

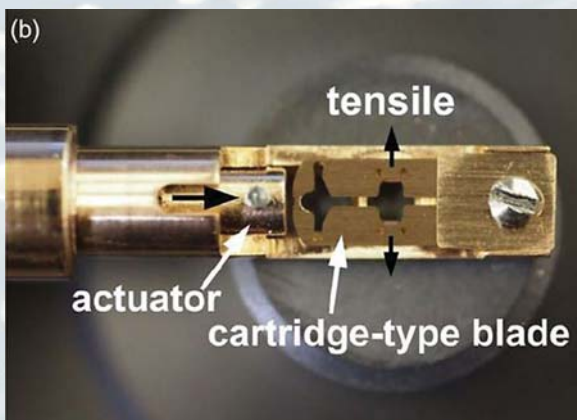
Exploring Materials at Virginia Tech

Fall 2015, Volume 16, Number 2

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

Research Highlights - Mitsuhiro Murayama

LeeAnn Ellis



New specimen holder for TEM designed by Dr. Murayama and colleagues: a) the “developed holder compatible for an FEI super-twin pole piece;” b) magnified view of “cartridge-type blade” designed for the holder. (Figure 2, see full report for more information.¹)

Since joining the Materials Science and Engineering Department in 2011, Professor Mitsuhiro Murayama has been engaged in research concerning technical and scientific challenges related to structural and compositional characterization of nanoscale materials. His contributions have proven significant in aerospace, sustainable infrastructure development, and other areas. His research is internationally recognized and is sponsored by private industry, national laboratories, and federal agencies. He collaborates with faculty at Virginia Tech as well as researchers in Japan. In 2014, Murayama was one of six engineering faculty to receive a College of Engineering Faculty Fellow, an award that carries an annual \$5000 account for three years to support research. The following is a brief summary of two of his recent papers. Full citation information can be found at the end of this article for further reading.

Dr. Murayama and several colleagues in Japan have designed a novel straining holder that is compatible with single tilt-axis electron tomography. Their technical report, “Development of a novel straining holder for transmission electron microscopy compatible with single tilt-axis electron tomography,” was published in *Microscopy* in May 2015.¹

Transmission Electron Microscopy (TEM) can be used to characterize microstructures ranging in size from nanometers to micrometers. Experimental techniques that are possible using TEM include multi-scale imaging, electron diffraction, electron/X-ray spectroscopy-based chemical analysis, among others. Techniques involving *in situ*, or “real time” observation of structural changes resulting from heating and straining have been established over the last fifty years.

The introduction of electron tomography in the field of materials science has opened new opportunities. The technique of tomography refers to imaging by sections using penetrating waves. Electron tomography retrieves

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Research continued

three-dimensional information about a structure previously unavailable in TEM. However, the absence of an appropriate sample holder that would cover both deformation and high angle tilting has presented a serious roadblock for applying electron tomography.

While two specimen holders are available commercially, a tensile holder and a tomography holder, the necessity of using both holders comes with limitations. For example, the tilt angles of the tensile holder are limited in a narrow range that does not meet the minimum angle range for three-dimensional reconstruction.

Thus, in this study, a new specimen holder was designed that is compatible with tensile test and high-angle tilting, termed a ‘straining and tomography (SATO)’ holder. The report goes on to explain the basic concept, which is a ‘single tilt-axis holder with a tensile mechanism’ that is also capable of electron tomography. The technical objectives for this holder were “*in situ* tensile mechanism with variable strain rates between 10^{-6} and 10^{-3}s^{-1} , and high-tilt angles of $\pm 65^\circ$.”

Simultaneous straining and high-angle tilt were achieved by incorporating a linear motion actuator in the holder rod that would deform a cartridge-type blade, made of phosphor bronze and designed specifically for this holder. A specimen can be fixed onto the blade, which sends stress to the specimen. A driving mechanism was

designed for the actuator and the blade to achieve the required strain rates.

A key feature in the design is a “perpendicular configuration of tensile direction and the actuator axis,” which “can minimize drift of a field of view during *in situ* deformation.” This is possible because stress is applied along the tensile axis from both sides of the specimen. The motion of the holder is controlled by a computer using software designed for the system.

Results indicate that the new SATO holder “maintains reasonable field of view at high angles for tilt-series acquisition” and that the holder is “fully functional as an *in situ* straining holder.

Another recent study, published in *Acta Materialia*, looked at “The role of twin boundary and surface energies in periodically twinned [111] nanowires.”² Synthetic control of twinning in nanowires could offer a way of tuning optoelectronic and physical properties of nanowires. “Periodic twins are an intrinsic structural feature of some types of chemically synthesized metallic nanowires but not others.” One metallic nanowire system that exhibits twins is gold “when grown in a [111] crystallographic direction via solution-phase chemical synthesis methods.” While many mechanisms that would explain the presence of twins have been proposed, this study suggests that “twins may serve a structural role that facilitates nanowire growth. If so, twins would be an intrinsic feature of gold nanowires rather than a random growth defect.”

For this study, a model was developed to predict twinning in a specific nanowire geometry. “The hypothesis that twinning plays an intrinsic role in the growth process of metallic nanowires was tested through a detailed structural characterization of gold and platinum nanowires (metals with low and high twin boundary energies, respectively).” Gold nanowires and platinum nanocrystals were both prepared using a solution-phase chemical synthesis. The study focused on nanowires “with a face-centered cubic (fcc) structure and low twin boundary energy growing in a [111] direction.”

Results of the study showed that “the model successfully explains the presence of twins in gold nanowires and the absence of twins in platinum nanowires. Considerations of twin formation within this energetic framework may have implications for the control of twinning in other types of nanomaterials.”

¹“Technical Report: Development of a novel straining holder for transmission electron microscopy compatible with single tilt-axis electron tomography,” K. Sato, H. Miyazaki, T. Gondo, S. Miyazaki, M. Murayama, and S. Hata, *Microscopy*, 2015, 1-7, doi: 10.1093/jmicro/dfv021, Oxford University Press on behalf of The Japanese Society of Microscopy.

²“The role of twin boundary and surface energies in periodically twinned [111] nanowires,” Chun-Hsien Wu, Deborah M. Aruguete, W.T. Reynolds Jr., M. Murayama, *Acta Materialia*, 75 (2014) 180-187, Elsevier Ltd. ❖

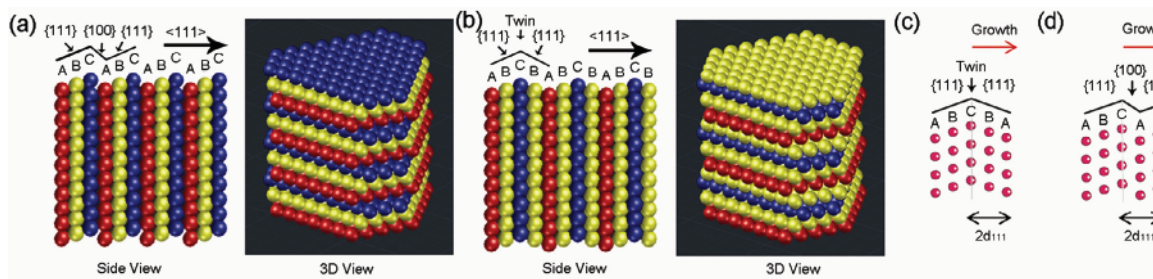


Figure 5 from twinning study: (a) An fcc nanowire with a perfect, single crystal structure growing in a [111] direction has both [111] and [100] side surfaces. (b) By introducing multiple twin boundaries, a nanowire can grow in the same direction with only [111] side surfaces. (c) The minimum distance between twin boundaries is the spacing between two [111] atomic planes, $2d_{111}$. (d) A perfect, single crystal nanowire that grows a distance, $2d_{111}$, introduces atomic [100] steps in its surface. See full study for more information.²

Farkas Honored by Alma Mater



Professor Diana Farkas pictured with two recent awards. Left: 2015 Distinguished Alumni Award. Right: 2014 Kreidl Memorial Lecturer.

Professor Diana Farkas was honored in 2015 with a Distinguished Alumni for Materials Science and Engineering Award, presented by the University of Delaware for outstanding career achievements. Dr. Farkas completed a Ph.D. at Delaware in 1980. This annual award is given based on uniqueness of career, significant achievements, and their measurable impact on the recipient's field of endeavor. Dr. Farkas has received many honors since joining MSE at Virginia Tech in 1982, including a Faculty Awards for Women given by the National Science Foundation and a Fulbright Scholar Award. She is a fellow of the American Society of Metals and also The Materials Research Society. In addition, she has served as a Jefferson Science Fellow with the U.S. Department of State, and she received a VT Alumni Award for Excellence in Research. She is currently serving in the Metals and Metallic Nanostructures Program at the National Science Foundation's Division of Materials Research.

Dr. Farkas' research is in the areas of structure of defects in alloys and the relationship of these structural characteristics with materials behavior and atomic scale models for mechanical behavior of metallic alloys. ❖

MSE Promotions

Dr. Kathy Lu was promoted to full professor, effective August 2015.

Dr. Abby Whittington was promoted to Associate Professor with tenure, effective August 2015.

MSE Welcomes New Assistant Professors

In January 2016, the Materials Science and Engineering Department welcomed **Dr. Carolina Tallón** and **Dr. Hang Yu**, who were hired as part of a coordinated Advanced Manufacturing Team in the College of Engineering. The team consists of nine faculty from five departments. Space has been rented (10,000 ft²) at the Corporate Research Center in Building RB26 to serve as a common area for the team. The space consists of first-class laboratories and some offices. Other faculty include Mike Bortner (ChE), Jaime Camelio (ISE), Ran Jin (ISE), Blake Johnson (ISE), Zhenyu Kong (ISE), Chris Williams (ME), Xiaoyu Zheng (ME).

Dr. Tallón received her bachelor's degree in chemical engineering from the University of Granada, Spain. She earned her graduate degrees from the Institute of Ceramic and Glass and the Universidad Autonoma de Madrid.

Her Ph.D. was in inorganic chemistry and her research topic focused on synthesis of ceramic nanoparticles and colloidal processing. After completing her doctorate, Tallón joined the University of Melbourne's Department of Chemical and Biomolecular Engineering as a research fellow in George V. Franks' group, where she served as a lecturer. She also contributed to research and teaching in the School of Engineering. In 2015, she became the academic convenor of the Hallmark Materials Research Initiative at the University of Melbourne. She has co-authored 17 refereed international journal articles and a book chapter on near-net-shaping of ultra high temperature ceramics in *Ultra-High Temperature Ceramics: Materials for Extreme Environment Applications*, published in 2014. Her research interests include ceramics and colloidal processing, surface science and rheology of suspensions, ultra-high-temperature ceramics, multi-scale porous ceramic materials, near-net-shaping techniques, modeling of materials properties and predictive performance materials properties, and nanocomposites and synthesis of nanoparticles.



Dr. Hang Yu earned his B.S. in Physics from Peking University in 2007, and his Ph.D. in Materials Science and Engineering from MIT in 2013. Professor Yu is an expert in the areas of

advanced manufacturing and mechanical behavior of materials. His research group will develop emerging structural and smart materials with unprecedented properties, such as ultra-high load-bearing capacity, damping capacity, actuation energy density, impact resistance, and ultra-low weight. The emphasis is on materials design at the meso-scale and micro-scale while exploiting new opportunities arising at the triple point between additive manufacturing, materials science, and mechanics modeling. Dr. Yu's other research interests include residual stresses in vapor phase deposition and additive manufacturing, kinetics and mechanical properties at micro- and nanoscale, *in situ* mechanical characterization, and shape-memory alloys and ceramics. ❖



Hin Receives a Dean's Award

Congratulations to **Dr. Céline Hin**, who was one of five to receive an Outstanding New Assistant Professor Award, presented by the College of Engineering in 2015. The Dean's Awards for Excellence are given annually to recognize innovation and excellence in research, teaching, and service. ❖



Department Gains New Labs and Offices in Randolph Hall

The MSE department is pleased to announce the acquisition of 10,000 ft² of laboratories and office space in Randolph Hall. Undergraduate laboratories have been moved from Holden Hall to newly renovated and larger labs in space vacated by the chemical engineering department (ChE), which moved into Goodwin Hall. In addition to lab space, there is new advising space, a conference room, staff offices, and eight faculty offices. MSE staff and faculty housed off campus in Collegiate Square since 2001 moved to Randolph Hall in August 2015, along with a few faculty from Holden.

Mining and minerals engineering also gained space in Randolph. The two departments worked together on proposals for the vacated space when the dean of engineering announced a competition for how the space might be used.

“One of the things that was very attractive about the chemical engineering space,” said Prof. Bob Hendricks, “was that all the labs have multiple hoods.” He explained that purchasing and installing one lab hood can cost up to \$300K.

The move is timely since the department is experiencing unprecedented growth. “In the last two years we have gone from about 60 or 70 undergraduate students to 250,” explained Dr. Hendricks, and enrollment is expected to increase to 300 by the end of next year. Renovated labs in Randolph are 50% larger than older labs in Holden and will accommodate the growing undergraduate enrollment.

Randolph Hall is located directly behind Holden Hall, bringing the full faculty and staff into closer proximity, improving interactions and meeting logistics.

Vacated labs in Holden are now available for research labs. With the addition of new faculty, this will work out very well.

University plans for the next several years propose extensive renovations to Holden Hall. With this in mind, Hendricks explained that the wisest decision was to move the MSE teaching labs into Randolph to avoid disruption of teaching in the event that Holden undergoes major construction. It allows for the growth of the department for the next several years. ❖



One of the new teaching laboratories in Randolph Hall



New advising and student study area in Randolph with conference room to the right.



Professor Bob Hendricks worked with Colley Architects of Blacksburg and general contractor F&S Building Innovations of Roanoke on the plans and construction for the new Randolph space.



MSE now occupies labs and offices on the first floor of Randolph Hall on the east side and along the front of the building facing Holden Hall.

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On the Cover
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Courtesy of Professor Johan Foster and
graduate student Rose Roberts

MSE Alumnus and Advisory Board Member Honored by College of Engineering

Paul Huffman, Jr. was inducted into the College of Engineering Academy of Engineering Excellence in 2015. He joins an elite group of 135 out of over 60,000 living Virginia Tech engineering alumni honored for meritorious engineering and leadership contributions during their careers.

Paul earned a bachelor's degree in materials engineering from Virginia Tech in 1978. He is one of the original members of the MSE Advisory Board, established in 1997, and remains an active member today.

He is the founder and president of Dominion Metallurgical, located in Roanoke, Virginia. Paul played a key role in the effort to build the Kroehling Advanced Materials Foundry at Virginia Tech. He is also the creator of the current Skipper cannon, which is prominent at all home football games as well as Virginia Tech Corps of Cadets ceremonies throughout the year. (His father cast the original Skipper.)

Congratulations Paul! ❖



MSE Department Head David Clark, Paul Huffman, Jr., and COE Dean Richard Benson.



Bladesmithing Team Presents Sword to MSE

Several students involved with MEPS attended the TMS 2015 conference in Orlando, Florida. Various competitions took place, one of which was a new bladesmithing competition. Two MEPS teams participated, and one team presented their finished entry, a bronze sword, to Dr. David Clark. The sword is a replica of a historical design. Pictured left to right are Christian Birkett (MSE B.S. 2012, current ISE grad student), Cameron Crowell (MSE B.S. 2015, current MSE grad student), Department Head David Clark, and Peter Kim (MSE B.S. 2012, current MSE grad student). The fourth team member was Adam Humphrys, (MSE B.S. 2012, current AFS Piedmont Chapter Education Co-Chair and metallurgical engineer at Dominion Metallurgical). Read more about the conference as well as other MEPS news on page 10.

In Memoriam: John H. Kroehling



David Clark with Joan and John Kroehling, AFS Piedmont dinner, 2010

MSE bid farewell to longtime friend and supporter, John H. Kroehling, who passed away March 19, 2015, at the age of 91. Mr. Kroehling, a graduate of the department, served as a member of the MSE Advisory Board from its inception in 1997. He was inducted into the College of Engineering Academy of Engineering Excellence in 2004, and he also served on the COE Committee of 100 Advisory Board.

Kroehling's education at Virginia Tech was interrupted by World War II when he was called to serve in the U.S. Army, earning a Purple Heart and a Soldier's Medal. He returned to school in 1946 and completed a B.S. in ceramic engineering in 1948. During his career, Mr. Kroehling worked for Roanoke-Webster Brick Company, followed by General Refractories, and finally DuPont. After retiring, he started his own company in Williamsburg, Virginia, JH Kroehling Associates, where he designed catalytic oxidation systems and specialized in industrial pollution control.

John and his wife, Joan, established two scholarships at Virginia Tech, one in MSE, and one in statistics. They also contributed a sizable gift toward the construction of the Kroehling Advanced Materials Foundry, which became operational in 2011. The foundry serves students interested in careers in metals as well as students in art and architecture. It plays host to workshops for industry and the American Foundry Society. The Kroehlings left a wonderful legacy in the foundry, which will serve the Virginia Tech community and industry for years to come. ❖



Photo of the first student to pour metal at the Kroehling Advanced Materials Foundry, February 22, 2011

Career Profile - Getting to Know Diane Folz

LeeAnn Ellis



It's been almost thirty years since Diane Folz embarked on a career as a ceramic engineer, and fifteen years have passed since she joined the faculty in Virginia Tech's MSE department.

experience in the professional ceramics world through her work with ACerS that served her well throughout her career.

Following graduation in 1987, Diane was hired to manage Dr. Clark's ceramics processing laboratory at the University of Florida. She had already spent two years as an undergraduate lab assistant prior to graduating. Now she oversaw the daily work of graduate and undergraduate students and maintained the facilities. She also assisted in teaching lab courses and helped Dr. Clark write a manual for the ceramics lab course taught at UF.

In December 2000, Diane joined the MSE department at Virginia Tech as a Senior Research Associate to manage the new Microwave Processing Research Facility when Dr. Clark moved up from Florida to become the MSE-VT department head. Her responsibilities and activities expanded and evolved over the years and a few are highlighted below.

Student Activities

Materials Engineering Professional Societies
Soon after joining the department, Diane was appointed the advisor for the Materials Engineering Professional Societies (MEPS), a student organization that first appeared in the department in the late 1990s. It is the Virginia Tech chapter of Material Advantage (MA), a student program providing access to the profession's top societies: American Ceramic Society; Association for Iron and Steel Technology; ASM International; and The Minerals, Metals and Materials Society. Diane transformed the major focus of MEPS to that of promoting professional development through sponsoring laboratory and industry field trips, inviting professional engineers to campus to speak to the students, encouraging student attendance at

The list of Diane's responsibilities and accomplishments offers an impressive portrait of a hard-working, enthusiastic engineer dedicated to working with and encouraging students in their educational and career endeavors. Before we delve into a few highlights through the years, let's look back to where she began as a student in Gainesville.

When Diane entered the University of Florida (UF), she studied architecture with a dream of seeing her designs become real structures. Along the way she decided engineering might hold more promise for her. A general engineering class introduced Diane, along with 500 other students, to the various types of engineering. It was a talk given by Professor Dow Whitney that started her down the path of materials engineering and ceramics.

She was drawn to the hands-on aspects of materials engineering, stating, "I could build something, I could put my hands on it, it was tangible." Along with others in her class, Diane pursued ceramics "because [I] really liked Dr. Clark's class. He was dynamic and his projects were very challenging. It was exciting." Professor David Clark became her mentor for classwork as well as student activities. She did an undergraduate senior project under his direction, using glass as a binder for circuitry. "It was a fun project. I got to make lots of glass." The project involved pouring different kinds of glass frits, screen printing them onto alumina substrates, and then running conductivity tests.

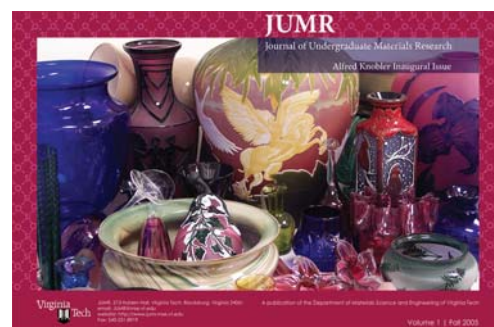
Diane soon became president of the student chapter of the American Ceramic Society (ACerS) where she learned how to lead student activities. She worked on building up the student ceramics group and saw a growing number of students getting involved in the ACerS student branch. She gained a wealth of knowledge and

Simultaneously a graduate student, teacher, research advisor, laboratory technician, and MEPS leader, Diane brings life and enthusiasm to everything she undertakes. Her energy provides the strength to keep MSE vital and growing. Though we are a small department, VT MSE has always been recognized for having the most heart. That heart is Diane Folz.

Connor Edsall
MSE B.S. 2010

professional conferences and Congressional Visits Days, as well as engaging in social activities such as hosting tailgate events on game days for alumni and students. MEPS members also participate in outreach efforts such as performing demonstrations at campus recruitment events and at area schools. Thanks in large part to Diane's efforts and enthusiasm, MEPS won a Material Advantage Student Chapter of Excellence Award multiple times (2005, 2006, 2007, and 2010).

Under Diane's leadership, MEPS participated in professional conferences, specifically the Materials Science & Technology conference (MS&T) and the Annual Conference on Composites, Materials and Structures, held in Florida. In recent years participation has expanded to include TMS and AFS. Students attend technical sessions, network with industry representatives, and participate in a variety of competitions involving public speaking and design projects.



Cover of inaugural volume of JUMR

The Journal of Undergraduate Materials Research

Diane recalls that it was around 2003 that Dr. Clark envisioned a student-focused technical publication. At the time, undergraduate research was not showcased anywhere in the materials engineering field. Diane enlisted the help of graduate student Ben Poquette (M.S. 2005, Ph.D. 2007), and together they created guidelines for a journal that would have a graduate student editorial board and feature undergraduate research papers. The first volume of *The Journal of Undergraduate Materials Research* (JUMR) was published in 2005 and christened the "Alf Knobler Inaugural Issue." Knobler was a dear friend of both the MSE and the English departments and envisioned increased communication and cooperation between the two departments. Poquette assembled an editorial board that worked with students and faculty in both departments to create the layout and design. Engineering graduate students as well as faculty served as reviewers. That first volume was a huge success and garnered awards

for the graduate editorial staff. Subsequent volumes have featured undergraduate research papers from around the globe.

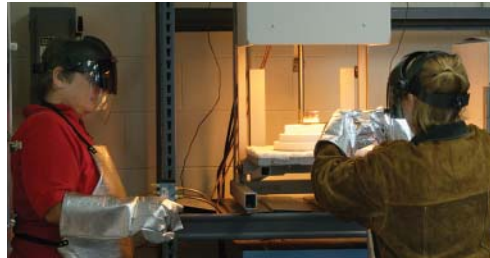
Teaching

Starting in the fall semester of 2001, Diane took on the duties of a senior research advisor for MSE senior design projects, advising one or two teams each year. One project of note was undertaken over multiple years, providing design projects for students graduating in 2009 and 2010. The project focused on microwave processing of composite materials and specifically, the development of a microwave curing process for polymer coatings on instrument woods. They collaborated with faculty and students at the University of Hartford and worked with Taylor Guitar Company in California. The culmination of each team's work was a visit to Taylor, where they presented the results of their year-long projects to Taylor staff and received an extensive factory tour. The projects netted two faculty and two student papers. Student visits to Taylor took place in 2009, 2010, and 2012.

Diane began teaching materials processing labs in 2007, passing along her enthusiasm for ceramics and materials engineering to many students. "I spent a lot of time with students," Diane said, "talking with them about their careers, especially those who wanted to pursue ceramics." Her classroom demonstrations were fun and innovative and drew several undecided students into the department.

One creative lab exercise turned into a formal assignment description published on the Materials Education National Resource Center website in 2010. "Materials Processing – A Piece of Cake!" is a fun, engaging exercise that teaches students about materials properties and processing by analyzing cakes that the students bake and bring to class. Also in 2007 Diane began teaching the introductory materials engineering course. She recalled loading a

cart full of samples and wheeling it to class to demonstrate all kinds of materials and their properties. Students who took the course recommended it to their friends. "I made the class very hands-on and interactive." She assigned projects where the students set up demonstrations for their classmates, such as one involving a small wading pool used to demonstrate shear thickening and thinning. Students would stand on the substance in the pool and sink, but if they ran across it they didn't break the surface. "I had fun teaching. If I didn't have fun, students are smart and they would know."



Folz, left, assists student in the furnace lab, learning to pour glass.

"In her activities with MSE, Diane was always very student-oriented," stated Dr. Steve Kampe (now MSE chair at Michigan Tech). "She was instrumental in establishing several out-of-classroom experiences for students, which I always felt was a distinguishing part of MSE at Virginia Tech. I remember the MSE tailgates and the Material Advantage Congressional Visits Days, in particular. Her dedication was always much appreciated by me as the Associate Chair."

Professional Organizations

When Professor Clark (UF) and Dr. Buckley (NASA Langley) conceived an idea for a student congress back in 1989, it was Diane who put it together and planned the National Institute of Ceramic Engineering (NICE) Student Congress that same year. Diane played a crucial role in NICE, serving as the vice president until 1994 when she was appointed the executive director, a position she held until 2006. Her duties were extensive and included working with the NICE Executive Committee and serving as a staff representative on the Board of Governors of the American Association of Engineering Societies. During her tenure with NICE, she saw the number of participating universities double. She also revived the PE exam in ceramic engineering in a number of states and gained acceptance by the National Society of Professional Engineers to hold the exams at annual ACerS meetings. Diane represented NICE through

As challenging as a university education is, Diane makes the learning process no different to a simple cookbook recipe. No student from her class would forget the Bake-A-Cake assignment. She metaphorically uses the students' baking experience for teaching the nuances involved with processing ceramics. These out-of-the-box teaching methods instill unforgettable educational experiences, leaving lifelong memories with students.

*Raghu Thridandapani
Editor-in-Chief, JUMR Vol. 4
MSE Ph.D. 2011*

management of the Annual Conference on Composites, Materials and Structures – Restricted Meeting, held each January in Cocoa Beach, Florida. Her duties included hiring student pages for the meeting, running onsite registration tasks, performing security clearance operations prior to and at the meeting site, compiling attendee lists, collecting manuscripts and delivering them to the appropriate government agency/representative, and handling all onsite logistics. This is only a small sampling of the vast number of duties and responsibilities Diane undertook as executive director.

Research and Honors

During the course of her career, Diane served as a co-principal investigator on federal and industry grants. She has co-authored more than 50 technical papers and presentations, and she is the co-editor for several books and proceedings. She also holds one materials processing patent. More recently, Diane collaborated with Dr. Clark and Dr. Rebecca Schulz on a chapter for a book on microwave processing of materials scheduled for publication in 2016. In 1996, she was named a Fellow in ACerS, and in 2000, she became a Fellow in NICE. She was inducted into the Alpha Sigma Mu Honor Fraternity in 2008, and into the Phi Kappa Phi Honor Fraternity in 2009.

Department Service

Diane's list of departmental activities and responsibilities is daunting. She has served as chair or member of several committees. She also served as the advisor for MEPS, JUMR, Alpha Sigma Mu, and the student branches of ACerS and TMS. Furthermore, Diane served as the department safety officer and the supervisor for computer services and the MSE website.

Diane's passion for music and research are overwhelming and contagious. I loved sharing both with her through a project with Taylor Guitar Company. Even though she had toured the facility several times before my first trip there, she always found something new to get excited about and loved sharing the experiences with the students!

*Lyndsay Kibler
MSE B.S. 2013*

Folz continued page 8

MSE Advisory Board Annual Meeting

The MSE Advisory Board met in November 2015 in the new Randolph Hall conference room. Among the attendees was a new board member, Mr. Paul Eusner, president of Great Lakes Minerals, LLC. Eusner completed B.S. and M.S. degrees in ceramic engineering at Virginia Tech between 1968 and 1970.

Professor Tom Staley gave the board members a tour of the new undergraduate labs as well as the common area in Randolph. They were impressed with the lab space, equipment, and safety features, and they were especially pleased with the common area where students can meet and work together, “creating a sense of community within the department.” MSE faculty and staff gave presentations with an emphasis on expected growth in the coming years. Topics included overviews of the graduate and undergraduate programs, department diversity goals, new faculty hires and searches, and senior design projects. Professors Abby Whittington and Alex Aning discussed some of their current research.

Special guests included Dr. Ed Nelson, Associate Dean and Chief of Staff for the College of Engineering, and Dr. Jack Lesko, Associate Dean for Research & Graduate Studies for the College of Engineering. Dr. Nelson gave an overview of the plans for a new Holden Hall, and Dr. Lesko talked about the new advanced manufacturing initiative and the Commonwealth Center for Advanced Manufacturing. Jasmine Brown, president of MEPS, gave a nice presentation of past and future MEPS activities. As in previous years, the board met with a group of students to get their feedback on their experiences in the department. ❖



David Clark presents a VT FIRE casting of a HokieBird to Paul Eusner.



MSE students met with the advisory board members in the new Randolph Hall common area.



Prof. Tom Staley, center, gave a tour of the new undergraduate laboratories in Randolph Hall.



MSE faculty and board members enjoyed an evening at Beliveau Winery.



Folz continued

Education

While working full time for the department, wearing numerous hats, Diane also pursued multiple degrees and certifications. She earned graduate certificates in 2009 and 2011 in Engineering Education and Future Professoriate, respectively. In August 2011 she completed an M.S. in MSE, and by 2015 she had completed about half of the work toward a Ph.D., also in MSE.

Outside Interests

Diane enjoys woodworking and is passionate about guitars—playing them and building them. In preparation for the senior design project dealing with instrument wood, she participated in two guitar-building workshops held at Purdue designed

for teachers with a goal of integrating arts and technology. She has built three electric guitars and mentored a high school student who also built a guitar. She was part of the worship team at St. Mary’s Catholic Church in Blacksburg for many years, playing guitar and also singing.

A bad fall in the winter of 2013 made it necessary for Diane to take an extended hiatus from her MSE duties in 2015. “Without Diane, we wouldn’t be where we are today with our students,” said MSE department head, David Clark. “She made it possible for different students to come along and step into leadership roles. She provided the foundation that has allowed us to build many successes and will continue to do so for years to come.”

The entire MSE department wishes her well with her recovery and hopes she will one day be back in the classroom, pursuing her passion for teaching and mentoring a new generation of materials science and engineering students. ❖



Diane tunes a guitar that she built.

Roanoke Valley Governor's School Students Visit Engineering Labs

Students from the Roanoke Valley Governor's School (RVGS) visited Virginia Tech for two days in November to learn about engineering. This annual visit has taken place every year since it was initiated in 2010 by Professor Alex Aning (MSE) and Fred Hoffman (RVGS). According to Dr. Aning, many of the visitors from previous years went on to study engineering at Virginia Tech or elsewhere. RVGS representatives say that their female students benefit the most from these visits. Sixty-five students participated this year, touring a number of laboratories and learning about the work that goes on in each one. Lab tours included the Kroehling Foundry, the Joseph F. Ware Advanced Engineering Lab, the Metal-Organic Chemical Vapor Deposition (MOCVD) Lab, the Bio-electromechanics Systems Lab, the Sustainable Energy Lab, the Advanced Materials Group lab, and a visit to the "inVenTs" Studio in Lee Hall. MSE Student Ambassadors were on hand to act as escorts and guides. ❖



Graduate student Cameron Crowell talks with RVGS visitors about materials processing equipment in MSE labs.



Graduate student Sean McMillan describes some of the research being done in Prof. Johan Foster's Advanced Materials Lab.



MSE Prof. Johan Foster gives a brief overview to RVGS students about areas of study in the Advanced Materials Group.



Graduate student Noah Allen describes the operations of the MOCVD Lab, a joint MSE/ECE lab directed by Prof. Louis Guido.

VT FIRE

VT FIRE has had a successful year. The foundry hosted 1000 visitors in 2015, including recruiting events, open houses, guest lecturers, and seminars. Open Foundry Days continue to be very popular. At the November event, as at previous open houses, visitors were able to design their own scratch plates to be cast in iron. They set a record in all ways with 130 visitors, 108 scratch plates cast, and 436 pounds of grey iron poured!

Competition teams have made use of the foundry to cast parts as diverse as a bronze sword for TMS to a functional shifting drum for the VT Formula SAE student team (mechanical engineering). The drum was entered in the AFS Southeast Regional Student Casting Competition and took first place. MSE students Aaron Weir and Ethan Edwards, who assisted with the casting, were on hand to accept the award.

Other student awards in 2015 included first and second place wins in the AFS Additive Manufacturing Student Casting Contest: Brian Tanaglia, first place, Category 2 (Other AM Technologies); Aaron Weir and Ethan Edwards, second place, Category 1 (Sand Core and/or Mold Printing). In the same contest, a senior design team received two

honorable mentions in Category 1. Team members were Allison Popernack, Avalon Schuler, Ian Knudsen, and Matt Antonelli.

That same team won second place in the 2015 AFS/FEF Student Technology Contest for their "Cast Aluminum Mesostructures Using 3-D Printed Sand Cores with Encapsulation" project. The group received a \$1200 scholarship and their paper was published in the *International Journal of Metalcasting* in 2016. Also published in the same journal was "Effect of Chemistry and Heat Treatment on the Pitting Corrosion Resistance of Three Duplex Stainless Steel Alloys," a paper by MSE 2015 seniors Ethan Edwards, Daniel Hodgkinson, and Myrissa Maxfield.

The AFS Piedmont Chapter held their annual VT meeting in Blacksburg in March 2015. They also held a meeting at the Hotel Roanoke in December. They awarded \$13,500 in scholarships in March and \$11,500 in November. Scholarships are provided by FEF, PCC, and the Piedmont Chapter.

MSE senior, Aaron Weir, received an FEF Delegate scholarship at the November



Above: Aaron Weir and Ethan Edwards at the AFS Southeast Regional Student Casting Competition. Right: Shift Drum casting awarded 1st place. Photos courtesy of AFS Piedmont Chapter



Aaron Weir, FEF Delegate scholarship recipient, FEF-CIC.

VT FIRE continued on page 16

MEPS 2015 Highlights

The Materials Engineering Professional Societies (MEPS) had a productive year with members attending three conferences between January and December. They organized plant tours and guest speakers and completed a successful fall membership drive. The group expanded their activities to include more professional conference opportunities, and they increased their participation in student competitions held at the conferences.

The three most active MEPS members were selected to attend the 39th Annual Conference on Composites, Materials and Structures - ITAR Sessions held in Cocoa Beach, Florida in January 2015.

Along with students from Alfred University and Missouri University of Science and Technology, they worked at the registration desk, made sure sessions ran on time, provided technical assistance, and ensured all attendees were U.S. citizens.

Several students attended TMS 2015, held March 15 to 19 in Orlando, Florida. This was the first year for MEPS students to attend this conference. They gave presentations and participated in competitions. A unique competition that debuted at the 2015 meeting was bladesmithing, where students produced a non-sharp knife or sword blade, a video about the process, a poster, and a characterization report. Two MSE-VT teams competed. Though neither team placed, the experience was educational as they delved into a lot of history to come up with their designs of a scimitar-inspired short sword and a 17th century bronze sword.

Eighteen students attended MS&T 2015 in October, held in Columbus, Ohio. A major highlight at MS&T was the Geodesic Dome Competition. For the second year in a row, a Virginia Tech MSE team won first place. A second VT MSE team took second place. The winning dome was designed by Nora Browning, Erik Quiroga, Peter Riley, Joey Griffiths, and Trey Vanhout. ❖



MEPS members at the TMS 2015 conference.



TMS Bladesmithing: Cameron Crowell's team created a bronze sword; Drew Stutts' team created a scimitar-inspired short sword.



TMS Materials Bowl: David Lichtman (team lead), Sarah DeSilva, Carmen Dennis, and Drew Stutts.



MS&T: The Geodesic Dome Competition winner, an aluminum and fiberglass composite, maxxed out the compression testing machine, supporting 55,000 N.



MS&T: Nora Browning and Erik Quiroga holding their winning geodesic dome.



MS&T: Olivia Wilson, Justin Yon, Mattie LaPrade, Jasmine Brown, David Hicks, Mackenzie Jones, Christina Romano, and J.P. Kramer

More MEPS photos on page 16.

MEPS 2015-16 Officers

- President - Jasmine Brown
- Vice President - Carmen Dennis
- Treasurer - Matt Crowley
- Secretary 1 - Nora Browning
(Historian/Advertising)
- Secretary 2 - Sean Cowden (Webmaster)
- Social Chair - Joey Griffiths
- Outreach Coordinator - Rachel Crane
- Professional Coordinator - Joey Griffiths
- SEC Chair - Peter Loomis
- Graduate Conference Advisor - Cameron Crowell

Scholarship Highlight

Trey Vanhout Receives the George and Clara Neall Scholarship

LeeAnn Ellis

Trey Vanhout has been honored with the George M. and Clara B. Neall Scholarship, awarded to veterans who served in Iran or Afghanistan and who are majoring in engineering. Trey, a junior in MSE, served in the U.S. Army from 2009 to 2012 and was deployed to Afghanistan in 2010.

Prior to his military service, Trey earned a bachelor's degree in history from James Madison University in 2008, a time of economic decline. After working briefly for insurance companies, he decided to enlist in 2009.



Nine months into his tour, Trey sustained a serious knee injury when he had to jump over a wall in the dark. He received a medical discharge in May 2012.

He transferred to Virginia Tech from Piedmont Virginia Community College in 2014. "I came to the realization that if you're going to go somewhere for engineers in the state of Virginia, Tech is the obvious choice." Besides, he's been a VT football fan since middle school.

Following intensive basic training at Fort Knox and advanced individual training at Fort Gordon, he reported to Germany in April 2010 and was promptly deployed to Afghanistan. Trained as a radio operator, he served in a communications squadron. The photo shown above was taken just before he headed out on his first mission to a remote checkpoint to establish real time communications between headquarters and a unit out in the field. He laughs when he sees this photo now and says, "I wouldn't have been smiling if I knew that I'd spend the next 38 days out in the middle of nowhere, not showering, not having a bathroom, washing clothes in a bucket, and eating MRE's."

He also participated in foot and mounted patrols, and he helped train the Afghan National Police (ANP). "I found out after I got back that was probably one of the most dangerous jobs in Afghanistan," Trey said. He went on to explain that many of the people who signed up for the ANP were members of the Taliban looking for ways to attack non-Taliban police.

Although he originally planned on majoring in chemical engineering, he soon discovered that MSE was a better fit. His comment to Prof. Hendricks was, "I honestly feel that I found where I belong." An internship with Steel Dynamics in Roanoke helped solidify his decision. "[The job] fit me perfectly. It was dirty and it was work and I related well to the people." His military background was a definite asset in being able to walk into the workplace, not as a student with only classroom work behind him, but someone who already had some technical expertise. He also gained excellent listening skills in the Army. Take the time to listen to the man who has been doing the job for 20 years or more. "Whatever they're doing, there's a reason behind it. You need to understand that reason, and the only way you're going to do that is to listen."

Trey was a member of MSE's winning team in the 2015 MS&T Geodesic Dome competition. "Our team leader, Nora Browning, did an excellent job getting us all together and she basically came up with the design," Trey said. His contribution was doing a lot of the

fabrication with casting performed at the Kroehling Foundry. He also offered a couple of suggestions for changes in the design based on deform analysis. Ultimately, the entire team's efforts paid off. Their dome maxed out the compression tester at the conference.

Trey is interested in metals and ceramics and hopes during his senior year to spend time at the foundry helping Dr. Druschitz. He plans to return to Steel Dynamics to work over the summer.

Regarding the Neall scholarship, Trey is very humble. He was "flabbergasted," he says, to receive such a generous scholarship, and he wrote a letter to Mr. Neall to thank him and to describe his duties in Afghanistan.

When people thank him for his service, he says, "My immediate gut reaction is to tell people to go find a Viet Nam veteran and thank them." Soldiers who served in Iran and Afghanistan have had the support of the American people. "Viet Nam veterans weren't given their due justice." He further explained, "As far as I'm concerned, those guys did a whole lot more than what we've done." When asked what the average person can do here at home, he said, "If you know somebody whose son or husband or wife is deployed, just be there to support them, because they're what makes it work, that support system."

His military experience offers an advantage, he believes, over traditional students in that he knows how to handle stress. "I don't have bad days. Once you've had really bad days, then you can't allow yourself to have worse days," Trey said. "Okay, today was crazy but it wasn't nearly as bad as that day in Afghanistan. So it's a good day. I got to take a shower. There's carpet under my feet. It's a good day." ❖

Biomedical Design Team Wins Second Place

Engineering World Health (EWH) is a non-profit educational organization whose mission is to create a global network of engineers and engineering students who work to improve healthcare in low-resource environments. The annual EWH Design Competition challenges students to create innovative medical equipment designs appropriate for use in very low resource areas. Many hospitals in Africa, Latin America, and Asia operate without steady electrical power under hot, dusty

conditions with unclean water, all of which can contaminate and render equipment unusable. Many EWH chapters around the globe enter the annual competition, which focuses exclusively on designing and building instruments that are low-cost and functional in these environments.

BioactiVT, Virginia Tech's first biomedical engineering design team, won second place in the 2015 competition. The team of fifteen was

founded by four students, including MSE senior, Priya Venkatraman, who serves as the current president. Co-founders include Charlie Roco (BSE), Eduard Krutyanskiy (ME), and Angad Verma (ME). BioactiVT's winning entry was a low-cost, thermoelectrically generated pulse oximeter for use in developing nations. The device is used during surgery to noninvasively monitor blood oxygenation levels. ❖

Meet the Class of 2015

Congratulations to our MSE 2015 graduating class. Many have moved into industrial positions, while others are pursuing advanced degrees around the country. The following articles highlight a few of our graduates. Good luck to all of you with your future endeavors!



Andrew Stutts Durham, North Carolina

Andrew (Drew) Stutts was born and raised in Durham, North Carolina. His father is a program manager with Blue Cross/Blue Shield, and his mother is a researcher for RTI International with degrees in sociology. The engineering influence probably comes from his brother, who received a B.S. from VT in civil engineering in 2010. While his brother did not actively steer him toward engineering, Drew recalls one conversation on a road trip when he said, “You should consider engineering.” When it was time to choose a university, he applied to three: UNC, NC State, and VT. He chose Virginia Tech, because “it felt more like home.”

In reflecting upon how he chose materials science and engineering, Drew said, “It’s a good thing that everyone has to do general engineering” during the first year, because he didn’t know what he wanted to do. Freshman engineering students are required to attend open houses offered during the fall by the different engineering departments. When he visited MSE, he discovered that the students were enthusiastic about the department and the demonstrations were interesting. Also, he had met Kelly Ramsburg (B.S. 2013), who lived in his dorm freshman year, so he talked with her at length about materials science. “She just



At TMS 2015 conference, Drew stands next to display case housing two swords designed by MSE-VT teams.

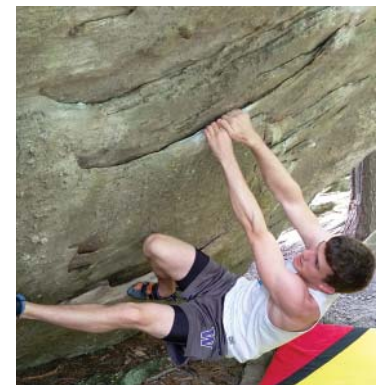
seemed really enthusiastic about it and all the things she was talking about seemed pretty cool.”

After spending the summer of 2013 doing an internship with Boeing in Everett, Washington, he developed an interest in composites for the aerospace industry. He described working on a project assessing the durability of an edge sealant applied to carbon fiber pieces to prevent corrosion. It was through observing the many applications of carbon fiber within the 787 program as well as other aspects of the aerospace industry that he became interested in composites.

He also pursued an interest in metals and participated in the 2015 TMS conference bladesmithing competition. Two teams represented MSE-VT in this new competition. Drew worked with Matthew Antonelli on a steel-forged short sword.

In the future, Drew plans to look into graduate composites programs abroad, perhaps in Switzerland or Germany. For the present, he began working in late June as a process engineer for Corning in Hickory, North Carolina. He will be working on fiber optic cables, taking glass fibers, bundling them up and coating them in a polymer and turning them into flexible cabling.

Aside from his studies at VT, he participated in Ultimate Frisbee on a club team over the last three years. He also did a lot of indoor and outdoor climbing. ❖



Drew practicing rock climbing

Myrissa Maxfield
Chesapeake, Virginia
2015 MSE Senior of the Year

A brief glance through Myrissa Maxfield's resumé gives a good indication of why she was selected as the MSE 2015 Senior of the Year. Not only did she maintain a high scholastic record, completing her program in Honors, she also participated in undergraduate research, internships, and professional conferences. She excelled in leadership roles in student chapters of professional materials societies, and she served as a volunteer at the Kroehling Advanced Materials Foundry, assisting in various demonstrations.

Myrissa comes from a large family centered in Chesapeake, Virginia. The first one in her family to attend college, Myrissa had some help in deciding to major in engineering. In her early years, an uncle introduced her to fun things like computers and the skill of soldering. Later on, during a camping trip with her father, his friends encouraged her to consider engineering because she did well in math and science. When she was a junior in high school, she met Stacy Evans. "She was the coolest," Myrissa said, "and I looked up to her." Stacy encouraged her to attend a Virginia Tech-sponsored camp aimed at high school girls called C-Tech2 (Computers and Technology at Virginia Tech). "I loved it there, and I had so much fun," Myrissa said. "Alright, I'm doing engineering!"

Her selection of Virginia Tech was influenced by a few things. First, she had to choose an in-state school, so she considered UVA and Virginia Tech. The C-Tech2 program was one deciding factor in her final decision. "I may have been a little biased on school colors." Orange is her favorite color, and both schools feature orange.

Myrissa had a unique method of selecting materials science and engineering. While the C-Tech2 camp was a factor, it was the MSE course descriptions that sealed her choice. As a University Honors student, she was required to fill out a four-year plan before arriving at Virginia Tech. She was advised to read course descriptions to aid in filling out the form. "Materials science had the coolest course descriptions!" So she completed her four-year plan assuming MSE would be her major, knowing she could change it later. "But I really liked it, so it worked out for me."



Myrissa stands beside an Inductotherm Lift Swing Induction Furnace at the Kroehling Advanced Materials Foundry (KAMF).

The decision to focus on metallurgy was also an honors-inspired choice. While she was selecting classes for her sophomore year, her honors advisor reminded her to sign up for the specialty courses in her major since some of those are only offered once in four years. The course she selected was an introduction to elementary metal casting. "The minute I saw metal casting I was hooked! This is what I want to do forever!"

The professor for that casting course, Dr. Druschitz, was so impressed with Myrissa's work in his classes that he invited her to join his research team to work on developing low voltage, aluminum, sacrificial anodes. In support of the project, Myrissa performed metal casting, electrochemical corrosion testing, and scanning electron microscopy.

She received numerous scholarships during her years at Virginia Tech from industry, professional societies, the College of Engineering, and the MSE department. One of the more prestigious awards was the AIST Foundation Premier Scholarship, an award that Dr. Druschitz points out has traditionally been won by a student from the Missouri University of Science and Technology, the "premier steel metallurgy school in the U.S." Myrissa was also the first recipient of the Dr. Kathleen E. Mortimer Scholarship for Women in Metal Casting, presented at the 2014 Foundry Educational Foundation College Industry Conference.

Myrissa seems to be a born leader, something she says "just happens." Regarding her leadership of a senior design team she said,

"I get satisfaction not just when I succeed but when my team succeeds, or people I'm working with succeed." She was in charge of planning MS&T for the VT MSE contingent in 2014 and found that she was able to delegate well and the work got done. The team did very well at MS&T that year, winning first place in three competitions (mug drop, mug aesthetics, and aluminum dome), as well as second and third place in the disc golf throwing competition.

During her college career, Myrissa participated in two internships. The first was at RTI International, a titanium company in Martinsville, Virginia, where she did forging and grinding and says it was a good way to "get my feet wet" in the industry. Her next internship was in the steel industry (a scholarship requirement), and she worked at SSAB Iowa in Muscatine, Iowa. "It was my easiest interview and it came so naturally." She described receiving a phone call one snowy April day while walking to campus with friends. The caller described the work and Myrissa said, "That sounds great." The caller said, "We really want you to work for us." She answered, "Let's do it!"

That internship proved to be very positive and resulted in a full time job with SSAB, which is a Swedish steel company where high quality steel is produced. "I really appreciate them for going above and beyond" in producing the highest quality steel. Myrissa began full time work for SSAB in June 2015. She likes the fact that she's living and working along the Mississippi River where the landscape is flat! Unlike many Virginia Tech students, Myrissa is not keen on mountains. They're nice to look at but she'd rather be in a place where she can "see forever." ❖



Suited up to pour metal at the KAMF.

James Hyres Lynchburg, Virginia



Jimmy and Tom Hyres

James (Jimmy) Hyres grew up in Lynchburg, Virginia, where his father is a materials engineer with Babcock & Wilcox and his mother works for the Campbell County School Board as an administrative assistant. Although Jimmy will agree that his father had some influence in his materials engineering interest, he says he always enjoyed chemistry and learning “what stuff is made of.”

When he arrived at Virginia Tech, he didn't know which engineering he would choose as his major, but MSE ultimately attracted him because he perceived materials engineering as “the beginning of everything.” He enjoys figuring out how things are made and what processes are used for various applications. He also liked the smaller department. “I like getting to know my teachers and my classmates.”

Jimmy's senior design team focused on nuclear materials under the direction of Dr. Céline Hin. The team modeled radiation, desegregation, and nanostructure for a material that is under consideration for the next generation of nuclear reactors.

In June, Jimmy headed to Euclid, Ohio, to begin work in the nuclear operations group at Babcock & Wilcox. At some point in the future, he would like to pursue an MBA.

Other interests while attending Virginia Tech included serving as treasurer for Circle K, a service organization. He was also heavily involved with the Lutheran campus ministry, serving as the outreach coordinator during his senior year. In addition, he participated in Galileo, an engineering learning community designed to bring together first-year male engineering students (Hypatia is the female counterpart) in a residential environment where they

can receive support and encouragement in their educational and career endeavors. After his first year living in the Galileo community, housed in Lee Hall, Jimmy served as a mentor for the next influx of first-year engineering students. During his senior year, he served as a resident advisor for the program. He also spent his summers working as an intern at Babcock & Wilcox in Lynchburg.

When asked about memorable experiences and highlights from his years at Virginia Tech or in MSE, Jimmy talked about Dr. Clark's physical ceramics course. The major project for the course was to develop a business plan for a ceramics company with a team of classmates. Jimmy's team met for dinner each week at a different restaurant to work on their project. “That was cool, because we got to know each other really well and got to eat some good food!” ❖

Cameron Reynolds Sterling, Virginia



Cameron Reynolds had the good fortune of growing up with all four grandparents living nearby. His father graduated from Virginia Tech in 1983 with a degree in environmental science, and his mother is an

artist. He has a younger brother who attends the University of South Carolina.

“We are a hockey family,” Cameron said. Weekends were spent traveling to games or spending time with extended family. While still in high school, Cameron interned with the Washington Capitals hockey team, and he considered a career in sports management with perhaps a law degree and future work with the NHL.

However, he was already moving toward engineering, thanks to his small high school, which housed the Academy of Science magnet school for Loudon County. Cameron took part in a year-long independent science research project during his senior year. His project involved sprayable fabrics. “I just happened to be categorized in the materials science and engineering path.” He always knew he would be attending Virginia Tech, and joining the MSE department “all worked out.”

He entered Virginia Tech as undecided, so he started out in philosophy, thinking he might consider a liberal arts major. He joined MSE during his sophomore year and stayed with both majors for a while.

That same year he began attending meetings of the Materials Engineering Professional Societies student organization (MEPS) and decided to get more involved the following year. A summer job exposed him to a lot of IT experience, so when it came time for MEPS elections, he ran unopposed for the position of webmaster for the organization. He bonded with the rest of the officers and increased his involvement with the organization, attending the MS&T conference and the Cocoa Beach Composites, Materials and Structures conference. These experiences gave him a better idea about the communications and business side of being an engineer which he enjoyed. During his senior year he took on the role of president for MEPS.

Student competitions at the MS&T meetings were one of his favorite events. “Materials science design teams are much more science oriented and require a lot more research and preparation and good execution to perform well.” He also enjoyed talking with people from the different companies and often found companies he had worked with in one way or another.

Outside of classes and MEPS, he followed his passion for hockey, playing on a recreational roller hockey team that won a championship during the last year.

In July 2015 Cameron moved to Akron, Ohio, to begin work with Bridgestone as a product development engineer. He would like to consider graduate school at some point in the future.

Final thoughts on MSE? “I feel like I was in the right place.” ❖



Cameron (kneeling) with his roller hockey team

Allison Popernack Yorktown, Virginia



Allison Popernack in Heidelberg, Germany

Like many students who enter the MSE program, Allison Popernack arrived at Virginia Tech expecting to major in chemical engineering. She attended high school in Yorktown, where she excelled in chemistry and math. During her freshman year at Virginia Tech, while exploring the engineering options, she discovered materials. "I didn't know materials engineering existed beforehand. I have been very happy ever since." She chose to focus on metallurgy saying, "After finding out about the foundry, how could you stay away from that! It's just so exciting and so much fun. I can't NOT do this!"

Allison spent a lot of time at the Kroehling Advanced Materials Foundry where she helped as a volunteer for demonstrations during open houses. Professor Druschitz was the advisor for her senior design team project, "Cast Metallic Encapsulations," which focused on making lightweight vehicle armor. "We were able to cast a very complex shape that even the mold had to be 3-D printed" because it was not a shape that could be made by traditional processes.

During her four years at VT, Allison spent three summers interning at NASA Langley where she was able to get involved in research. She worked with a group focused on electron beam freeform fabrication, involving 3-D printing with a metal wire feedstock. She gave a presentation at the 2015 TMS meeting in Orlando highlighting the work she did during her third summer looking at the gradient in a printed piece between two different metal alloys and studying the characteristics.

She noted that her internships were excellent and she especially enjoyed the electron beam



freeform fabrication project. "That internship gave me a lot of opportunities for different materials analyses" such as polishing and etching samples, and tensile and hardness tests. "So the internship allowed me to use a lot of things that we learn and how they come together in one project."

Allison traveled to Germany on a cultural exchange program offered through MSE in the summer of 2013. She spent three weeks in Darmstadt learning about German engineering, visiting several companies, and touring southern Germany. The ice cream was one of her favorite things.

Aside from her MSE work and activities, Allison was part of Hypatia for two years, a program sponsored by the Center for the Enhancement of Engineering Diversity (CEED). Hypatia is a living, learning community for female engineering students, and sophomores serve as mentors for freshmen. "One of my mentees, Mattie LaPrade, is now in materials science and engineering and in the foundry, so I like to think I had a part in that." Mattie, now a senior in MSE, said, "Allison was a great influence, and without her passion for MSE I probably wouldn't have found my place within the major. She is also the reason why I am heavily involved in the foundry, because she 'dragged' me to Open House my sophomore year."

Allison is also an artist, and the foundry offered a new tool for her creativity. "I try to get my hands into just about every art form I can, which is one reason I was so excited about the foundry." During her first semester there, she learned investment casting and created intricate roses for her class project. This involved designing roses in wax, coating them in a ceramic, burning out the wax, then pouring bronze and aluminum castings. One of her completed roses was exhibited at a 2014 AFS dinner. As an artist, Allison participated as a speaker in the VT Center for the Arts "My Take Talk" series, where she discussed her interpretation of a particular artist's work. She chose Manfred Mohr, whose work "transcends materials" because it is digital. "It goes outside of my realm of everything physical that I know and can touch and analyze."

Following graduation last spring, Allison interned in the metallurgy department at Corning, Inc., in Corning,

New York. "It was my first time working in an industry setting," she said. "It was a fantastic experience!" She worked with aspects of processing a nickel alloy that allowed her to use many skills she learned at Virginia Tech as well as in her previous internships. During her time in New York, she visited the Corning Museum of Glass and did a hot glass pulling activity. She also enjoyed kayaking and hiking around the Finger Lakes and spent a weekend in Toronto. Another MSE 2015 graduate, Sarah Whipkey, was also interning at Corning.

Currently, Allison is pursuing a master's degree at the University of Virginia, working in the Center for Electrochemical Science and Engineering (CESE) under Professor James T. Burns. "My research is focused on the hydrogen embrittlement behavior of MP98t, a cobalt-nickel super alloy used in bolts on Navy ships and submarines. My project has caused me to delve deeper into mechanical behavior and fracture mechanics. My tests are performed on a tension test frame with the sample submerged in salt water. My analysis includes comparing the crack growth rate to the stress intensity increase in addition to fractography." She expects to complete her master's in 2017.

"I really enjoyed being at Virginia Tech in the MSE department," Allison said. "I was exposed to a broad spectrum of things, a lot of different classes in materials." ❖



Allison works on a glass pulling project in a workshop at the Corning Museum of Glass.

Maria Handley Virginia Beach, Virginia

When it came time to choose a major at Virginia Tech, Maria Handley first considered chemical engineering. Her visit to the MSE open house and participation in one of the demonstrations convinced her to join the department. “I wanted to learn about how the chemical structure of things affects the properties,” Maria said. “Engineering opens so many doors. MSE did me no wrong.”



Maria overlooking a valley in Peru

She is from Virginia Beach “at the moment” and refers to her family as “world citizens.” As a Navy family, they’ve lived in several locations, so they all enjoy learning about new cultures and take turns planning different trips. While Maria was co-oping with Michelin in France, her brother and sister visited her. In the spring of 2015, Maria traveled to Peru to visit her sister, who was doing a study abroad through William and Mary. She is already looking toward the family’s next world adventure, perhaps New Zealand in 2017.

Maria interned with Michelin North America in South Carolina in 2012, where she worked in the area of polymers. She did co-op work with Michelin, France, Clermont-Ferrand from July to December 2013. Her work was in textile materials—in French!

Her senior design team studied recycled plastics and polymers under the supervision of Professor Sean McGinnis. “He’s really

knowledgeable and helpful, wonderful to work with.”

Aside from academics, Maria taught yoga and Pilates at the McComas gym, and she also played tennis.

Maria earned a B.S. in MSE and minors in green engineering and leadership. “MSE is awesome. Every freshman should consider looking into our program.”

During her time at Virginia Tech, Maria was part of an interdisciplinary engineering and science project, and based on her experiences with that, she’s interested in pursuing a master’s in food science and nutrition.

In the fall of 2016, Maria will enter graduate school at California Polytechnic State University in San Luis Obispo. She will work toward a master of science in agriculture with a specialization in food science and a concentration in nutrition. ❖

VT FIRE Continued

FEF-College Industry Conference. The foundry received FEF certification in 2014, and since then at least one of our students has been awarded a scholarship at the FEF-CIC every year. Four students attended the conference with Professor Alan Druschitz: Alexandra Dudley, Ashley Durrbeck, Dylan Platt, and Aaron Weir. All four had multiple job interviews while attending the conference.

AIST scholarships were awarded at the fall MS&T conference. And in January, four more students received very nice scholarships that include internships. See full list of scholarships on page 18. ❖



Twenty-four VT students (23 MSE, 1 ME) attended the AFS Piedmont Chapter dinner held November 18, 2015, at the Hotel Roanoke. \$11,500 in scholarships was awarded during the dinner.

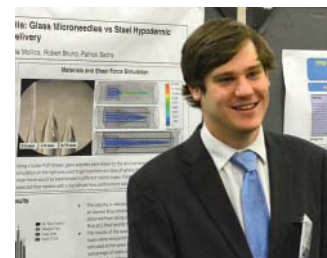
MEPS Continued



MS&T: Second place Geodesic Dome competition. Team members were Peter Loomis, Casey Clark, Aaron Weir, and Peter Kim.



MS&T: AIST scholarship winners included 3 VT students: Joseph Ogea - MSE, Zach Corey - ME (2nd & 3rd from left), and Aaron Weir - MSE (far right).



MS&T: Josh Thomas presented a poster titled “Viability and Longevity of 3-D Printed Cells: Glass Microneedles vs. Steel Hypodermic Delivery.”



Our graduate program continues to grow! In fall 2015 we gained 26 new students. With the addition of 3 more in spring 2016, this brings the total to 72, our highest graduate enrollment in the last 10 years. Pictured above are many of our new students.



Mr. Yanxi Li, a Ph.D. candidate in MSE, received the 2015 Graduate Excellence in Materials Science (GEMS) Sapphire Award given by the American Ceramic Society (ACerS). Yanxi is advised by Prof.

Dwight Viehland and co-advised by Dr. Jiefang Li. His research is focused on epitaxial growth and characterization of multifunctional solid oxide thin film materials with magnetoelectric and multiferroic properties. The GEMS award, organized annually by the Basic Science Division of ACerS, recognizes the outstanding achievements of graduate students in materials science and engineering. It is based on the quality of the student's research, academic and scientific accomplishments, and the overall quality of the student's oral presentation at the Materials Science & Technology Conference, held this year in Columbus, Ohio. Yanxi received his B.S. and M.S. degrees in MSE at Wuhan University of Technology in China. ❖



Austin Scherbarth is one of three COE graduate students to receive a prestigious 2015 Rolls-Royce Doctoral Fellowship. Austin earned a B.S. in materials science and engineering from Purdue University in 2015, where

he was on a Presidential Scholarship for Academic Achievement for four years. At Virginia Tech, he is working with MSE Professor Gary Pickrell, director of the Commonwealth Center for Advanced Manufacturing Surface Engineering group. This fellowship provides

a yearly stipend of \$30,000, full tuition and fees, health insurance, and an annual travel budget of \$2,500 for up to three years for students pursuing areas of interest to Rolls-Royce, Virginia Tech, and other partners. Other awardees were Christina DiMarino in ECE, and Matt Jones in AOE. Technical areas of interest for these students include next-generation materials, coatings, and thin films; electrochemistry, including corrosion and high-temperature oxidation; propulsion combustion, including afterburners; machine controls and mechatronics; computation fluid dynamics; energy storage; manufacturing systems; thermal management; mechanics; and multi-functional materials. ❖

Keith Hendren was named one of three ICTAS Doctoral Scholars in the College of Engineering for fall 2015. Only candidates of the highest academic caliber are eligible for this four-year award. A new Ph.D.



student working for Dr. Johan Foster, Keith received a B.S. in chemical engineering at New Mexico State. He spent two summers at Sandia National Laboratories, and he also did a summer REU at the University of Massachusetts related to a PDMS drug delivery device. In addition, he spent four years working in an oil field doing onsite geology analysis of drill cuttings and gases.

At Virginia Tech Keith is working on polymers and smart organic/biological materials. He is interested in organic chemistry and would like to work on responsive materials. ❖

In September 2015 **Shane Seaman**, a Ph.D. candidate in MSE, received a NASA Langley Research Center Group Achievement Award as part of a DISCOVER-AQ Science Team. Shane



was recognized for his contributions as an in-flight operator of the HSRL-2 lidar instrument, and in-flight interferometric optical filter operator during the 2014 and 2015 DISCOVER-AQ field campaigns. DISCOVER-AQ was a four-year campaign to improve the use of satellites to monitor air quality for public health and environmental benefit. Through targeted airborne and ground-based observations, DISCOVER-AQ will enable more effective use of current and future satellites to diagnose ground level conditions influencing air quality.

Also in 2015, Shane received a Virginia Space Grant Graduate Fellowship for his proposal, "Model Development and Experimental Validation of Interferometric Spectral Filters for High Spectral Resolution Lidar." Other recent honors for Shane include a 2014 National Institute of Aerospace (NIA) Fellowship, and a 2014 NIA Martin L. Drews Scholarship.

In August 2015 Shane presented a first-author paper entitled "Performance Characterization of a Pressure-Tuned Wide Angle Michelson Interferometric Spectral Filter for High Spectral Resolution Lidar" at SPIE Optics and Photonics 2015. Shane is advised by MSE Affiliate Professor Randy Heflin (Physics). ❖

Amelia McMullen, a new graduate student in MSE, was recognized in August 2015 by NASA, along with her team members in the Boron Nitride Nanotube Research Team. The team



received a Group Achievement Award for "establishing the infrastructure and programmatic development of the LaRC/NIA Boron Nitride Nanotube (BNNT) capability." Amelia did undergraduate internships with NASA Langley prior to entering Virginia Tech and joining Dr. Foster's research group. ❖

Spring 2015 Materials Science and Engineering Bachelor of Science Degrees

<i>Matthew Thomas Antonelli</i>	<i>Devin Neil Huling</i>	<i>Allison Somers Popernack</i>
<i>Peter Edward Barbieri</i>	<i>James William Hyres III</i>	<i>Cameron Lee Reynolds</i>
<i>Benjamin Patrick Conlon</i>	<i>Gerald Leo Kirk</i>	<i>Joseph Anderson Rittenhouse</i>
<i>Kevin Hurley Corcoran</i>	<i>Ian Phillip Knudsen</i>	<i>Chance Xavier Roman</i>
<i>Cameron Anderson Crowell</i>	<i>David Ethan Lichtman</i>	<i>Elizabeth LeeAnn Rosson</i>
<i>Sarah Suzanne DeSilva</i>	<i>Weihan Luo</i>	<i>Matthew Douglas Rost</i>
<i>Paige Lee Eckard</i>	<i>John Evan Luthringer</i>	<i>Avalon Vija Schuler</i>
<i>Samuel Ethan Edwards</i>	<i>Josh Michael Marett</i>	<i>Kevin Scott Seay, Jr.</i>
<i>Donald Joseph Erb</i>	<i>Kevin James Markle</i>	<i>Andrew Jonathan Stutts</i>
<i>Sara Kaitlin Fleetwood</i>	<i>Ethan Xavier Martinez</i>	<i>Samantha Katherina Swayne</i>
<i>Robert Corey Gallagher</i>	<i>Myrissa Nichole Maxfield</i>	<i>Hunter Cole Taylor</i>
<i>Maria Ann Handley</i>	<i>Collin Charles McClain</i>	<i>Sarah Catherine Whipkey</i>
<i>Daniel Aaron Hodgkinson</i>	<i>Christopher Evan Nellis</i>	<i>Stephanie Anne Wiltman</i>

2015-2016 Undergraduate Awards and Scholarships

Charles P. Blankenship

*Randi N. Clayton
Matthew J. Crowley
Kevin Gjata
Grant D. Glowacki
Dana A. Kazerooni
Alec D. Labitt
Ashley H. Long
Matthew T. McGuire
Jacob D. Paule
Kelsey G. Snead*

Ronald S. Gordon

*Peter W.L. Riley
Heather M. Wadsworth
Jake K. Yoder*

Alfred E. Knobler

*Sulman A. Khan
Anna L. Kofer
Jordan A. Seibert*

John H. Kroehling

*Emily A. Bautista
Fletcher J. Blue
Gabiella R. Calcavecchio
Alison A. Carney*

Kroehling Continued

*David Garcia
Jee Yun Kim
Mattie M. LaPrade*

Thomas G. Stroyan Memorial

*Fletcher J. Blue
John R. Colby
Jackson P. Cooper
Sean T. Cowden*

Michael Stuback Memorial

*Grant D. Glowacki
James R. Mangahas
Peter W.L. Riley*

AIST

2015-16

*Aaron S. Weir
Joseph L. Ogea*

AIST

2016-17

*Joseph L. Ogea
Mattie M. LaPrade
Mackenzie E. Jones*

Foundry Education Foundation

*Jasmine N. Brown
Sean Cowden
Alexandra F. Dudley
Ashley N. Durrbeck
Mattie M. LaPrade
Joseph L. Ogea
Dylan A. Platt
Anna G. Schierlmann
Jordan A. Seibert
Aaron S. Weir*

Modern Casting Partners (FEF-CIC)

Aaron S. Weir

HH Harris

*Allison Poppornack
Joseph Ogea
Sean Cowden
Aaron Weir*

George and Clara Neall

Trey Vanhout

**Spring/Summer/Fall 2015
Materials Science and Engineering
Graduate Degrees**

Doctor of Philosophy

Name	Dissertation	Advisor
William Cary Hill	Low Modal Volume Single Crystal Sapphire Optical Fiber	G. Pickrell
Michel Vargas Vallejo	Nanoscale Structural/Chemical Characterization of Manganese Oxide Surface Layers and Nanoparticles, and the Associated Implications for Drinking Water	M. Murayama
Zhenbo Xia	Surface Forces in Thin Liquid Films of H-Bonding Liquids Confined Between Hydrophobic Surfaces	R. Yoon
Hanguang Zheng	Die-Attachment on Copper by Nanosilver Sintering: Processing, Characterization and Reliability	G.Q. Lu

Master of Science/Master of Engineering

Name	Thesis	Advisor
Devon Baker	Understanding the Corrosion of Low-Voltage Al-Ga Anodes	A. Druschitz
Elizabeth Bonnell	Temperature Dependent Behavior of Optical Loss from Hydrogen Species in Optical Fibers at High Temperature	G. Pickrell
Jacob Calvert	Microstructure and Mechanical Properties of WE43 Alloy Produced Via Additive Friction Stir Technology	W. Reynolds
Sunny Chang	Cure Kinetics of Two Part Epoxy Resin and the Effect on Characterization of Thermal Barrier Coatings	G. Pickrell
Alexandra Egert	Aggregation Behavior of Keratin Proteins Determined by Dynamic Light Scattering	M. Van Dyke
Michel Vargas Vallejo	M.Eng. (Spring 2015)	M. Murayama
Yue Zhang	Magnetoelectric Thin Film Heterostructures and Manipulation of Magnetization	D. Viehland



Heads Up!

David Clark
MSE Department Head

As you can see from this newsletter, the faculty and students in MSE are extremely active and play a vital role in helping the college and university sustain their mission of teaching, research, and service. Many administrative changes have occurred in the last year. With the new leadership of President Tim Sands (whose background is materials science and engineering) and Provost Thanassis Rikakis, and their strong emphasis on research and teaching, and one of the strongest engineering colleges in the world, MSE is well positioned to be competitive both nationally and internationally. Let me share with you a few of the exciting things that you can expect to see in the future.

For years MSE has occupied space in several buildings with the quantity and in some cases the quality of the space being below that of our peers. In fall 2015, an architectural firm was hired by the college to provide a “concept” for a new and renovated Holden Hall, the main home for Materials Science and Engineering and Mining and Minerals Engineering. The new design would essentially double the space and significantly expand the instructional and research laboratories.

This will allow both departments to consolidate the majority of their activities in one building. Assuming all goes well we could be in the new Holden space within the next 5-7 years!

We have experienced substantial growth in MSE during the last several years. We have competed successfully for top-notch graduate students (in fall 2015 we admitted 26 new graduate students) and research dollars. We expect our total graduate student enrollment to reach nearly 100 in the next five years. Our graduate program is presently ranked 21st by *U.S. News & World Report*. In 2010 we had 120 undergraduates. Presently, we have 90 sophomores and anticipate a similar enrollment for fall 2016. If this trend continues we could exceed 300 undergraduates total and be among the top five MSE departments in the U.S. by 2018 with respect to undergraduate enrollment. So far we have managed the growth through 10,000 ft² of renovated space in Randolph Hall. This space was designed to accommodate the growth until the new Holden Hall is completed. In addition to space considerations, we have revised and will continue to revise our undergraduate curriculum to ensure that all of our students continue to receive the high quality education (technical, professional, and leadership) that our program is known for.

In addition to the facilities in Holden and Randolph Halls, MSE also has a world-class

nanoscale characterization and fabrication laboratory (NCFL), a state-of-the-art high-tech foundry (VT-FIRE), and an MOCVD laboratory (shared with ECE). These facilities, together with our strong computational materials capabilities and the new advanced manufacturing initiative will be very attractive in growing our graduate program and in securing major funding from government agencies and industry. Our goal is to leverage all of these capabilities to develop a better understanding of the processing/structure/performance relationship of materials. The bottom line is that we will become more efficient in expanding the frontiers of materials science while helping companies reduce the time and costs required to get their products to the marketplace.

On a sadder note, Dick Benson, Dean of the College of Engineering for 10 years, has accepted a new position as president of the University of Texas at Dallas beginning July 1. Dean Benson has provided outstanding leadership to the college and will be dearly missed. It has been a privilege to work for him. Please join me in congratulating Dean Benson and wishing him well in his new position as President Benson.

As always, we thank our alumni for their continued support and loyalty. Please e-mail us, stop by the department, or join us during one of our pre-game tailgates. Just stay in touch! ❖