductory laboratory.

Resources

The resources available for developing an integrated microelectronics education and research program at Virginia Tech comprise its people, the space and equipment available, and an adequate capital and operating budget to build and sustain the activity. Virginia Tech has had a long and distinguished record in certain areas of microelectronics. The Fiber and Electro-Optics Research Center (FEORC), the Center for Wireless Telecommunications (CWT), the Center for Power Electronics Systems (CPES), and the Mobile and Portable Radio Group (MPRG) are internationally renowned. The work of previous faculty in the area of ferro-electric ceramics and hybrid microelectronics was also well known and highly regarded. Our Photonics Laboratory excels in developing sensors for harsh environments.



Diffusion Furnace Module



Device Characterization Module

Physical Vapor Deposition Module

Processing tools in new undergraduate semiconductor processing clean room.

Personnel

There are currently twenty-two faculty members at Virginia Tech whose research interests are primarily microelectronics or VLSI-related. Table 1 identifies these faculty and summarizes their research interests. This group represents a diverse multidisciplinary team from seven departments: Chemical Engineering, Electrical and Computer Engineering, Engineering Science and Mechanics, Industrial and Systems Engineering, Materials Science and Engineering, Mechanical Engineering, and Physics.

Centers of Excellence

The faculty members involved with this program have made a significant number of research contributions, which are being used by the microelectronics industry, and they are investigating topics that offer great potential for improving the efficiency and effectiveness of microelectronic systems.

Virginia Tech has allocated approximately 25,000 sq. ft. of personal research space in support of their ongoing research as identified in Table 2. It is clear that our microelectronics effort is based on a firm foundation of people, equipment, research funding, and space.

As a result of a strong commitment from the Electrical and Computer Engineering and the Materials Science and Engineering Departments, and with similarly strong support from the Dean of Engineering, we have been allocated almost 10,000 sq. ft. in three closely related buildings in which to create our central or common teaching and research facilities and clean room. The combined central facilities plus personal research space dedicated to microelectronics research being performed at Virginia Tech is approximately 35,000 sq. ft.

Equipment

The faculty members identified in Table 1 have assembled an impressive array of microelectronics processing and characterization equipment and tools. It is essential that we develop a series of common or centralized processing and characterization facilities that will serve the entire user community.

Our current facilities (equipment and tools) come from four major sources: an ongoing grant of used semiconductor manufacturing tools donated by Motorola, equipment left behind when two senior faculty members departed to accept department headships at other universities, equipment obtained by faculty members for inclusion in a materials analysis and characterization cost center, and equipment obtained by faculty members as a part of their ongoing research. Virginia Tech already has in place approximately $12 million in processing and materials characterization equipment. Thus, we are starting our integrated microelectronics teaching and research program on a very solid foundation.

Central Facilities Development
We are creating two undergraduate teaching laboratories and four centralized advanced teaching and research laboratories that will support our university-wide microelectronics effort. The undergraduate teaching laboratories include an introductory Semiconductor Fabrication Laboratory (SFL) in which entering students will learn the basics of semiconductor processing and a Semiconductor Packaging Laboratory (SPL) in which they will learn the basics of semiconductor device packaging. The four centralized facilities are being developed for teaching and research with advanced undergraduate and graduate students and include a Materials Synthesis Laboratory (MSL) that will include PVD, CVD, and MOCVD reactors for growing semiconductor thin films; a Materials Analysis Laboratory (MAL), open to research from across the university, that will contain state-of-the-art electron microscopes, x-ray diffraction, and other analytical tools; a Device Fabrication Laboratory (DFL) in which students will perform research in a Class 100 to Class 10,000 clean room on a wide range of advanced electronic materials; and a Device Characterization Laboratory (DCL) with electronic and optical characterization instrumentation.

Curriculum Development
As part of our ongoing activity to build a truly integrated education and research program for microelectronics, we are in the process of completely rewriting the syllabi of all courses in microelectronics as they appear in the ECE, MSE, and Physics sections of the University Catalog. To be sure, this is an enormous undertaking. To assure close collaboration between the ECE and MSE curriculums, Professor Hendricks, who is jointly appointed between the two departments, has taken on chairmanship of the area committees in both departments. In addition, he has a long history of close cooperation with Physics in developing the joint curriculum offered by MSE and Physics as service classes to ECE.

Our integrated program provides an educational experience in microelectronic materials, processes, and systems that:

- is comprehensive in that it includes an introduction to semiconductor manufacturing for up to 500 undergraduates per year and is required of all students in computer engineering, electrical engineering, materials science and engineering, and physics;
- integrates the Transfer Program of the Virginia Community College System (VCCS) to provide a "2 + 3" program for exceptional entry-level students;
- provides a University Option for a concentration in microelectronic materials for those students who elect to continue their education in the field;
- is diverse and includes semiconductor manufacturing processes and operations; operational control of semiconductor facilities; photonic, ceramic, magnetic and organic materials; nanotechnology and self-assembling materials; power and high frequency/high-speed devices; and the packaging of each of these;
- emphasizes the role of research in education and integrates increasingly sophisticated modeling and experimental and processing "hands-on" experience within a comprehensive curriculum; capitalizes on the strengths of our institution in multimedia methodologies and educational technologies (including distance learning) for the development of a pedagogically excellent curriculum; and
- attracts exceptional undergraduates to graduate research through our new five-year BS/MS program for Honors Students in which undergraduate research leads to, and is incorporated within, our advanced degree programs.

Table 2. Faculty Research Laboratories

Lab Name	Professor
Compound Semiconductor Lab	Louis Guido
Electromagnetic Materials & Devices Lab	Guo-Quan Lu
Electronics Manufacturing Research Lab	Subhash Sarin
Fiber & Electro-optics Research Lab	Richard Claus
Nanomechanical & Confirmed Optical Systems Lab	Stephane Evoy
Nanotechnology Lab	Ravi Saraf
Nonlinear Optics Lab	James Heflin
Organic Microelectronic Materials Lab	Wilhelm Graupner
Photonics Lab	Anbo Wang
Power Electronics Packaging Research Lab	Guo-Quan Lu
Wireless Microsystems Technology Lab	Sanjay Raman

The National Science Foundation has recently awarded eleven of our faculty a Combined Research and Curriculum Development (CRCD) grant of $356,000 for the development of this curriculum.

Professor Robert W. Hendricks is on the faculty at Virginia Tech. He holds joint appointments in the Department of Materials Science and Engineering and the Department of Electrical and Computer Engineering.

MSE Alumni and Corning, Incorporated

LeeAnn Ellis

A prominent employer of materials engineering graduates is Corning, Incorporated.* Several MSE alumni have left Virginia Tech over the years to join Corning operations across the country. In conjunction with its subsidiaries, Corning, Inc. represents 41 plants and 37 sales and service offices around the world. With corporate headquarters in Corning, New York, Corning maintains offices, subsidiaries, operations, or associated companies in 22 countries. Known around the world as a leader in technology in the areas of ceramics, glass, optics, and photonics, Corning manufactures optical fiber, cable and cable components, television components and high performance glass, electronic displays, and advanced materials for science, environmental, and life sciences markets.

Marty Swan stands in front of the Corning Corporate Office building in Corning, New York.

Beginnings

In 2001, Corning will celebrate 150 years of innovation in technology. Established in 1851, Corning Flint Glass Company was mainly involved in the consumer products market. The name soon changed to Corning Glass Works, and one of the company's earliest inventions was a glass bulb, created in 1880 for Thomas Edison's electric lamp. From that point forward, Corning quickly gained a reputation as a company of innovation and "firsts" in technology, beginning with one of the nation's first industrial research departments, established in Corning, New York, in 1908 and now known as Sullivan Park, after Dr. Eugene Sullivan. Under Dr. Sullivan's leadership, "Corning became a byword for research in glass." Just a few of the more well known accomplishments of Corning are discussed here.

In 1912, Corning developed a glass with the chemical durability to withstand sudden temperature changes either hot or cold. The first Corning physicist, hired in 1913, was Dr. Jesse Littleton. His innovative ideas for using this new durable glass in the kitchen lead to the development of Pyrex for baking and cooking and for industrial glass products. When Dr. Donald Stookey accidentally overheated a piece of glass known as Fotoform, the resulting invention was Pyroceram, a glass transformed to a fine-grained ceramic through heat treatment after nucleating agents have been added to the batch material, thereby paving the way for Corning Ware in 1957.

Corning is a company that reinvests heavily in research

For the millions of television viewers in the world, Corning is responsible for the invention of processes for the mass-production of all-glass television bulbs in 1947, which made television more affordable.

A major breakthrough in telecommunications came in 1970 when three researchers at Corning (Robert Maurer, Donald Keck, and Peter Schultz) invented glass fibers made from fused silica that could carry coded light signals over long distances with very little signal loss. This invention made possible fiber optics commercialization for long-distance telecommunications, and in 1998, Corning® LEAF fiber was introduced. This fiber and optical component increases the speed and capacity for carrying information of telecommunication networks.

MSE Alumni at Corning

The MSE Department has seen several of its graduates head off to various Corning locations over the years, and a few of these alumni are profiled here.

Corning was **Martin Swan's** (B.S. '96) second stop after graduating from Virginia Tech in 1996. He likes the company's size and sees a lot of room for variety and growth in his career with them. "Through the career that I'll have here I may have ten to fifteen different jobs that can be in ten or fifteen different areas."

Corning's main industry and main product over the last five to ten years, Marty says, has been optical fiber. He explained that there are two main methods for producing fiber, outside vapor deposition and inside vapor deposition, which is his area. The outside vapor deposition method begins with a quarter-inch thick alumina rod, called a bate rod, which is placed in a lathe. Chemicals are passed through a multistage burner to form oxides which will adhere to the bate rod, eventually forming a large soot blank. The bate rod is removed from the soot blank, and the blank is then taken to a consolidation

furnace where it is heated to around 2000^{o}C. The soot consolidates and densifies to form a solid glass blank. Eventually, the blank is placed inside a draw tower, which is four to five stories high, and drawn downward to form glass fiber that is 125-250 microns thick, about the thickness of a human hair.

Inside vapor deposition involves passing chemicals inside a glass tube that is heated up. As the chemicals reach the hot zone inside the tube they react to form oxides which attach to the glass tube. Heat is provided by a burner that passes back and forth along the length of the tube. Rather than forming a soot blank, individual layers of glass consolidate with each pass of the flame. The final result is a solid rod of glass that can then be taken to a draw tower to form fiber.

Corning's size and product variety mean lots of room for career growth

Until recently, Marty's work mainly focused on processing the inside vapor deposition or modified chemical vapor deposition (MCVD) lathe. He figured out what chemical flows to use, what temperatures were needed, why variations showed up in the glass. Basically, he took an idea that came from the research area and worked to form a fiber consistently based on a certain prescription of chemicals.

"The strength of Corning," Marty says, "has always been its knowledge of materials. They do a very good job of saying, 'we have this knowledge, how can we use this in the marketplace?' So it still goes back to a basic understanding of what materials can do and having an expertise in that area, and we've taken that into the environmental, the fiber optics, the advanced display products."

Another important strength of the company is its people. "Corning likes to capitalize on diversity," Marty said. "The more types of people we have ideas coming from, the more ideas we're going to be able to capture."

At Virginia Tech, Marty concentrated on polymers. He has since worked with metals and now glasses and ceramics. "One of the things I liked about Tech is I still came in with a pretty good understanding and knowledge of what I was doing in a metals company, what I was doing in a ceramics/glass division. So it's worked out pretty well."

Since last fall, when this interview was conducted, Marty has submitted two patent applications as a co-inventor: "Method for Creating Co-doped Layers and Fibers Containing Co-doped Layers," and "Fiber Bragg Grating with Cladding Mode Suppression." This spring, Marty moved into a new position as the International Technology Transfer Engineer for Corning. His main responsibilities include heading up expert teams in the laydown and consolidation process of manufacturing optical fibers, as well as transferring technology, equipment, and processes between Corning's five fiber producing plants in England, Germany, Australia, and North Carolina. Marty embarked on his first global excursion in April during which he visited each of the international plants to become familiar with and identify key technology, equipment, and processes for transfer to other plants.

Robert Mason (B.S. '63) joined Corning Glass Works as a Process Engineer at their Consumer Product Plant in Martinsburg, West Virginia, shortly after he graduated from Virginia Tech with a degree in ceramic engineering back in 1963. "Corning has a very progressive management development system that strongly emphasized movement from position to position and facility to facility." Based on this management philosophy, Corning sent Bob to 5 geographic locations and 11 different positions during his 34 years with the company. All 11 positions focused on manufacturing or development in the areas of engineering, production, quality, or logistics. Bob's engineering projects included:

- Work with the U.S. Air Force and the federal government to develop a pyroceram glass tactical fighter dispenser for use in the war in Vietnam.
- The development of an ore flotation process to extract BETA Spodumene to be used as a lithium substitute for petalite in melting Corning Ware.
- The development of grinding, lapping, and polishing operations for finishing the bottoms of Corning Ware and the top of the Corning Cooktop.

"Corning, Inc. has always been a company that reinvested heavily in research to develop inorganic materials and processes," resulting in the development of materials and products such as:

- Pyroceram used for Corning Ware and Visions,
- Glass forming process of spinning to form the television tube,
- The vapor deposition and draw process to form optical wave-guides.

"The knowledge and experience I gained at Corning, Inc. permitted me to retire in January 1997 and begin a second career in consulting and auditing for quality and environmental management systems. Corning's challenging work with a strong reward system, progressive thinking, and a never-ending desire to blend work and family granted me an enjoyable and fulfilling career."

Continued

Corning continued

Ronald Johnson (B.S. '65, Ph.D. '71) started his career at Corning's Blacksburg plant, where he worked for four and a half years while pursuing a doctorate at Virginia Tech. When he completed his Ph.D. in 1971, he was transferred to Corning, New York, where he worked until he retired in 1998. In December, 1998, Ron was appointed Engineering Fellow, an honor which recognizes "continuous and outstanding technical contributions to Corning."

During his 31-year career with Corning Ron focused his attention on materials and process development with particular emphasis on processes dependent on polymers. In 1980 he started a Polymer Engineering Group, which he lead for the next 18 years. Upon his appointment as an Engineering Fellow, it was noted that his contributions "have been critical to the success of several key businesses. Ron holds 43 patents relating to glass decorating, ceramic binders, adhesives, and various unique printing/forming processes. A glass decorating process invented primarily by Ron has been in use by Corning Consumer Products, now World Kitchens, Inc., since 1979. Other of Ron's inventions have found use in Consumer Products, Electronic Products, and Photonics. Ron also has made significant contributions to developments in Advanced Display, Environmental, Optical, and Science Products."

Corning is a company that champions diversity

Ron also received two individual outstanding contributor awards during his Corning career. Since his retirement, he stays active in community affairs and in consulting. He is collaborating on a research project with another former Corning employee who is now a professor at Iowa State University.

Robert Morena (Ph.D. '82**)** has been with Corning since 1986, and he has spent most of the last fourteen years in the Glass and Glass-Ceramics Research Group at Sullivan Park. He has been involved in several areas of research, ranging from transparent, glass-ceramic compositions for consumer cookware to new glass compositions for liquid crystal displays.

Currently, Bob is a Senior Research Associate and the Technical Leader for Frits, which are powdered glasses that are refired for various applications, such as low temperature, durable glass compositions to replace Pb-based sealing frits, and high temperature, very refractory glass-ceramic compositions for protective coatings for metals in extremely corrosive environments. He is also working on developing low temperature, very low expansion frits to bond optical waveguide fiber for telecommunication applications.

Garrett Childs (B.S. '86) has been with Corning since 1994, when he joined the Wilmington, North Carolina, operations as a Production Shift Supervisor. In that capacity, he supervised fourteen production associates in two different areas and assisted engineering in evaluating process improvement experiments. In 1996, he took on responsibilities as a Manufacturing Process Engineer. As such, he worked as the project leader for increased draw speed for HDR products and as the process leader for Fiber Draw CPU upgrade. He also supervised contract workers and junior engineering staff. Garrett developed continuous improvement process control strategies for coating fiber, and he developed fast feedback metric for selects/attribute improvement. He served as a member of a plant-wide cost reduction and defect elimination team, and he was recognized as an outstanding contributor in the department by plant management.

Last May, Garrett transferred to a new plant in Concord, North Carolina, where he is a Senior Quality Engineer with the main task of implementing quality architecture systems that ensure product quality to the customer "as we bring up a new 'greenfield' plant."

Ann Norris (Ph.D. '87**)** works for Dow Corning in Michigan, which was created as a joint venture between Corning, Inc. and The Dow Chemical Company. Both companies continue to hold equal shares today. "Dow Corning has pioneered the development of silicones for commercial applications," Ann explains. Silicones are a diverse family of materials that combine the temperature and chemical resistance of glass with the versatility of plastic. They are used to enhance the performance of thousands of products in virtually every major industry," particularly automotive electronics, general electronics, and microelectronics.

Ann joined Dow Corning after completing her Bachelor's degree in Chemistry at the University of Wisconsin-LaCrosse. After working for Dow Corning for two years, she took an educational leave to work on her doctorate at Virginia Tech. She completed her Ph.D. in the interdisciplinary materials engineering science program in 1987 and returned to Dow Corning in research and development. She has spent the last five years working in the area of developing silicones for the electronics industry. "Some of their major attributes," says Ann, "include high thermal stability, low modulus, low moisture absorption, good electrical properties, and high purity. Silicones have been formulated into sealants, general adhesives, conformal coatings, encapsulants, potting compounds, die attach adhesives, and many other products useful for the electronics industry. Most recently she has been concentrating on developing materials for device packaging. "New

packaging technologies have adopted extremely small chip designs that accomplish similar functions that larger ones did in the past. This industry is continually demanding smaller, lighter, faster chips for consumer devices such as computers and cell phones. Silicones are a material of choice in these new chip designs."

Jean Miller (B.S. '89, M.S. '91) began her career at the Blacksburg Corning plant in 1991 as a process engineer. This facility manufactures extruded monolithic substrates for catalytic converters in the automotive industry, and Jean focused on extrusion line support and product improvement. "I had many opportunities in the Blacksburg plant because it was small (200-250 employees)," Jean says. Those opportunities included working as the "startup engineer for a new production line, developing and owning shrinkage systems for the ceramic substrate, and implementing a major technology change across all products that led to improved plant performance and quality." She became the Continuous Improvement Leader in 1995, a managerial position for the plant, where she was responsible for managing the plant project portfolio for cost reduction, product improvement, and equipment upgrades.

Jean Miller at Corning, Inc. in Blacksburg, Virginia

In 1997, Jean transferred to American Video, a start-up plant in Mount Pleasant, Pennsylvania, which was created to manufacture TV glass for SONY. "Our biggest challenge," Jean explained, "was not only starting up as a new plant but developing the flat panel TV glass used for the SONY WEGA televisions." She began as a process engineer to familiarize herself with the plant, then quickly moved into a technical leader position for the "Cold End," where she "supervised technicians, operators, and inspectors in glass finishing and polishing, as well as Final Inspect and pack of the glass."

Jean transferred back to the Blacksburg plant in 1999 to become the Production Engineering Leader. In this capacity, she leads a group of engineers and technicians who handle the daily technical operation of the "green end" (dry batch blending, extrusion, and piece cutting).

Jean points out that Corning has improved, as a company, in manufacturing. She notes that when she first joined Corning, the company "was great at inventing innovative materials (silicone, glass ceramics, fiber optics) but was not great at manufacturing systems." Since then [1991], Corning has focused on improving their plant performance by bench marking plants with excellent process discipline and requiring the other plants to meet these same standards."

In terms of work environment, "Corning champions diversity," Jean explains. "Corning has been ranked as a top ten company for women to work, and they also get kudos for hiring dual career couples into the company."

**Information for this article came from the company website, www.corning.com, and from MSE alumni employed by Corning.*

The author greatly appreciates alumni contributions, which made this article possible. She especially wishes to thank Marty Swan for taking the time to give her a tour of Sullivan Park.

Congratulations MSE 2000 Graduates!

L to R, Back: Brian L'Heureux, Jason Midkiff, Pete Widas
Front: Andrew Atwood, Sarah Doman, Kelly Renshaw

Complete list of graduates appears on page 19.

L to R, Back: Keith Lyon, Eric Holloran, Brian Okerberg
Front: Amita Berry, Lucy Wasserman, Tracey Jones, Kelly Stinson-Bagby

Student and Alumni News
Global Hokies!

News from West Africa

Since last June, **Billy Abernathy** (B.S. '98) has been roughing it as a Peace Corps volunteer in Africa. He recently wrote the folks back home to say that, aside from a few bouts of food poisoning, he's alive and doing fine in Benin, West Africa. If you pull out your handy world atlas, you can find Benin scrunched up next to the Western side of Nigeria.

Billy Abernathy holds broken pottery unearthed at an archeological site near Ouidah.

During the three-month training period, Billy lived with a family in Comé. His family consisted of father, mother (both teachers), three children, an aunt, and a fourth child who was an orphaned friend of the son. They had electricity and running water, no shower or toilet, but "the cleanest latrine I've ever seen," Billy writes. A shower took the form of a bucket of water. Training involved four to six hours of language classes each day with technical, cultural, and health classes squeezed in. During the last month of training, the volunteers taught summer school (in French) each morning in Ouidah, 25 km east of Comé, which meant very early mornings for Billy and the other math/science volunteers living in Comé. They conducted class in the mornings, then returned to Comé for more language instruction and lesson preparation each afternoon.

Since September, Billy has been stationed in Ouidah, which he says is a cultural and historical center of Benin. "Once a major slave trading port for the French and Portuguese," Billy writes, "Ouidah is more known in academic circles for being the voodoo capital of the world." Ouidah is also "home of things like paved roads and canned vegetables," even fresh fruits, vegetables, bread, and occasionally cheese. Milk, unfortunately, comes only in powdered form. Home is a small apartment with electricity, a shower, a double sink, "an honest-to-God flush toilet," and a refrigerator (a gift from a former Ouidah Peace Corps volunteer). Billy considers himself to be very lucky with these luxuries, especially after visiting his new Peace Corps friends stationed in more rural posts around the country.

Work for Billy means teaching the equivalent of tenth grade math 18 hours a week to 117 students divided into 3 classes of 26, 43, and 48 students ranging in age from 15 to 23. There are no textbooks to speak of, so Billy's chalkboard notations become the textbook. "Can you imagine learning math without having pages of practice exercises to do?"

Billy has learned that teacher strikes are a fairly common aspect of teaching in a third world country. Peace Corps volunteers are required to remain politically neutral, so they must continue teaching during a strike. For three weeks last fall, Billy was the only teacher working in his school, and his students continued to show up for class.

In addition to teaching math, Billy has a hand in many other activities, in typical Abernathy fashion. He has been giving computer lessons to fellow teachers on two donated laptops. He coaches his school's first official basketball team using one court, one basket and two basketballs. And he also helps with the publication of a newsletter for the Peace Corps education volunteers in Benin.

In his spare time, Billy visits fellow volunteers, and he has gotten back into artwork by designing envelopes that he mails out to other volunteers. "It keeps me sane," he says, since his beloved French horn remains back in the States.

On the cultural side, he is witnessing a very different realm of religious practice. For example, during the period of time when much of the world celebrates Christmas, Beninoise children will don masks and dance and sing in the streets. Adults will reward their efforts with candy or money. There is little emphasis on Christmas, per se, because, first of all, the economy does not encourage a large celebration, and second, most of the country is not Christian. "In the North," Billy writes, "Islam dominates, while Voodoo and Christianity battle it out in the South." There are ceremonies during December in honor of the "revenants, those who have died and come back to live among us."

Billy with fellow Peace Corps volunteers in Benin.

The entire month of January is a celebration, with a major voodoo festival falling on January 10. "It's probably the only time in my life when I'll see schools and offices officially closed for a voodoo holiday." There is plenty of dancing, singing, possessing, and even some sacrificing during

the festival. Shopkeepers will raise prices during this time of the year, mainly to support all of the celebrating.

Of particular interest to MSE people, Billy seized an opportunity to visit an archeological dig just north of Ouidah in the village of Savi, where a University of South Carolina archeologist comes to excavate in the summers. Until about 1727, Billy says, a kingdom reigned in Savi, but today there are only cornfields. "Be sure to tell the ceramics faculty…I got to hold *in my hand*, straight from the ground, Venetian glass beads made in the 17th and 18th centuries….It was history in my hand!"

Watch future newsletters for more updates from Benin. Meanwhile, Billy writes, "Think of me when you drink milk…"

Travels to Austria....

Since graduating last spring, **Brian Seal** has been working as a process engineer for BOHLER-UDDEHOLM Specialty Metals, Inc. (BUSMI) in South Boston, Virginia, a bar and wire finishing facility primarily focusing on high speed steel. "The BOHLER-UDDEHOLM Group was founded in 1991 through a merger between the Austrian special steel producer, BOHLER, and the Swedish special steel manufacturer, UDDEHOLM. The new company became a world leader in special steel and high graded special steel products." The Group acquired BUSMI in 1998.

Brian was able to do a little sightseeing in Salzburg in the midst of business.

Brian spends his time refining processes used to finish products. As part of his training to learn about processes and equipment, Brian spent two weeks in Austria visiting BOHLER facilities. His current projects include revising the edgewire process (used for saw blades), improving the descaling operation, and bringing six new furnaces online. "We have a dedicated team pulling all of this together. They've welcomed me aboard and have spent a lot of time training me."

Brian writes: "Me at Gerhard Hakl's house after a traditional Austrian meal of roast pork, dumpling, and sauerkraut. Our distinguished Austrian colleague also provided a traditional aperitif--home distilled plum schnapps." Brian says the schnapps are responsible for this particular photo where he is modeling a traditional Austrian costume.

Brian enjoys an Austrian beer with BOHLER manager, Trevor Biggs.

...and France

Julie Martin, a Ph.D. candidate in MSE, traveled to Paris to attend a SAMPE (Society for the Advancement of Materials and Process Engineering) conference. Initially, she explains, she entered a student paper contest sponsored by the Baltimore/Washington Chapter of SAMPE and won first place, which was a trip to SAMPE's International Symposium in Long Beach, California last May. At this conference, about 20 students from all over

Julie Martin stands beside her poster presentation at the SAMPE conference in Paris.

the U.S. and Canada competed for cash prizes and trips to other international SAMPE conferences. Each student gave a 15-minute presentation on his/her research and winners were selected in undergraduate, masters, and doctoral categories. Virginia Tech was represented in this student symposium by Jennifer (Howard) McPeak and Julie, both students studying under Prof. Ron Kander. In the Ph.D. category, Jennifer and Julie tied for first place, and the prize was a trip to the SAMPE Europe or SAMPE Japan con-ference. However, since it was a tie, they sent Jennifer to Tokyo (October '99) and Julie to Paris (April '00). SAMPE covered airfare and accommodations during the conferences for Julie and Jennifer.

In Paris, Julie reports that eighteen students from all over Europe presented their work. The European students competed for a trip to next year's SAMPE conference in Long Beach, and Julie presented her work as the SAMPE North American representative. Each student also prepared a poster, which was displayed throughout the week of the conference. "The student group made fast friends and had a great time getting to know each other and learning about the research being conducted at universities in other countries," Julie said. "The official language of the conference was English, and for many of the European students, this was their first time presenting their work in English."

Jennifer McPeak and Sandy Willis at a Japanese fan shop in Kyoto.

Julie spent Easter weekend in Paris following the conference, and a few of her favorite experiences included an evening boat tour on the Seine to see the "city of lights"; visiting the Musee D'Orsay to see paintings by Monet, Renoir and Van Gogh; visiting Monmartre, Versailles; and exploring the Latin Quarter of the city. "Paris is a spectacular city," Julie said. "The best part of the experience, however, was making new friends from all over the world."

How about Japan!

Jennifer McPeak traveled to Japan last fall to give a presentation as a guest student speaker at the 6th Japan International SAMPE Symposium and Exhibition (JISSE-6) in Tokyo. Jennifer said she was treated like a VIP in Japan. "The Japanese people are very sincere, genuine, thoughtful, and prompt." She visited many shrines and temples and received an introduction to Japanese history, religion, and government. She also visited the cities of Kyoto and Nara to absorb history and scenery after the symposium. "It was awesome! Quite an experience for my first overseas trip!"

Jennifer and her host, Dr. Nubuo O'Hashi, visited the Kinkaku-Ji Temple in Kyoto City.

Jennifer completed her Ph.D. in MESc in December 1999, and she was the student speaker at the December commencement. She also spoke at the undergraduate commencement ceremony. Jennifer is now working as a research scientist/engineer in the skin beauty care technology division at Proctor and Gamble in Cincinnati, Ohio.

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Other Student and Alumni News

Sean Grealis (B.S.'99) is working for Magnetic Metals Corp. in Camden, New Jersey, as a metallurgical engineer, where he is able to apply both his metallurgy and electronic materials backgrounds. The company makes transformer and motor laminations out of electrical grade steels, as well as ground fault circuit interrupters (GFCIs). Sean works in both the theoretical and the manufacturing aspects of the business, "learning the concepts behind transformer design and material properties, as well as heat treating and other processing related subjects." ❖

Jennifer Lowekamp (B.S. '94) received her Ph.D. in Materials Science from Carnegie Mellon University in May 1999. She is now working for Claritech Corp. in Pittsburgh, Pa. ❖

Best wishes to **Michael Bremser** (B.S. '94) and **Susan Reitz** (B.S. '90, M.S. CE '97), who were married on April 8, 2000 on Santa Catalina Island, Ca. Last September, Michael was promoted to Manager of Process Engineering with AIXTRON, Inc. He oversees process qualification and post-installation process support of AIXTRON customers in North America. Susan is employed by Anteon Corp. as an Environmental Engineering Consultant at Seal Beach Naval Weapons Station in California. ❖

Brian Okerberg (MSE '00) has been selected as one of five national finalists in the SAMPE Undergraduate Student Paper Contest. He received an all-expense-paid trip to the SAMPE national convention in Long Beach, Ca., to compete in the national finals. ❖

Richard Clark (B.S. '91, M.S. '94 , Ph.D. '97) left Virginia Tech this past winter to join the faculty of the College of the Canyons in Santa Clarita, Ca. After completing his Ph.D. at Tech in 1997, Rick worked as a full time instructor for the MSE Department before accepting a job as a research scientist at Luna Innovations, a fiber optic sensor research company in Blacksburg's industrial park. He maintained ties with MSE as an adjunct instructor. When Rick decided he was ready for a full-time career in academia, he found the perfect situation at the College of the Canyons, a community college in southern California. "It is the only community college in its district," Rick said, and it has an enrollment of about 10,000 students. "With the size of the school almost doubling in the past two years and with the growth of the community and industrial park, the college needed to rebuild its engineering program." Rick was hired in January to be the lead engineering faculty in charge of developing and growing the program. He is teaching four lower division engineering courses and two semesters of physics for engineers and scientists. He is also developing a cooperative education program and other support programs for engineering students.

This summer, Rick will begin studies at The Master's Seminary in Sun Valley, with plans to com-plete a Master of Divinity program over the next four years. And finally, Rick and his wife, Julie (also a Virginia Tech graduate), are expecting their first child this September! ❖

Mike and Rebecca Stawovy (both B.S. '91 with multiple graduate degrees between them) are the proud parents of Stanley Jacob Stawovy, born April 3, 2000. ❖

Erik Herz, a second year MSE student at Virginia Tech, received the Paul E. Torgerson Leadership Scholarship on March 29. This scholarship is presented each year to one student based on a written essay detailing leadership and how it applies to engineering as well as a twenty-minute interview with the Student Engineers Council, who asked the candidates questions such as "What is important in leadership style?" and "What do you do when leadership breaks down?" Erik is in the Virginia Tech Honors Program, and he is currently pursuing three majors, MSE, Economics, and International Studies. He hopes in the future to work as an international intermediary for business or research.

Next fall, Erik hopes to study materials engineering and economics at Monash University in Australia, and he will spend the spring semester at Virginia Tech's Center for European Studies and Architecture in Lugano, Switzerland, where he plans to study Italian and International Studies. In addition to the Torgerson scholarship, Erik also received the Gilbert and Lucille Seay and the Alfred E. Knobler Scholarships this year. ❖

Julie Martin and **Jeff Schultz** (both Ph.D. students in MSE) attended The Minerals, Metals and Materials Society (TMS) conference in Nashville, Tennessee in March. They each presented papers in the Materials Processing and Manufacturing Division's International Symposium on Global Innovations in Materials Processing and Manufacturing.

Julie's TMS conference paper, entitled "Mechanically Alloying Polymer Blends for Selective Laser Sintering," won her the Outstanding Student Paper award with a cash prize of $200.

Jeff Schultz, who received his B.S. in MSE from Virginia Tech in 1999, presented a paper entitled "Materials for Selective Laser Sintering Made by Cryogenic Mechanical Alloying." Jeff has been appointed vice-chair of the TMS Student Leaders, which is a newly formed committee seeking to promote and enhance student activities in TMS. Julie is a member-at-large on this national committee. ❖

Continued

Student and Alumni News *Continued*

In April, Jeff Schultz and **Shawn Kelly** (B.S. '99) presented papers at the MRS Spring 2000 Meeting held in San Francisco, California. Jeff's talk was on "Processing-Structure-Property Relations of Polymer-Polymer Composites formed by Cryogenic Mechanical Alloying for Selective Laser Sintering Applications." Shawn, who is in the MSE Master's program, gave a presentation entitled "Microstructural Study of Laser Formed Ti-6Al-4V." ❖

Coming Soon! MSE polo shirts! Watch your mailbox for details!

MEPS Rounds Up Year of Activities

Shawn Kelly

The Materials Engineering Professional Societies (MEPS) is comprised of the nationally recognized organizations ASM/TMS, SAMPE, and ACerS. Our goal is to provide students with a better understanding of the materials engineering profession and promote department morale. To this end, MEPS combines industry speakers, plant tours, and social events with our meetings and activities.

The winning golf team: grad. students Anders DiBiccari, Frank Lomax; MSE undergrad. Leslie Flowers and her boyfriend, Tommy.

Over the last year, the following people have given talks at MEPS meetings: Vic Dangerfield (B.S. '91), Pechiney Aluminum; Kelly Brown (B.S. ME, '99), Gala Industries; Ron Kander, MSE faculty; Warren White (B.S. '75), Howmet Corporation; Sean Corcoran, MSE faculty. Students have found the talks informative and enjoyable. We are currently looking for speakers, especially alumni, to speak at our fall 2000 and spring 2001 meetings.

A few of the golf tournament participants: l to r, back: Jeff Haeberle (B.S. '98), Jeff Schultz (B.S. '99, current grad. student), Shawn Kelly (MSE '99, current grad. student), front: Scott Trenor (grad. student), Ben Liptak (B.S. '99), Dan Esterly (grad. student).

One of the largest activities we organized this past year was the First Annual ASM/TMS Golf Tournament, which was held last October at the Draper Valley Country Club. About 20 students, faculty, alumni, and friends took to the greens to enjoy a round of golf surrounded by picturesque fall scenery. The tournament was a scramble format and trophies were given to the winning foursome and for the longest drive, closest to the pin, and longest putt. After the tournament, a reception was held at the Foxridge clubhouse for the golfers as well as other students, faculty, and friends. We are currently in the process of organizing the sequel to this golf tourney, scheduled for October 6, 2000. Virginia Tech plays Temple on October 7 for Homecoming. Please see the registration form on page 20.

Other events that were organized during the past year included a trip to Nashville for a tour of the Saturn Plant and a trip to Floyd Elementary School for our Science on Wheels program, which brings MSE students into the schools to enlighten elementary school children on the subject of materials through experiments and discussion. We also sent several undergraduate and graduate students to conferences to present posters and papers.

MEPS would like to take this opportunity to invite greater alumni involvement in activities such as joining the annual golf tournament, coming to speak at MEPS meetings, or monetary donations to help cover expenses for field trips and other MEPS activities. If you would like to help out in any way, please contact MEPS President, Shawn Kelly at shkelly2@vt.edu or (540) 231-2105.

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Department News *Continued*

Dr. Ran Datta, who served as a visiting professor in the department for several years, left Virginia Tech to return to his Cleveland home last December. From there he immediately embarked on a six-week visit to Bangladesh to serve as a foreign consultant for the Council of Industry and Science Research. He helped set up industrial projects in ceramics and refractories. Dr. Datta is now back home in Cleveland, trying to reclaim his garden and volunteering in the Conservation Department of the Cleveland Museum of Art. ❖

1) ***Logan O'Brien***
Born September 4, 1999 to
Denise (former office staff) and Mike O'Brien
2) ***Kathleen Marie Schuetz***
Born February 19, 2000
Matt Learn's (Dept. Network Liaison) niece
3) ***Hailea Madison Sowers***
Born May 1, 2000 to
Susette (Progr. Support Tech.) and Robert Sowers
4) ***Christian Nathaniel Berry***
Born March 23, 2000 to
David (Senior Technician) and Melissa Berry
5) ***William David Corcoran***
Born March 21, 2000 to
Sean (faculty) and Aimee Corcoran
6) ***Stanley Jacob Stawovy*** *(not pictured)*
Born April 3, 2000 to
Mike and Becky Stawovy (MSE alumni)

Department of Materials Science and Engineering 1999-2000 Graduates

B.S. Degrees

Tim Evans (Sum '99)
Ken Jennings (Sum '99)
Andrew Atwood
Amita Berry
Sarah Doman
Bob Fielder
Eric Holloran
Tracey Jones
Brian L'Heureux
Kelly Leese
Keith Lyon
Jason Midkiff
Brian Okerberg
Kelly Renshaw
Kelly Stinson-Bagby
Allison Suggs
Lucy Wasserman
Pete Widas
Matt Gordon (Sum '00)
Jason Dietz (Sum '00)

M.S. Degrees

Shannon Arnold (MEng)
Murat Durandurdu
Jeremy Duthoit
Kristen Droesch
Viktor Simkovic
Scott Steward
Sridhar Tiramula (MEng)
Sihua Wen
Nadia Obechou
Tong Wang
Wei Wei Du

Ph.D. Degrees

Kanadil Verghese
Rachel Giunta
Mitch Jackson
June-Key Lee
Jennifer McPeak
Shatil Haque
Jay Sayre
Seungmon Song

MSE 1999-2000 Scholarship winners

Robert Fielder, *John H. Kroehling*
Matthew Gordon, *Stroyan*
Kelly Hales, *Gilbert & Lucille Seay* and *Stubach*
Todd Heil, *Alfred E. Knobler*
Erik Herz, *Alfred E. Knobler, Gilbert & Lucille Seay,* and *Paul E. Torgerson Leadership*
Shane Juhl, *John H. Kroehling*
Christopher Kessler, *Lelvesley* and *Alfred E. Knobler*
Jeff Maciborski, *Alfred E. Knobler*
Jason Midkiff, *Durham* and *Stroyan*
Brian Okerberg, *Bock* and *Lawson*
Stacey Sharp, *Alfred E. Knobler*
Andrew Signor, *Alfred E. Knobler*
Pete Widas, *Foundry Education Foundation*
April Williams, *Gilbert & Lucille Seay*

Announcing the 2nd Annual Virginia Tech ASM/TMS Golf Tournament

October 6, 2000, starting at 1:00 p.m. at Fountain Spring Golf Course in Peterstown, WV. Tournament will be scramble format. Dinner and reception afterward at the Foxridge Clubhouse, starting at about 6:00 p.m. Tournament trophies will be awarded after dinner for the winning team, the longest drive, the closest to the pin, and the longest putt.

Alumni, students, faculty, and friends are invited to participate. Morning activities include:

- ✦ MSE lab tour
- ✦ Research updates presented by MSE faculty
- ✦ Alumni discussions about materials engineering in industry

Please send the following registration form along with your payment of $50 per golfer (Dinner only, $8 per person). Questions: jeschult@vt.edu

Yes, I plan to attend the 2nd Annual Virginia Tech ASM/TMS Golf Tournament on October 6, 2000

_____ Number in my party who will be playing in the tournament ($50 per person, includes dinner/reception)
_____ Number in my party who will attend the dinner/reception only ($8 per person)

Name _____
Address _____
_____
_____
e-mail _____

$_____ Total registration fee enclosed. Please make checks payable to: Virginia Tech ASM International/TMS Joint Student Chapter

Send to:
Jeff Schultz
MSE Dept. (0237)
213 Holden Hall
Virginia Tech
Blacksburg, VA 24061

Please register by September 1, 2000

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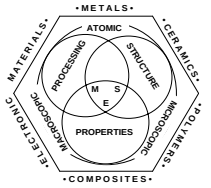

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