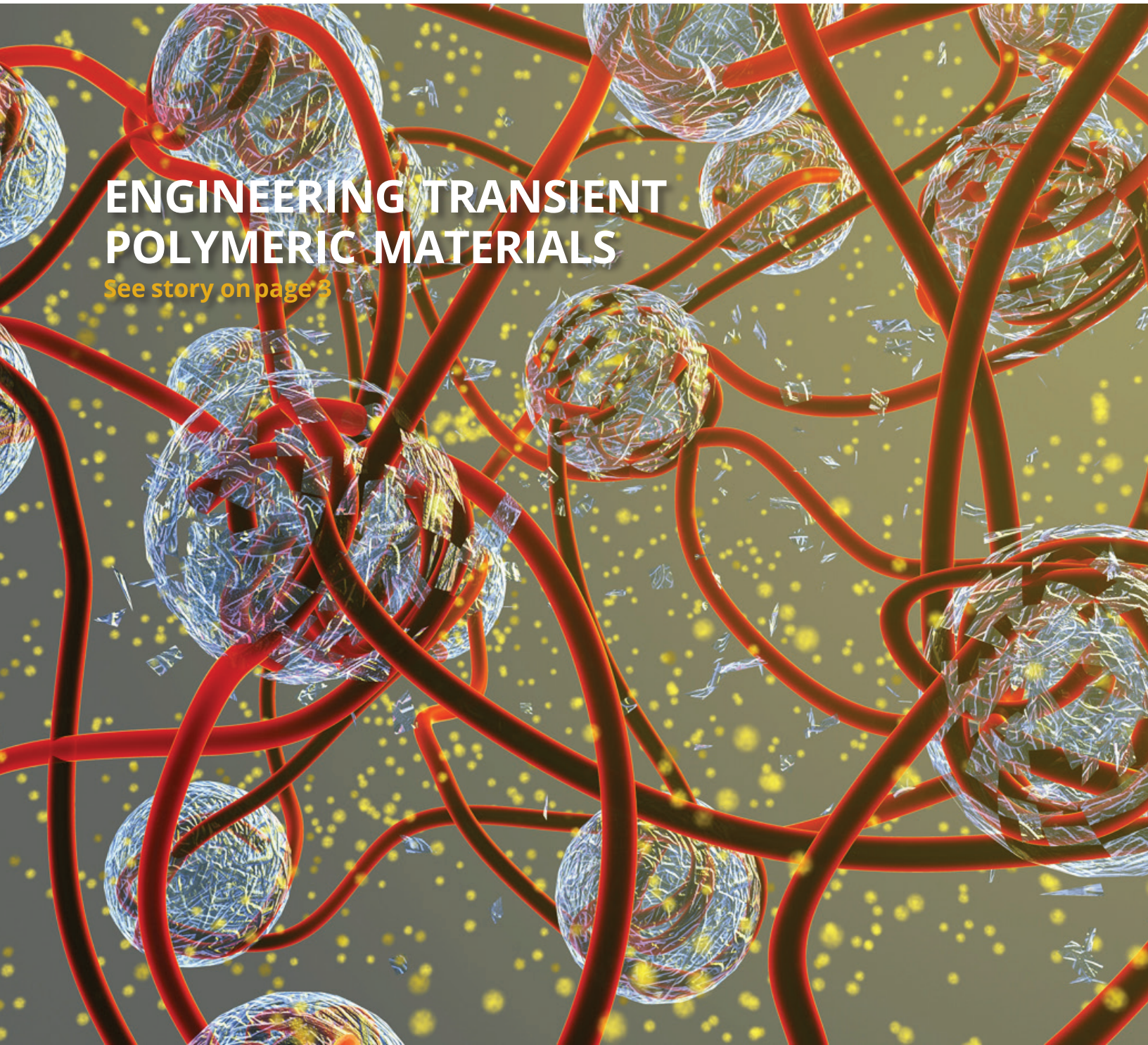
MSE NEWS

MATERIALS SCIENCE AND ENGINEERING

VOLUME 13 | NUMBER 2 | SPRING 2017

Carnegie Mellon University



ENGINEERING TRANSIENT POLYMERIC MATERIALS

See story on page 3

A NOTE FROM THE DEPARTMENT HEAD
Gregory S. Rohrer
W.W. Mullins Professor

Greetings to our MSE alumni! I am happy to report that the Department continues to grow and thrive. As always, you will find this issue of *MSE News* packed full of the successes of our students, faculty, and alumni.

The research stories in this issue reflect the evolution of the Department to a more balanced materials research portfolio over the past decade. Specifically, a little more than a decade ago there were no Carnegie Mellon MSE faculty laboratories concentrating on polymeric materials. In the next few pages, you will read about research in transient polymeric materials that can disappear after being used, polymer chains that can be tethered to nanoparticles to control their interactions and assembly at the micron scale, and polymer electrolytes that can be used in Li-ion batteries.

Of course, these are only a few representative examples of what is going on in our laboratories. The bigger picture is that, over the course of time and by design, MSE's faculty and their research have changed to embrace a broader range of materials types. Our faculty and students are, of course, succeeding in these new areas, bringing additional recognition to the Department.

Another change at MSE is our approach to advising undergraduate students. We've added a new staff member, Paige Houser, to increase our focus on this area. In the next issue of *MSE News*, we will profile her and describe our plans to improve the advising process.

The College of Engineering overall, and MSE in particular, has been increasing its activity in producing informational videos to highlight faculty research. There are now 17 MSE videos available on the web; links to these videos can be found at our website, www.materials.cmu.edu. This is an interesting way to keep up with what faculty are doing, and I recommend taking a look.

In November, we were saddened to learn of the passing of **Henry Piehler**. Henry taught in the Department for 40 years and continued to teach after retirement, so is therefore well known to many of our alumni. You can read more about Henry on page 9.

In addition, this year **Heiskell Rogan** retired from the MSE staff after more than four decades in the Department. Heiskell maintained the Department's digital infrastructure and assisted students with their computational needs. See page 8 for more on Heiskell.

I hope you enjoy reading about the other activities and achievements of MSE faculty and students. For those of you who plan to attend the Materials Science and Technology Meeting this fall, it will be held in Pittsburgh. If you have the opportunity, you are always welcome to visit the Department while you are in town.

GREGORY S. ROHRER

MSE SPRING CARNIVAL 2017

8th Annual MSE Alumni Deck Party

Wean Hall, 3300 Corridor Deck
Friday, April 21, 2017
4-6 PM

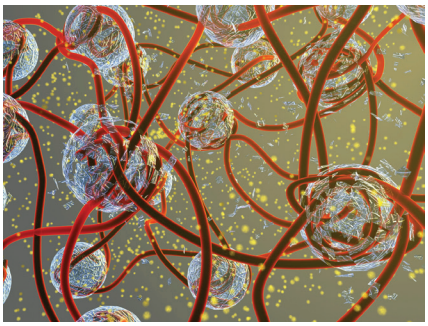
Please join Professor Rohrer and the MSE faculty for food and drinks

We hope to see you "on deck"!

RSVP by Friday, April 14, 2017

by email to:
krockens@andrew.cmu.edu
or call Kelly Rockenstein at
412.268.2700

Engineering Transient Polymeric Materials



This image shows the connections between individual polymer molecules that must be broken down in a highly controlled manner to support DARPA's research goals.

Bettinger Group

Professor Christopher Bettinger is working to develop a new class of polymers that change from a solid to a gas over time, effectively making the material disappear. This MSE faculty member is part of a team receiving a grant from DARPA's ICARUS program, which seeks to develop vanishing drones and devices for the military and intelligence communities.

"The goal is to develop a unique parachute material that will allow military planes to drop medical supplies, food, or electronics to deployed personnel," explains Bettinger. "Once the delivery is made, the single-use parachute will disappear in response to an external trigger, keeping the troops' location secret. This means developing a new class of polymers capable of changing from a solid to a gas in a consistent, reliable manner."

While Professor Krzysztof Matyjaszewski of CMU's Chemistry Department is attacking the problem with chemistry at the molecular level, Bettinger is engineering materials that can transmit stimuli throughout the polymer network — which is critical to ensuring a dependable transformation to a gas under a wide range of conditions.

"A lab is a very precise, controlled environment, but in the field, these parachutes will be exposed to a wide range of variants like temperature, wind, sunlight, moisture, and other non-controllable factors that could activate the chemical reaction prior to the parachute reaching its target," says Bettinger. "The material will have to be stable enough to be reliably functional, yet transient enough to break down on command. Also, being able to ensure that the external trigger can progagate uniformly through the material is an essential part of that equation."

NextManufacturing Center Consortium Takes Shape

NextManufacturing
Carnegie Mellon University

NextManufacturing Center Consortium

Professor Anthony Rollett of MSE is the Associate Director for the NextManufacturing Center, which is rapidly emerging as one of the world's leading research hubs for additive manufacturing — also known as 3D printing. This CMU center was founded to investigate and overcome the challenges of this evolving technology so it can join the ranks of other mainstream manufacturing processes. The center will use these challenges not only as a focus for research, but also as a testbed for developing new tools for a broad range of complex manufacturing processes.

Recently the center has taken a significant step forward in this goal by creating the NextManufacturing Center Consortium. The consortium brings together major players in industry, nonprofit, and government to share knowledge and ideas with the goal of unlocking the potential of additive manufacturing in the United States. Consortium members include Alcoa, Bechtel Marine, Bosch, Carpenter, Covestro, Eaton, Federal Aviation Administration (FAA), General Electric Company, General Motors, Ingersoll Rand, National Energy Technology Laboratory (NETL), SAE International, and United States Steel Corporation.

"Collaborating across disciplines and with outside companies has been a huge reason that we have been able to deliver such impactful results here in the NextManufacturing Center," says Rollett. "We are very excited that the NextManufacturing Center Consortium is creating more valuable partnerships for Carnegie Mellon's additive manufacturing researchers. These collaborations will not only ensure that our research directly targets real-world problems, but that real-world problems directly influence our research."

Bockstaller Pioneers New Nanoparticle Methods

Research could result in brighter, more energy-efficient TV and smartphone screens

> “We have shown that you can control interactions between nanoparticle building blocks, and therefore you now have the ability to create molecular structures with particles which were not previously possible.”

Professor Michael Bockstaller and his research team recently uncovered a new method for organizing nanoparticles in a more predictable fashion by surface-modifying them with polymer chains. By harnessing the intrinsic organizational properties of polymeric tethers, nanoparticles can be programmed to self-assemble into a variety of micron-sized domain structures in a reversible way. These findings were published in the December 23 issue of the journal *Science Advances*.

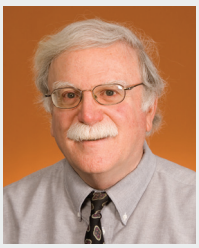
Bockstaller’s research findings can help create new nanomaterial technologies for such applications as next-generation lighting. Many new applications hinge on the organization of particles into layers, called films, that have a precise microstructure. Historically, fabrication of these films has been challenging, because it is difficult to control the structure of nanoparticle assemblies on micrometer scales.

“We have shown that you can control interactions between nanoparticle building blocks, and therefore you now have the ability to create molecular structures with particles which were not previously possible,” says Bockstaller, lead author on the study. Bockstaller and his team have demonstrated this new approach for a model particle system that will act as a synthetic testbed for a range of other nanoparticle materials. These materials are being investigated for applications in a range of nanomaterial technologies.

“No one has ever been able to control particles in this way before, so this finding is very exciting across a wide range of nanoparticle-based material technologies,” says Bockstaller. The new results mark an important stepping stone to improving the efficiency of technologies such as sensors and solar panels. Because these technologies rely on the organization of particles to propagate light and heat, this new finding has the potential to dramatically change the way the materials function in the future. For example, Bockstaller explains that better control over the organization of fluorescent particles called quantum materials could result in brighter and more energy efficient television and smartphone screens.

“This fundamental research opens the door to try a whole new set of ideas in the realm of nanoparticle-based materials, from photonic to luminescent materials. Imagine if we were able to dynamically change the properties of these materials in defined ways,” says Bockstaller. “With our understanding of how to organize particles, we hope to make this possible in the future.”

Laughlin Retires From Editorial Position



After 30 years, **ALCOA Professor of Physical Metallurgy David E. Laughlin** has stepped down as the Principal Editor of the journal *Metallurgical and Materials Transactions (Met Trans)* at the end of 2016. Laughlin has been an editor for the journal since 1982 and Principal Editor since 1987. His editorial legacy with *Met Trans* was featured in a recent article in *JOM*, the member journal of The Minerals, Metals and Materials Society.

In that article, Laughlin said, “In particular, I am proud of the rigorous review process and the high-quality micrographs that are published in our journals. Of great importance is that we do not reject papers out of hand because they are not currently hot topics. Our judgment is based on the quality of the work, not on how recent the topic. Our papers are well cited many years after their publication.”

To ensure a smooth transition, Laughlin is working closely with his successor, Tresa M. Pollock, Alcoa Professor in the Department of Materials, University of California, Santa Barbara.

Cohen-Karni Recognized for Innovation

Nano Letters

Professor Tzahi Cohen-Karni has been in the news recently for his innovative research on nanomaterials.

In January, he traveled to Hawaii to receive a Rising Star Award at the 2017 Cellular and Molecular Bioengineering Conference for his efforts to develop 3D nanosensors that will help reveal how engineered microtissues communicate with one another. This groundbreaking research is funded by the National Science Foundation and the Charles E. Kaufman Foundation.

Last July, Cohen-Karni and a group of colleagues at Carnegie Mellon published a paper on another research effort, "Synthesis of Group IV Nanowires on Graphene: The Case of Ge Nanocrawlers," in the journal *Nano Letters*.

As electronics get smaller, nanowires — tiny wires nearly a thousand times slimmer than a human hair — are becoming very important. Cohen-Karni and his team made the first observation of nanowires that seemed to "crawl" along the surface of graphene films. The advantage of having nanowires crawl along the surface as opposed to growing vertically out of the surface is that they could make photodetectors — devices that convert light to electricity — more sensitive, able to detect smaller amounts of light than their vertical nanowire counterparts.

The discovery of nanowires on graphene was a happy accident, according to Cohen-Karni. "We tried a few experiments where we wanted to grow the nanowires up, out of the surface," he recalls. "My students told me that it didn't work, so we looked at the results, and we were very surprised by what we saw."

The team decided to investigate further — and found that adding hydrogen chloride gas at a certain point during the synthesis process made the wires more likely to crawl along the graphene surface than to grow vertically out of the graphene.

Whitacre Receives DOE Funding

New polymers could make lithium-ion batteries safer, more efficient

Professor Jay Whitacre has received $185,000 over two years from the US Department of Energy's Advanced Research Projects Agency – Energy (ARPA-E) to study the use of dendrite-blocking polymers in lithium-ion batteries.

When charged repeatedly, lithium-ion batteries run the risk of overheating, and even catching fire. This is due to the formation of dendrites, or microscopic fibers of lithium that can form during the charging cycle. Over time, these dendrites can grow long enough that they connect the battery's electrodes to one another, causing the battery to short-circuit and become a potential hazard. In order to fully implement future lithium-ion battery technologies, which could greatly increase the battery power of our smartphones and electric vehicles, engineers need to find a way to stop these dendrites from forming.

Whitacre, along with collaborators from Tufts University, CUNY Hunter, and Massachusetts-based company Ionic Materials, will optimize a new solid electrolyte made of polymer material created by Ionic Materials. Their project — titled "Novel Polymer Electrolyte for Solid State Lithium Metal Battery Technology" — aims to maximize the potential of this new material to enable a battery to endure hundreds of charging cycles with no dendrite formation. The team will use computer modeling to maximize desirable traits, such as life cycle and energy density, while ensuring a final product that is low-cost and manufacturable.

"By implementing new polymers that fight the formation of dendrites and enable the use of pure lithium metal electrodes, a more energy-dense and safer lithium ion battery system is possible," says Whitacre. "This could lead to both a greater degree of safety and more energy in the same size battery package."

ARPA-E looks to drive innovation by providing funding for high-impact energy technologies that are in stages too early for private investment.

Ionic Materials

Jayan Wins Young Investigator Award

Young Investigator Research Award

Air Force funding will support the development of new materials

Assistant Professor B. Reeja Jayan, who holds a courtesy appointment in Materials Science and Engineering, has received a 2017 Young Investigator Research Award from the Air Force Office of Scientific Research (AFSOR). Jayan will receive a three-year, $360,000 grant for studying electromagnetic fields in materials synthesis.

Jayan, whose primary appointment is in Mechanical Engineering, leads a multidisciplinary lab at Carnegie Mellon focused on molecular scale engineering of everyday materials like plastics and glass. Jayan and her colleagues work to uncover new behaviors and properties of materials that could lead to developments in areas like energy and sensing. "We give existing materials another look with new tools, along with discovering new materials. It's sort of our lab's motto: give all materials a second look," Jayan explains.

The Young Investigator Research Program grant will help Jayan focus her research on ceramic materials. Jayan will use low temperatures with electromagnetic fields instead of high temperatures to grow and crystallize ceramics, a process that could help the Air Force develop new technologies in science and engineering.

"My students and I are excited about the resources this award provides us to probe deeper into what happens when electromagnetic fields interact with matter. Equipped with this understanding, we can discover far-from-equilibrium routes toward synthesizing crystalline materials like ceramic oxides with interesting properties at significantly lower temperatures," says Jayan.

The Young Investigator Research Program is open to scientists and engineers at research institutions across the United States who have received a doctorate or equivalent degrees in the last five years and show exceptional ability and promise for conducting basic research.

Matyjaszewski Wins Benjamin Franklin Medal

Franklin Institute Awards

Professor Krzysztof Matyjaszewski, who has a joint appointment in MSE and the Department of Chemistry, is a winner of the 2017 Benjamin Franklin Medal in Chemistry. Matyjaszewski, the J.C. Warner Professor of Natural Sciences at Carnegie Mellon, shares the award with Mitsuo Sawamoto, professor of polymer chemistry at the University of Kyoto. They will receive the award on May 4 during a ceremony at the Franklin Institute in Philadelphia.

Matyjaszewski and Sawamoto were cited "for their seminal contributions to the development of a new polymerization process involving metal catalysts. This powerful process affords unprecedented control of polymer composition and architecture, making possible new materials including improved composites, coatings, dispersants, and biomedical polymers."

The Franklin Institute Awards have recognized and encouraged preeminent accomplishments in science and technology on an international level since the Institute was founded in 1824. Past laureates include Thomas Edison, Marie Curie, Stephen Hawking, and Bill Gates.

Matyjaszewski is best known for developing copper-mediated atom transfer radical polymerization (ATRP), a precise method for making macromolecules that has revolutionized the field of polymer synthesis. ATRP uses a specialized catalyst to start and stop the polymerization reaction, allowing researchers to construct polymers in a piece-by-piece fashion and precisely control their size, architecture, and function.

Since first publishing his finding on ATRP in 1995, Matyjaszewski has worked to refine the process, making it more efficient and environmentally friendly. His work has been cited more than 80,000 times, making him one of the most cited chemists in the world.

Holm Recognized for Machine Learning Research

New techniques make it easier to sort and identify materials images

Professor Elizabeth Holm has won widespread recognition, including an article on the website TechXplore, for her innovative work on machine learning. This technology is aimed at studying data and developing algorithms that help the information to be better understood, analyzed, and categorized.

Holm is the first to combine computer vision techniques with machine learning methods to better understand the enormous number of research images accumulated in the field of materials science. This unique application is an interdisciplinary approach to a materials science problem that hasn't been explored this way before.

"Just like you might search for cute cat pictures on the internet, or Facebook recognizes the faces of your friends, we are creating a system that allows a computer to automatically understand the visual data of materials science," explains Holm.

Historically, the field of materials science has relied on human experts to interpret research images. Using computer vision and machine learning algorithms, Holm and her group have created a system that automatically recognizes and categorizes microstructural images of materials. Her goal is to make it more efficient for materials scientists to search, sort, classify, and identify important information in their visual data.

"In materials science, one of our fundamental data is pictures," explains Holm. "Images contain information that we recognize, even when we find it difficult to quantify numerically."

Holm's machine learning system has several different applications within the materials science field including research, industry, publishing, and academia. For example, the system could be used to create a visual search of a scientific journal's archives so that a researcher could find out whether a similar image had ever been published. The system can even quantify how similar (or how different) two images are. In fact, this approach can automate many of the repetitive and subjective tasks of microstructural image analysis.

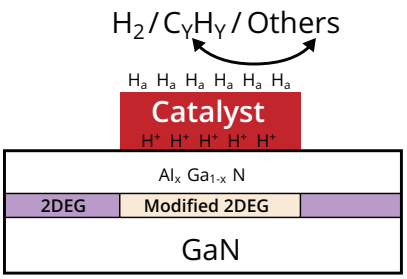
"Big companies can have archives of thousands of research images. No one wants to look through those, but they want to use that data to better understand their products," notes Holm.

TechXplore

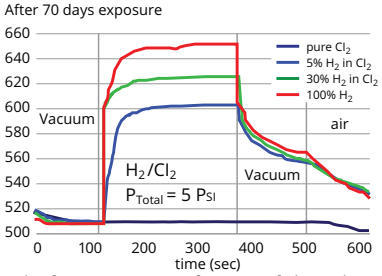
Davis and MSE Team Win Patent

Professor Bob Davis has been awarded a patent, along with two members of his research team — MSE alums **Jason Gu** *(B.S. 2005, M.S. 2007, Ph.D. 2010)* and **Jacob Melby** *(M.S. 2008, Ph.D. 2013)*. Patent #9,470,650 recognizes the team's research outcome, "Two-Dimensional Electron Gas (2DEG)-Based Chemical Sensors."

The development of a robust GaN/AlGaN semiconductor heterostructure-based sensor was a component of Gu's dissertation, and it catalyzed the formation and future growth of SenSevere LLC. This startup, headed by Gu, develops semiconductor-based hydrogen and hydrocarbon sensors for severe environments, providing real-time safety and compliance monitoring solutions. SenSevere serves the power generation, environmental, and chemical manufacturing industries.



Schematic of GaN/AlGaN high electron mobility transistor [HEMT] hydrogen sensor



Graph of capacitance as a function of elapsed time that illustrates ability of GaN/AlGaN-based HEMT sensor to detect H_2 entrained in the corrosive gas of Cl_2 without either chemical or electrical degradation after 70 days

Heiskell Rogan Retires

Rogan (left) is shown with Tom Nuhfer, MSE's Director of Electron Microscopy and Materials Characterization.

After 40 years, Carnegie Mellon says farewell to **F. Heiskell Rogan** as this long-time staff member retires. Heiskell has been a quiet, yet valuable and steady presence in the Department for 28 years. After earning a B.S. in Physics from the University of Tennessee and a Ph.D. in Physics from the University of Pittsburgh, he was hired as a Postdoctoral Fellow in the Chemical Engineering Department here at CMU. He retained that position from 1976 to 1989.

In 1989, Heiskell was hired as a Postdoctoral Fellow in the Materials Science and Engineering Department to work on the SEMPA Project in collaboration with the Data Storage Systems Center (DSSC) to create a specific microscope to study magnetic domains.

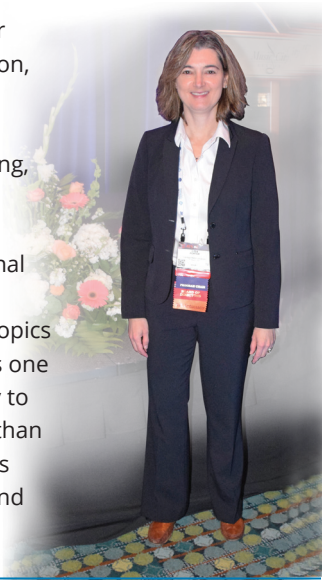
Professor David Laughlin reports that during this time, his office in Wean Hall had a direct line of sight to Heiskell's apartment building on Fifth Avenue. Sometime in 1990, Heiskell set up one of the first conceived wireless connections to CMU. By 1992, it was clear that he had a natural interest in, as well as a great talent for, developing electronics for detector systems as well as computer programming. Heiskell was then officially hired as the Department's Computer Systems Manager. During this time, he facilitated the complete wiring system for the Materials Characterization Facility in Roberts Hall, as well as providing electronics expertise and computer hardware and software support to MSE.

Shortly after MRSEC (Materials Research Science and Engineering Center) was founded in late 1996, Heiskell took on the role of Systems Engineer for MSE, a position he held until his recent decision to retire.

We will miss his gentle company in Roberts Hall, and we wish him the best in retirement!

Porter Chairs AVS 63rd Symposium

Professor Lisa Porter served as General Program Chair for the AVS 63rd International Symposium and Exhibition, held in November in Nashville, Tennessee. The AVS International Symposium and Exhibition addresses cutting-edge issues associated with materials, processing, and interfaces in the research and manufacturing communities. The weeklong Symposium fosters a multidisciplinary environment that cuts across traditional boundaries between disciplines, featuring papers from AVS technical divisions, technology groups, and focus topics on emerging technologies. The equipment exhibition is one of the largest in the world and provides an opportunity to view the latest products and services offered by more than 200 participating companies. More than 2,000 scientists and engineers gathered from around the world to attend the November event.



MSE Shares Videos Online

To communicate some of the exciting things happening in the Department of Materials Science and Engineering, MSE has posted some short videos on its website. Viewers can learn about the latest developments in the Materials Characterization Facility, watch faculty members describe their research, and otherwise keep up to date on MSE news.

"We're always looking for new ways to share what's happening in MSE," notes Department Head Gregory S. Rohrer. "Video is a great medium for demonstrating some of the cutting-edge research being performed by our worldclass faculty, as well as showing off some of our outstanding labs and facilities."

To watch MSE's video updates, visit http://www.materials.cmu.edu.

Faculty research

IN MEMORIAM: Professor Henry Piehler

It is with sadness that we report the passing of **Professor Henry Piehler** on November 24 in Pawleys Island, South Carolina. He was 78 years old.

With a joint appointment in MSE and the Department of Engineering and Public Policy (EPP), Henry joined the CMU faculty in 1967 and retired in 2007. His expertise included the mechanical behavior of materials, the interaction of law and technology, and technology transfer. He held three degrees from MIT: an S.B. in Aeronautics and Astronautics *(1960)*, an S.M. in Aeronautics and Astronautics *(1962)*, and an Sc.D. in Metallurgy *(1967)*.

Surviving Henry are his wife of 51 years, Margaret Forbes Piehler; two sons, Michael and his wife Betsy, and Christopher and his wife Anita; and three grandchildren, Owen, John, and Hallie.

Many of Henry's colleagues at CMU recalled cherished memories of him, and we share a few of them here:

"Hank was one of the first people I met and came to know well at CMU. He was one of the pioneers in the earliest days of EPP, bringing his knowledge and skills in materials science to address issues in product liability, law, and product safety — key issues in engineering and public policy. And his office was unlike any other on campus. We are all indeed fortunate for the time he spent with us as a dear friend and colleague."

— PROFESSOR ED RUBIN

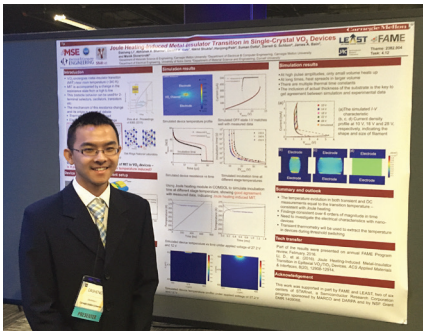
"Another founding father has passed. He and Bob Dunlap were office mates in the deep basements of Doherty, and their offices were the original home office for EPP. Hank was always in a suit and tie and neatly dressed. In contrast, his office was a mess. He filed things horizontally and vertically in piles. He was evicted from Baker because his filing system overflowed and violated the housekeeping rules. He was smart, energetic, and a great colleague. I also liked visits with his Jack Russell dogs in the days when dogs were more welcome."

— PROFESSOR FRAN MCMICHAEL

"One thing I will always remember about Henry is his enormous appreciation for the practical aspect of our field. He would happily point out when something was too esoteric to be useful. I think it was his appreciation of the practical which also led him to collect also sorts of things in his lab: a sheet of metal stamped into the shape of the hood of a Plymouth Prowler, some seats from the old Three Rivers Stadium, a cross-section cut from "The Fence" in the center of campus, and a famous neon light that can still be found in the Department. We will all miss working with Henry."

— PROFESSOR GREGORY ROHRER

MSE Students Win CIT Graduate Fellowships



Dasheng Li

Five MSE doctoral students have won a total of $67,000 in graduate fellowships awarded by the Carnegie Institute of Technology. These fellowships provide partial support for their tuition as they pursue a Ph.D. degree. The students are:

- **Ankit Gupta** won the Bradford and Diane Smith Graduate Fellowship, created through the generosity of Bradford and Diane Smith. This award supports the graduate studies of highly deserving students in the College of Engineering.
- The John and Claire Bertucci Fellowship has been awarded to **Madeleine Kelly**, **James Pellegren**, and **Saransh Saransh**. This fellowship, created through the generosity of John and Claire Bertucci, was established to provide merit fellowships to graduate students pursuing doctoral degrees in engineering in CIT.
- **Dasheng Li** has been recognized with the Neil and Jo Bushnell Fellowship in Engineering. This award was created through the generosity of Neil and Jo Bushnell. It was established to provide merit fellowships to graduate students pursuing doctoral degrees in nanotechnology or electronic materials in CIT.

2016 Boeing Scholars Named

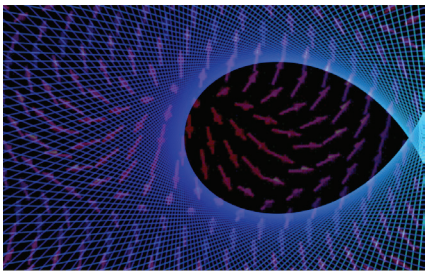
Boeing Scholarship

Three MSE undergraduates are among the 2016 recipients of the prestigious Boeing Scholarship. They are sophomores **Mari-Therese Burton** and **Jack Forman**, as well as junior **Stacy Chang**. These scholarships are awarded annually to students from across the US who are interested in a career in the aerospace industry. They include a grant of $5,000 to support winners' studies in a related field, such as engineering.

This grant program was created to help the aerospace leader build relationships with the nation's top engineering programs, as well as with especially promising students who may seek internships or entry-level positions with Boeing in the future. Eligible sophomores or juniors with a G.P.A. of 3.0 or higher, the ability to work successfully as a team member, and a strong interest in the aerospace industry were encouraged to apply for the scholarships.

Lau Selected as Dowd Fellow

Dowd Engineering Seed Fund



MSE doctoral student **Derek Lau** has been selected as one of four Dowd Fellows for the 2016-17 academic year. Lau's selection for this prestigious award was based on his project, "Model Using Interface Thermodynamics to Investigate Chiral Magnetism for Next-Generation Spintronic Devices."

The Philip and Marsha Dowd Engineering Seed Fund was established in 2001 through a generous gift to the College of Engineering from MSE alum **Philip L. Dowd** *(B.S. 1963)* and Marsha Dowd. This fellowship grant program provides support for third- or fourth-year doctoral students proposing work on cutting-edge research projects that are currently unfunded. The objective of the fund is to help enable future external research funding and possible future entrepreneurial activity by generating initial research results through the seed project.

Fellowship funds will cover Lau's tuition for the 2016-17 academic year and also include a stipend. Lau will present his research goals at the annual Dowd Fellowship Seminar in October.

MSE Selects Andrew Carnegie Society Scholars

Outstanding students are chosen by deans and department heads

The Andrew Carnegie Society (ACS) Scholars is a university program sponsored by Carnegie Mellon's University Advancement office to honor students, promote service, and foster leadership. Each year, seniors are selected for this honor by their deans and department heads from every college at Carnegie Mellon. The criteria is a high standard of academic excellence; volunteerism; leadership; and involvement in student organizations, athletics, or the arts.

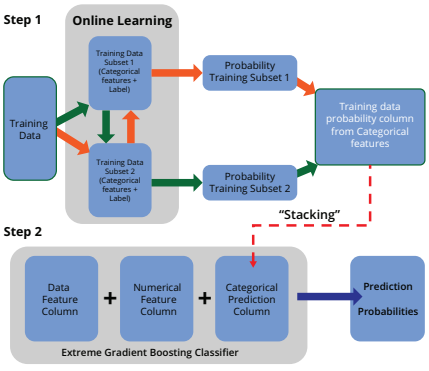
Katie Beittenmiller and **David Ott** have been chosen by the MSE Department to represent the 2017 class. Beittenmiller is an MSE major who also studies Biomedical Engineering and Modern Languages. Ott majors in MSE but is also pursuing studies in Biomedical Engineering.

Both ACS Scholars are advised by **Professor Christopher Bettinger.**

In this photo from the ACS dinner last fall, David Ott is in the back row, third from the right. Katie Beittenmiller is in the front row, second from the right.

Andrew Carnegie Society

Mangal Presents at IEEE BigData 2016



In December, doctoral student **Ankita Mangal** received a $2000 travel stipend and the opportunity to present her work at IEEE BigData 2016, Special Symposium on Data Analytics for Advanced Manufacturing, held in Washington, DC.

Mangal and her collaborator, Nishant Kumar — a data scientist at Uber Technologies — won a competition sponsored by Bosch, using one of the largest datasets (in terms of number of features) ever hosted on Kaggle.com. They submitted their solution for predicting internal failures along an assembly line, using data on thousands of measurements to identify components that would fail quality control. Mangal and Kumar were selected as winners based on peer review scores.

Mangal is a Ph.D. student in the research group of **Professor Elizabeth Holm**.

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