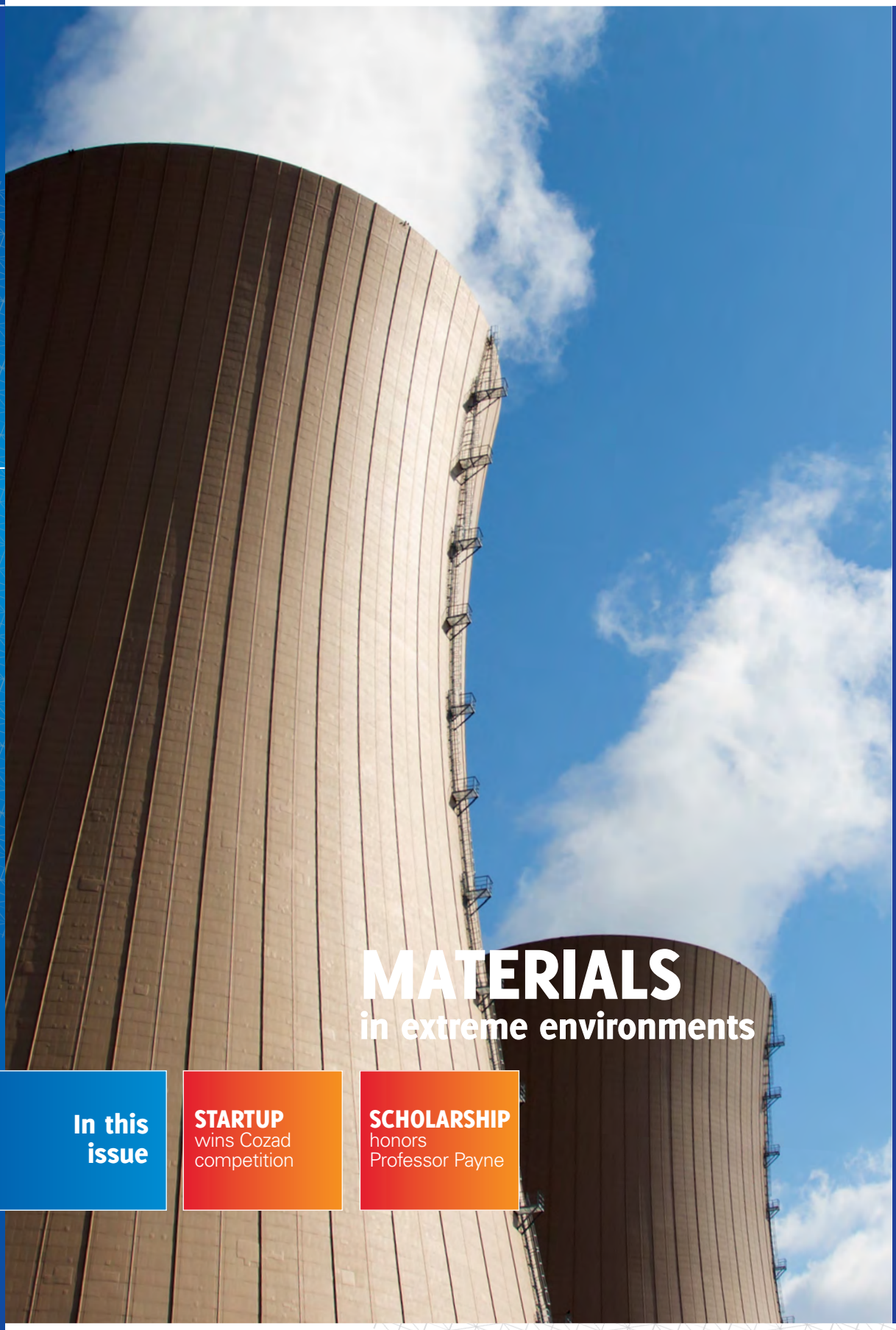
MatSE news

Summer 2016



MATERIALS
in extreme environments

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SCHOLARSHIP honors Professor Payne

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MATSE ALUMNI NEWS

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Letters, comments and newsletter submissions

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Greetings from Urbana

This fall, we will begin the somewhat long and drawn-out process of making major changes to the senior year of our undergraduate curriculum. We are in the process of replacing the requirement of a one semester senior laboratory taken in a narrow area of specialization (ceramics, electronic materials, metals, polymer, or biomaterials) with a requirement that each student enroll in four ½-semester "lab modules" of their choice. We will be doubling the hours of laboratory instruction in the senior year from 3 to 6, essentially replacing one lecture course with three hours of laboratory instruction. The new lab modules are intended to be more dynamic than the relatively static topics that we offered in the past; topics covered in the lab modules will be responsive and reflect changes in the field. This fall, we will introduce new lab modules on novel photovoltaic materials; 2D electronic materials; and computational engineering at the micro- and macro-scales that reflects emerging research directions in electronic materials as well as the growing importance of computational science and engineering in our discipline.

The MatSE faculty are in agreement that these changes will have many benefits to our students. I have often heard from alumni that the materials specialist in most small to mid-sized companies is called on to solve problems that span the entire breadth of our discipline, one day we are dealing with the mechanical failure of solder, and the next addressing the surface finish of a polymer coating or the formation of a biofilm on a ceramic. The flexibility in scheduling courses will open up more opportunities for students to work as interns or to study abroad. The topics of the lab modules will take advantage of the research expertise of our world-class faculty. Readers of this newsletter realize that we have had extraordinary success in attracting the very best young faculty to our department, a total of 10 since 2011, with the addition of Assistant Professor Chris Evans this fall.

Of course, equipping new laboratory offerings comes at a substantial financial cost. We have used donors' gifts to the MatSE Fund to help purchase the new equipment that is making possible the conversion to the lab module format. Because of philanthropic support, in the past few years we have been able to purchase $415k of major equipment for our instructional labs, including a powder diffractometer, thin film sputter deposition system, scanning electron microscope, and ellipsometer. Planned purchases of a Raman spectrometer and thin film stress measuring system are in the works, which will bring the total to $595k. In future issues of this newsletter, we will highlight the impact your gifts are making on laboratory instruction as the new lab modules come on-line.

Sincerely,

David Cahill
Willett Professor and Head

RESILIENT CERAMICS COULD MEAN SAFER NUCLEAR ENERGY

Research breakthroughs in the Assistant Professor Jessica Krogstad laboratory could one day lead to safer nuclear power plants. Krogstad has received an Early Career Research Program grant from the Department of Energy's Office of Science for her proposal, "Dynamic, Robust, Radiation-Resistant Ceramics: Harnessing Thermodynamic and Kinetic Driving Forces."

The core idea behind her proposal is letting the extreme environment of the nuclear reactor help mitigate radiation damage. Krogstad has proposed mechanisms to explore how the large thermal gradients in a reactor/waste environment could be used to continually modify the microstructure of structural ceramics, thus making them more resilient to irradiation.

"The surfaces of the pores are ideal places for defects generated by irradiation to heal, but the pores have to be the right size and distance apart," Krogstad explained. "We are going to try to use the thermal gradient to help keep this spacing/size appropriate so that the defects can be healed. First we have to engineer the ceramic microstructure, then come the irradiation experiments, followed by development of a thermal gradient test set-up, and finally (a couple of years down the road) we will combine all of this insight to understand how microstructure, irradiation and thermal gradients interact all at once."

Krogstad is generating ceramic samples with a controlled microstructure via conventional sintering and spark plasma sintering (SPS). SPS, sometimes referred to as field assisted sintering technique or current assisted densification, heats the ceramic to a high temperature by passing very large currents directly through the die and pellet rather than using convective heating. "This enables us to generate the fine, distributed porosity that we're interested in," Krogstad said.

Using a particle accelerator in the F. Seitz Materials Research Laboratory, the Krogstad research group can implant a range of ions into samples to simulate the type of damage that might be experienced in a reactor environment. The group will then use scanning and transmission electron microscopes to characterize

"The thermal gradient can actually drive new pores to the hot side of the gradient—the amount, size and distribution of those new pores can be modified by the composition of the material."

the microstructure on the side of the pellet that was damaged and compare it to the pristine microstructure on the other side. "These preliminary observations will also inform some more involved microstructural observations that we plan on conducting at Sandia National Laboratories in collaboration with MatSE alumnus Dr. Khalid Hattar," Krogstad said. "The unique part of the experiments at Sandia is that we will be able to irradiate the ceramics in a TEM and watch defects form, propagate, and potentially annihilate (heal). These in situ observations are critical to understand how the generated defects interact with our engineered microstructure—something that can only be inferred in the ex situ experiments conducted in MRL."

While the Krogstad group works to understand irradiation damage in porous ceramics, they will also be building a test rig to emulate the large thermal gradients found in many reactors. This will involve using a CO2 laser to heat one side of a ceramic sample and cooling the other side with flowing gas or fluid. "There's a lot of development to do here, but we'll ultimately be looking for microstructural and compositional changes that are the result of one side of the pellet being hundreds of degrees hotter than the other," said Krogstad.

Under the Early Career Research Program, university-based researchers receive at least $150,000 per year to cover summer salary and research expenses for five years. This year, the DOE's Office of Science selected 49 scientists from across the nation – including 22 from DOE's national laboratories and 27 from U.S. universities – to receive significant funding for research as part of this program.

Krogstad (BS MatSE '07) joined the University of Illinois as an assistant professor in 2014. She received her Ph.D. in materials science and engineering from the University of California, Santa Barbara in 2012, followed by a postdoctoral fellowship at Johns Hopkins University.

Shape of tumor may affect whether cells can metastasize

Only a few cells in a cancerous tumor are able to break away and spread to other parts of the body, but the curve along the edge of the tumor may play a large role in activating these tumor-seeding cells, according to a new University of Illinois study.

Using engineered tissue environments in various shapes and patterns, the study of skin cancer found that the more curved the cell cultures were, the more cancer cells at the edges displayed markers of stem cell characteristics – the key to spreading to other tissues. This has potential for furthering our understanding of cancer as well as developing personalized treatment plans.

Led by Assistant Professor Kristopher Kilian and Timothy Fan, an associate professor of veterinary medicine, the researchers published their findings in the journal *Nature Materials*.

"The most dangerous part of cancer is metastasis," Kilian said. "Some cells that we call cancer stem cells adopt deadly characteristics where they can travel through the bloodstream to other tissue and form new tumors. There's a need for ways to find these cells and to study them, and importantly, to develop drugs that target them, because these cancer stem cells are resistant to chemotherapy drugs that target the main tumor. This causes recurrence. The cancer comes back."

Kilian's group specializes in tissue engineering to create models of tumors, in order to more accurately study cancer processes in a culture dish. In the new study, the researchers cultured mouse skin-cancer colonies on various 2-D and 3-D environments of different shapes and patterns to see if the tumor shape contributes to activation of cancer stem cells, and to see where in the tumor the stem cells appeared.

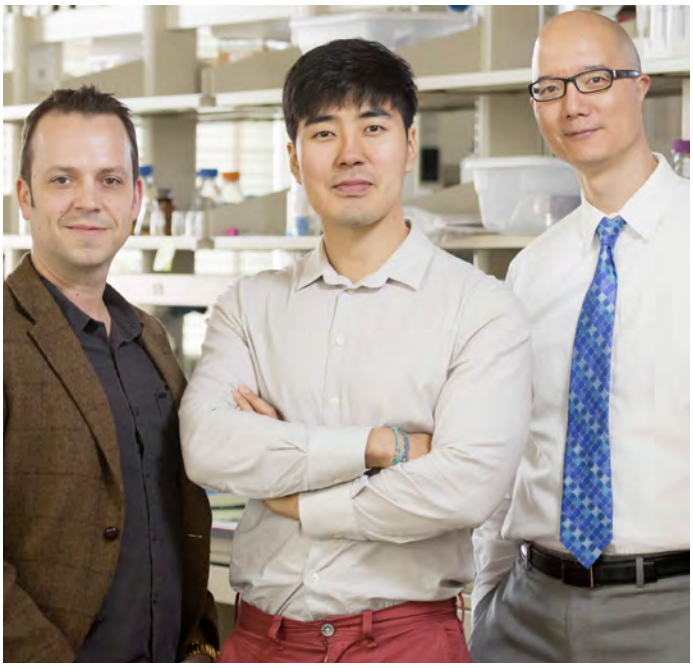
They found that cancer stem cells seemed to appear in the highest numbers along the edges of the engineered tumor environments, particularly where there were corners and convex curves.

"It was actually quite surprising," Kilian said. "Normal stem cells prefer a soft, squishy, internal position. So for cancer, everyone had assumed that the cancer stem cells were in the middle of the tumor. We found that geometric constraints, like you would have where a tumor touches healthy tissue, seem to activate these cancer stem cells at the perimeter."

The researchers did a number of tests in their engineered environments to confirm tumor-spreading ability, such as genetic analysis. They also tested other cancer lines – human cervical, lung and prostate cancers – and found that they responded to the patterned tumor environments in the same way.

Then Kilian's group teamed with Fan's group to test the skin-cancer stem cells in live mice, and found that the cells taken from the patterned environments were much more likely to cause tumors than cells taken from a conventional flat dish.

"We found that many more mice developed tumors when given the cells that we had engineered to have these stem cell characteristics, and they had a much higher incidence of metastasis in the lungs," Kilian said. "In a tumor, similarly, regions that develop these kinds of shapes may activate cells that can then escape and form more tumors. This may allow surgeons to look at the perimeter of a growing tumor and use the shape to guide their assessment of which regions could be more problematic – where they need to take out more tissue around the tumor and where they may not need to take as much."



Kris Kilian, MatSE graduate student Junmin Lee, and veterinary medicine professor Timothy Fan. Photo by L. Brian Stauffer

Kilian hopes that the patterned, engineered tissue environments will give researchers a new way to find and culture cancer stem cells, which have been very elusive in conventional cultures – less than 1 percent of cells, he said. Beyond the fundamental science of finding and understanding these cancer-spreading cells, he also sees engineered tumor environments as having therapeutic applications in personalized medicine.

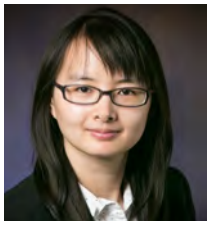
"You can imagine a patient has a particular tumor. You could engineer that in a dish, and using the patient's own cells, you could develop a model of their specific tumor to test out drugs," he said. "If you could take a patient's cells and within days have microtumors that you could use to screen all the available drugs, then an oncologist would be able to prescribe a treatment that's tailor-made for the patient that targets both the tumor cells and these elusive cancer stem cells that currently we can't see."

"There's a lot more work to be done, but we're very excited about how a very simple materials property of a growing tumor might be a culprit of the disease spreading. We think it opens up a new avenue of investigation for drug development, guiding surgery, and understanding progression and spreading of cancer," Kilian said. "Cancer is very complex, so putting it in context is key. If there is a microenvironment that provides the context for activating cells that can spread cancer, then that's important to know."

The American Cancer Society and the National Science Foundation supported this work.

-University of Illinois News Bureau

FACULTY **ACHIEVEMENTS**



Qian Chen

Chen makes Forbes' list of 30 Under 30

Assistant Professor Qian Chen made Forbes' list of "30 Under 30" for 2016 in the science category. For its fifth annual celebration, the publication selected "600 game changers, movers, and makers in 20 fields—all under the age of 30." Qian Chen (PhD MatSE '12) developed new "bottom-up" strategies for materials construction for her doctoral work. She was among the first to encode multiplexed information into colloids in a "Janus" or "patchy" fashion and to assemble them into functional materials. The Chen group's focus is on "the new paradigm of design, fabrication, imaging, and fundamental science of active soft matter—the artificial materials analogous of smart living systems that can self-replicate, self-regenerate, eventually evolve in structure and function with ever-changing external environment."

Cecilia Leal

André Schleife

Leal and Schleife receive NSF CAREER Awards

Assistant professors Cecilia Leal and André Schleife recently received National Science Foundation CAREER Awards.

Research in the Cecilia Leal laboratory could one day lead to smart materials capable of interfacing with the human body to heal wounds, repair bones, and deliver drugs, vaccines, and antibiotics through a programmable delivery system.

"The main goals of this project are to understand the self-assembly process of lipids, polymers, and associated species onto thin films and to design nanostructures that respond to underlying surfaces and environmental cues. This knowledge will enable the development of smart interfaces that could be actuated by a device on one side and release therapeutics to biological tissue on the other," Leal explained.

"This work is integrated with outreach activities to enhance the participation of minorities to science and technology," Leal explained. "We will develop a summer camp for middle school girls and a materials science workshop as part of the Education Justice Project to deliver instruction to incarcerated individuals." The Education Justice Project offers educational programs at Danville Correctional Center through the University of Illinois.

The André Schleife research group is developing a multi-scale approach for the computational design and discovery of optical materials that bridges the simulation gap between several atoms and actual optical materials.

"We will further develop parameter-free quantum-mechanical techniques to overcome limitations that currently lead to large uncertainties for optical absorption spectra and especially for excitonic effects in polar materials," Schleife explained. "Using these results as input to solve Maxwell's equations, we are building a multi-scale approach that enables us to study nanostructured materials for optical applications and devices entirely from computer simulations." Using modern computational capabilities such as NSF's Blue Waters super computer, Schleife's team will be able to widely disseminate research results.

Schleife plans to incorporate computer simulations into the undergraduate curriculum and develop computational learning modules that can be used in the classroom. He also aims to develop a new virtual-reality technique for the interactive visualization of simulation results using smartphones.

Nancy Sottos

Sottos paper selected for 2016 Hetényi Award

A paper by Professor Nancy Sottos has been selected to receive the 2016 Hetényi Award from the Society for Experimental Mechanics (SEM). The award is given annually for the best research paper published in Experimental Mechanics in a given year. The paper, "In Situ Measurements of Strains in Composite Battery Electrodes during Electromechanical Cycling," E. M. C. Jones, M. N. Silberstein, S. R. White, N. R. Sottos, Experimental Mechanics, July 2014, 54 (6), 971-985, was selected by the SEM honors committee from among a group of outstanding papers nominated by the Experimental Mechanics editorial board. The award was presented at the annual SEM meeting in Orlando, FL, in June.

From left to right: Yingfeng Yang, Garrett Chou, Hanze Ying, Yuxiao Wu, Manas Gosavi, Yichen Yang.

MATSE STARTUP WINS COZAD COMPETITION

Hindered Polyurea Technology (HPT), a startup led by MatSE graduate student Hanze Ying was named a grand prize winner of the 16th Annual Cozad New Venture Competition in the University Resource track (having used significant university resources in the development of their innovation).

HPT and Amber Waves Grain, an agtech company, each won $20,000 plus space in EnterpriseWorks (the University of Illinois Research Park incubator) and legal resources. The two companies beat out four other finalists, 19 semifinalists, and over 120 startups that entered the competition in total.

Professor Jianjun Cheng and his Ph.D. student Hanze Ying created the Hindered Polyurea material two years ago, but Ying and the other HPT team members recently discovered that in addition to its self-healing qualities, the polymer's sacrificial properties (ability to thermally evaporate) and lower cost give it added commercial appeal. In addition to Hanze Ying, HPT includes Yichen Yang (MatSE undergrad), Garrett Chou (Mechanical Science and Engineering undergrad), Yuxiao Wu (BS MatSE 2015), Manas Gosavii (finance and physics undergrad), and Yingfeng Yang (MatSE grad).

Cozad, along with the Illinois Innovation Prize, is part of the Provost's Annual Entrepreneurship Forum, hosted by the Technology Entrepreneur Center and the College of Engineering. Cozad is designed to encourage students to create new businesses, and teams are invited to create a venture around a topic of their choice.

Building semiconductors, orthopedic implants and hydrogen fuel cells are just a few of the potential uses of the new polymer material. See Hindered Polyurea in action: **https://youtu.be/1i3yoK0C9Ag**

MATSE STUDENTS RECEIVE NATIONAL FELLOWSHIPS

Three MatSE graduate students and one undergraduate recently received competitive national fellowships.

Connor Bailey, Leon Dean, and Shannon Murray received a Graduate Research Fellowship (GRF) from the National Science Foundation. Launched in 1952, the NSF-GRF program is the nation's oldest and largest fellowship program for graduate students. Approximately 17,000 students applied this year, and 2,000 were offered awards. Fellowships provide three years of support and come with a $34,000 annual stipend, along with coverage of tuition and fees. Awardees also have access to international research opportunities, supercomputing resources and internships with federal agencies.

Connor Bailey will graduate in May with his bachelor's degree in MatSE. Bailey participated in undergraduate research with Professor Can Bayram in the Department of Electrical and Computer Engineering.

Leon Dean received his B.S. in Chemical Engineering from the University of Texas at Austin. Dean, a Ph.D. student in the Nancy Sottos research group, is working on biomimetic regeneration and remodeling in polymeric materials.

Shannon Murray is a Ph.D. student in the Daniel Shoemaker research group. She is currently working on the synthesis of ternary systems expected to exhibit a metal-insulator transition with temperature in order to study the change in thermal conductivity. She received her B.S. in Mechanical Engineering from Texas A&M University.

Megan Brooks received a National Defense Science and Engineering Graduate (NDSEG) Fellowship. The Department of Defense awarded approximately 200 new three-year graduate fellowships in 2016. NDSEG Fellowships last for three years and pay for full tuition and all mandatory fees, a monthly stipend, and up to $1,000 a year in medical insurance.

Brooks, a Ph.D. student in the Sottos research group, is currently working on fabricating pH responsive microcapsules for use in anti-corrosive smart-coatings. "Depending on the core material, these microcapsules will allow for autonomous release of corrosion inhibitors or indicators to aid in identifying and preventing pitting corrosion," she said.

Brooks received her B.S. in Chemical Engineering from Texas A&M University.

MatSE grads recognized at MRS Spring Meeting

Two MatSE graduate students received awards at the 2016 Materials Research Society spring meeting in San Francisco. The MRS Graduate Student Awards recognize students of exceptional ability who show promise for future substantial achievement in materials research. The criteria for selection are excellence in the conduct of materials research, promise for future substantial achievement in materials research, and clarity of the presentation and discussion.

Hanze Ying

Hanze Ying, Ph.D. student in the Jianjun Cheng group, was awarded the MRS Gold Graduate Student Award for his presentation on Bioinspired Dynamic Materials—Synthesis, Engineering and Applications. After earning his B.S. in chemistry from Peking University, Ying set off for the University of Illinois to study at "the best materials Ph.D. program in the world." His research on dynamic covalent bonds (DCBs) that have reversible bonding/debonding properties earned him the top award at MRS. "We seek to develop a novel platform for dynamic materials design using a new type of DCB – hindered urea bond (HUB)," Ying explained. "We demonstrated that HUB enables the facile designs of self-healing materials, hydrolyzable polymers, and malleable thermosets." He plans to finish his Ph.D. this summer and will either stay at the University of Illinois to build his startup, Hindered Polyurea Technology (HPT), or look for a post-doc position and a future career in academia.

Nuri Oh

Nuri Oh, Ph.D. student in the Moonsub Shim group, received the MRS Silver Graduate Student Award for his presentation on Materials for Next-Generation Displays. Oh received his B.S. and M.S. in materials science and engineering from Hanyang University in South Korea. His interest in novel materials and their unique properties prompted him to continue his graduate studies in the U.S. Oh developed Double-Heterojunction Nanorods (DNHR) as a new subclass of nanocrystals. "The DNHR incorporate both type I and type II band offsets where the heterojunctions are active rather than passive insulators," Oh said. "Band offsets designed into the nanorods can facilitate both charge recombination and separation, ultimately allowing one device to function as both high performance LED and PD." The new design and functionality could have commercial application in the design of future electronic devices. Oh defended his Ph.D. in April and will continue to work with Professor Shim over the summer, with plans for a post-doc position in the fall.

MATSE GRAD ON "FIFTY FOR THE FUTURE"

Kaimin Cai, Ph.D. student in the Jianjun Cheng group, was honored as a 2016 Illinois Technology Foundation "Fifty for the Future" Awardee. His research focuses on trigger-responsive conjugates for selective delivery of drugs to diseased areas of the body. "I synthesize drug conjugates that can be easily incorporated into nanoparticles and use them for cancer-specific delivery and treatment." Cai received his B.S. degree in chemistry and molecular engineering from Beijing University in 2012. He came to the University of Illinois to pursue graduate studies in biomaterials for therapeutics. He has been named a 2016 Beckman Institute Graduate Fellow. Following graduation, Cai plans a career in academia.

The Illinois Technology Foundation (ITF) is a not-for-profit organization dedicated to fueling the technology workforce in Illinois. "Fifty for the Future" mobilizes academia and industry to support students across Illinois universities who aspire to greatness in the field of technology.

RACHEFF AWARD RECIPIENTS

Junmin Lee, Ph.D. student in the Kristopher Kilian group, and **Mohit Tuteja**, Ph.D. student in the Angus Rockett group, received the 2016 Racheff-Intel Award for Outstanding Graduate Research in Materials Science and Engineering. Lee's research presentation was "Interfacial geometry dictates cancer cell tumorigenicity" and Tuteja's presentation was "Investigating the effects of CdC12 anneal treatment on nanoscale electronic properties of CdTe solar cells."

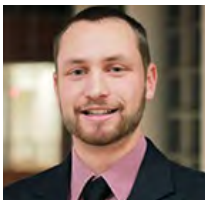
Students named to **Senior 100 Honorary**

The Senior 100, sponsored by Student Alumni Ambassadors and the U of I Alumni Association, recognizes outstanding seniors for their academic achievement, leadership, and commitment to the university. This year, six of the 100 honorees are MatSE undergraduates.

CONNOR BAILEY

Downers Grove, IL

"The summer before my senior year of high school I participated in an ASM-sponsored materials 'camp,' where I learned all about materials science and really got interested in it. Ultimately, I chose MatSE because I saw it as a great blend of both chemistry and physics, and thought that there were many exciting advances being made in the field. Once I decided on MatSE, U of I was an easy choice, one of the top programs and not too far from home. I've been heavily involved in Tau Beta Pi, the Engineering Honor Society, serving as their recording secretary this year. I've also been involved in Keramos as the service chair. In addition, I've participated in undergraduate research with Prof. Can Bayram in the ECE department and I am in my second year of being a TA for MSE 206. I've been involved in the Campus Honors Program as a Chancellor's Scholar as well. I plan on attending Stanford University to pursue a Ph.D. in the fall."



DREW CURTIS

Arlington Heights, IL

"I chose the University of Illinois for multiple reasons. The largest of which was the caliber and reputation of the engineering education that I could receive here. I was eager to be challenged in my coursework and to interact with some of the best faculty that an institution could offer. As for MatSE, I chose this major because, as it was once explained to me, at the basis of any problem plaguing our world lies a materials solution. I'm involved in the Campus Honors Program, Hoeft Technology and Management Program, Illini Hockey Radio on WPGU 107.1, Keramos, and Phi Sigma Kappa Social Fraternity. After graduation, I will be moving to Boston, MA, to take a position as a systems engineer at MITRE Corporation. I will be on the Emerging Technologies team working to develop new technologies to solve engineering problems that plague various government organizations."

FANG EWE

Penang, Malaysia

"I chose MatSE because when I was studying in Singapore, my chemistry teacher recommended MatSE to me as an area, and I was always drawn to biomimetic materials designs. I decided to apply to schools known for their materials departments, and was accepted into UIUC. On campus, I have been involved in various organizations. In my freshman and sophomore year, I went out to elementary schools to teach third and fourth graders science and engineering concepts by doing experiment demos with Engineering Outreach Society. I volunteered at Crisis Nursery and Meadowbrook Nursing Home with Tzu Ching Collegiate Association and was active in the Malaysian Student Association (MaSA) and Philippines Student Association (PSA). I did research with the Autonomous Materials Systems group with Professors Sottos and White. I became an active performer with PSA in their cultural performances and competitions and served as vice president external in MaSA. I participated in i-Program workshops held by the Illinois Leadership Center (ILC), and in my senior year, I became an intern at the ILC organizing these programs. I would like to travel around the U.S. before I start my job, wherever that ends up being."

KATHARINE MEHAN

Elburn, IL

"I first learned about the field of materials science and engineering through the summer camps I attended at the University of Illinois. I have always been intrigued by the 'how' and 'why' behind every object and process , and MatSE provides the means to explore that. At the university, I've been active in Material Advantage, the Society of Women Engineers, Student Introduction to Engineering (SITE) and Engineering Student Alumni Ambassadors (ESAA). I held committee positions on SWE for two years and held positions in ESAA for all four years. I'm currently chair of ESAA. I've also worked as a tutor at CARE and an undergraduate research assistant in Professor Jianjun Cheng's group. After graduation, I'll be working at AbbVie in their Operations Development Program."

Katharine was also named a 2016 Knight of St. Patrick, an honor given to students who represent leadership, excellence in character, and exceptional contribution to the College of Engineering.

SEAN MURRAY

Dousman, WI

"I've been interested in MatSE ever since an uncle of mine explained to me how Japanese sword smiths can take black, iron-rich sand and transform it into a hard yet flexible sword. The process requires extreme heat and many hours of hard labor. The result is an impressive and (for the warriors at the time) useful object. I feel like this story applies to many students at Illinois who are applying themselves towards finding an education. I've been involved in Material Advantage, Tau Beta Pi, the MSE 441 student-led seminars, and several university jazz bands and wind ensembles. I've been an undergraduate researcher in the Braun group, White group, and Krogstad group and studied abroad for a semester at Otago University in New Zealand. I will be pursuing a Ph.D. in Materials Science at the University of California, Santa Barbara."

HANNAH TAYLOR

Pawnee, IL

"I've always been an Illini fan and dreamt of coming here since I was in grade school. I choose MatSE because it offered so many routes of study and it was intriguing to me. I have been an active member of the Society of Women Engineers and I was the president of the Orange Krush Foundation. Following graduation, I will be moving to Baltimore to work with Northrop Grumman in the Professional Development Program a part of the electronic systems sector."

Undergraduate research contributes to better understanding of the brain

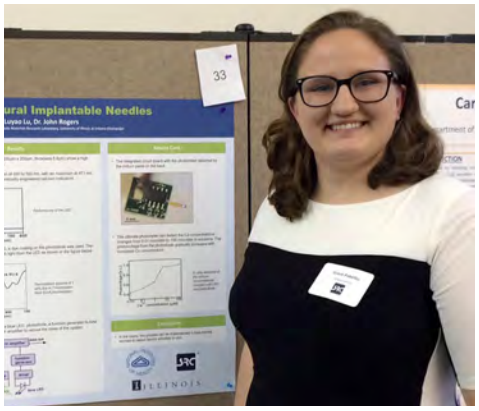
A select group of undergraduates in the College of Engineering presented their research at the Illinois Scholar Undergraduate Research (ISUR) Poster Expo in April. One of the four MatSE undergraduate research projects was "Wireless Neural Implantable Needles for Optogenetics," presented by junior Grace Pakeltis. An undergraduate researcher in the John Rogers lab since her freshman year, she has been involved in fabricating a small device that can be injected into the brain to gain more information on how the brain functions.

"The devices are small photometry platforms that can measure fluorescence stimulation through the use of a high performance microscale inorganic light emitting diode and captured using a co-located, sensitive microscale inorganic photodetector," Pakeltis explained. "This platform reduces the motion artifacts because they are directly integrated into the regions of the brain we wish to study."

The wireless delivery and data communication schemes allow the device to be used in awake, moving animals.

Students in ISUR enroll in a semester-long apprenticeship class in addition to time spent on research.

"Working with Professor Rogers, I have been able to learn firsthand about the versatility of electronic materials and how they can save lives," said Pakeltis.



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New scholarship a tribute to Professor **David Payne**

A new endowed scholarship in honor of Professor David Payne has been established at the University of Illinois. Bob Schwartz, Geoff Brennecka, and Matt Frey, former Payne group members and current MatSE Alumni Board members, were instrumental in the fundraising effort. A whopping $100,000 was raised in record time, thanks to the generosity of former Payne group members.

The first David A. Payne Scholarship was awarded at the MatSE Awards Banquet on April 15. The scholarship recipient, Collin Anderson, is a freshman from Lindenhurst, IL, who is interested in ceramic materials.

Professor Payne graduated his first Ph.D. student, Sang Moo Park, in 1977 and his last Ph.D. student, Jim Carroll, in 2007. In total, during his tenure at the University of Illinois, he advised 53 graduate students and sponsored 35 post-doctoral associates and visiting scholars.

In his remarks at the banquet, Schwartz said, "Professor Payne put us on a path to success through his patient mentorship and focus on the 'why's' of ceramic science and engineering. He wanted each of us to understand material behavior at the most fundamental level possible. But there was an added benefit to studying under Prof. Payne. His research group was typically 10 to 14 graduate students, a post-doc or two, a few visiting scholars from the United Kingdom, China or Japan, and several undergraduate student researchers. It was quite a diverse group but all members of the team set a high standard for their science, something that helps us each to this day."

Former Payne group members who were present at the banquet included Bob Schwartz, Geoff Brennecka, Matt Frey, Pin Yang, Alp Sehirlioglu, Dennis Eichorst, Lorraine Francis, Ryan Ong, Jian Tian, Brent Clothier, Jeff Roubik, Yu Tung Huang, and Dave West.

Gifts to the David Payne Scholarship Fund may be made using the form on page 11 or donate online at **matse.illinois.edu/give**

David Payne with his first scholarship recipient, Collin Anderson

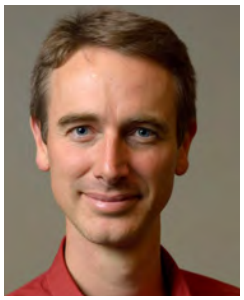
Payne group members return to campus to celebrate.

MatSE Alumni Board welcomes new members

Katharine Nickell (MS MatSE '05) is a Packaging R&D productivity manager for the Wrigley Company. Her responsibilities at Wrigley encompass leading the optimization of packaging material use as well as the development of novel packaging materials in order to drive cost savings across North America. She previously spent 11 years with the Kraft Heinz Company where she held multiple roles in Product and Packaging R&D. In her most recent role at Kraft Heinz, she was a Packaging R&D section manager for the company's $4.2B cheese business unit, with responsibility for the packaging R&D team across all cheese brands for the company. As a packaging developer, she led the commercialization of a new-to-Kraft flexible film/peelable package technology and product that launched in 2012 under the Fresh Take brand. She earned her master's degree in engineering management in 2013 from Northwestern University.

Craig Gowin (BS MatSE '00) is a senior innovation manager at Quaker focusing on new product commercialization for the Quaker brand. He has held previous roles within in PepsiCo as a member of the Lean Six Sigma Black Belt team, and on Procurement productivity. Prior to this, he spent four years in operations at the Bridgeview, IL facility. He is currently on the University of Illinois Supply Chain recruiting team, a member since 2008. Prior to joining to PepsiCo, he spent six years working for PPG Industries in a variety of operations roles. His primary focus at PPG was with glass manufacturing.

Paul Braun appointed to lead MRL



The new director of the Frederick Seitz Materials Research Laboratory (MRL) is MatSE alumnus and faculty member Paul Braun (PhD MatSE '98). Braun, Racheff Professor of Materials Science and Engineering at Illinois, is recognized as a world leader on the synthesis and properties of 3D architectures with a focus on materials with unique optical, electrochemical, thermal, and mechanical properties.

In his official announcement of Braun's appointment, College of Engineering Dean Andreas Cangellaris said of Professor Braun, "His deep understanding of the MRL culture, and his appreciation of the lab's significance to the university's reputation in the physical, chemical, and material sciences, will serve him well as he works closely with the lab's users and stakeholders. Together, they will chart a 21st-century path to sustained excellence through groundbreaking scientific breakthroughs, diversification of its capabilities and research areas of emphasis, and a heightened emphasis on materials innovation and entrepreneurship."

A prolific scholar, innovator, and entrepreneur, Braun has co-authored a book and more than 200 peer-reviewed publications. He has been awarded multiple patents and has co-founded two companies. His honors include the Friedrich Wilhelm Bessel Research Award (2010), Stanley H. Pierce Faculty Award (2010), Beckman Young Investigator Award (2001), Robert Lansing Hardy Award from TMS (2002), Xerox Award for Faculty Research (2004, 2009), plus multiple teaching awards. In 2006, he was named a University Scholar by the University of Illinois, and in 2011 was named the Ivan Racheff Professor of Materials Science and Engineering.

Since its inception in 1962, MRL has fostered interdisciplinary research at the forefront of materials science. MRL brings together world-class faculty and students in condensed matter physics, materials chemistry, and materials science in a highly collaborative research environment. MRL is also home to several large-scale, multi-investigator research programs supported by the Department of Energy's Office of Basic Energy Sciences, Materials Sciences and Engineering Division; Department of Defense agencies and DARPA; the National Science Foundation; other federal agencies; industry; and the University of Illinois.

Kevin Anderson elected to NAE

Kevin Anderson (BS Met '86, MS Met '87, PhD Met '90) has been elected to the National Academy of Engineering "for advances in metals recycling through invention of innovative aluminum alloys." Academy membership honors those who have made outstanding contributions to engineering research, practice, or education. Anderson is a member of TMS and a Fellow of ASM. He was a NORCUS fellowship recipient at Battelle Pacific Northwest National Laboratory, leader of aircraft materials and physical metallurgy at Reynolds Aluminum Research, and is presently a Senior Fellow for Mercury Marine in Fond Du Lac, Wisconsin.

He holds over 25 U.S. patents in the areas of aluminum alloy development, aluminum heat treatments, cast stainless steel alloy development, neutron shielding, engine fuel system and hybrid material drive components, and biological antifouling technology, among others. He has taught aluminum metallurgy on an international level since 1999 and is presently the chairman of the Advanced Casting Research Consortium at WPI and the vice chairman of the Materials Innovation Committee of TMS. On a local level, Anderson is the founding president of the Fond Du Lac STEM Academy and STEM Institute which are public charter schools to engage students in grades 3 through 8 in the fields of science, technology, engineering and mathematics.

In Memorium: Clif Bergeron

Clifton Bergeron (BS Cer '50, MS Cer '59, PhD Cer '61) died April 14, 2016. He was born Jan. 5, 1925, in Los Angeles. He married Laura Kaario on June 9, 1950, in Milwaukee. She died on Jan. 19, 2010. Surviving are a daughter, Ann Bergeron (Kevin Fahey) of Urbana; a son, Louis Bergeron of San Francisco; and a niece and nephew.

Clif served from 1943 to 1946 as a corporal in the U.S. Army 14th Armored Division in England, France, and Germany during World War II. He was awarded the European-African Campaign Medal with two Bronze Battle Stars. He graduated from the University of Illinois in 1950 with his bachelor's degree and was subsequently employed in the research and development laboratories of the A.O. Smith Corp. in Milwaukee. In 1955, he joined the Whirlpool Corp. of St. Joseph, Michigan, as a staff engineer.

Returning to Illinois in 1957, he was employed as a research associate in the Department of Ceramic Engineering. He received an M.S. in 1959 and a Ph.D. in ceramic engineering in 1961. He was appointed an assistant professor in 1961, full professor in 1967 and was appointed head of the department in 1978. He retired from the university in 1988 but remained active as a consultant to industry. With his graduate students, he conducted research in the areas of high temperature materials, properties of glass and crystallization kinetics in glasses, authored more than 100 research papers and co-authored a textbook on high temperature chemical reactions.

In recognition of his many contributions to research, teaching and to his profession, he was named a fellow of the American Ceramic Society in 1967. Among the awards he received was the UI College of Engineering Everitt Award for Teaching Excellence in 1975, the American Ceramic Society Outstanding Educator Award in 1988, and the ACS Greaves-Walker Award for Professional Achievement in 2005. He was especially pleased when a group of former students established an endowed scholarship in his name in 2004. He enjoyed fishing, woodworking and nature photography. He was a member of the Nature Conservancy, Izaak Walton League, Wilderness Society, Sierra Club and Prairie Rivers Network. He served as a volunteer reader for the sight-impaired at the Illinois Radio Reader for a number of years. He was also an avid home winemaker for many years, advancing the art of making wine from Concord grapes, an unusual choice at the time.

Professor Bergeron with his 2015-2016 Bergeron Scholarship recipients Colton Adamick and Allyson Brusich.

For several years, Clif and his family enjoyed camping and fishing vacations with his parents throughout northern Illinois and southern Wisconsin. In 1968, Clif and Laura bought land on a small lake near the Salt Fork River and with their children and the help of family friends built a cabin. For the rest of their lives, they spent time at the cabin whenever they could, enjoying many happy weekends relaxing, fishing, and forming enduring friendships with neighboring cabin owners. In later years, they enjoyed visiting Meadowbrook Park.

Clif moved to Clark-Lindsey Village in 2006, where he was an active participant in daily life, serving on numerous committees, as well as contributing articles and nature photographs to The Village Voice magazine published by CLV residents.

Memorials may be made to the Clifton Bergeron Scholarship Fund using the form on page 11 or donate online at: **www.matse.illinois.edu/give**.

Thanks for your service to MatSE!

Faculty, staff, and family gathered to celebrate the retirements of Angus Rockett, Debbie Kluge, and Bob Averback. Professor Averback retired in August 2015, while Professor Rockett and Debbie Kluge, research and policy analyst for MatSE, retired in December.

William Payne honored by Engineering at Illinois

William Payne with Dean Andreas Cangellaris

The University of Illinois College of Engineering honored MatSE alumnus William Payne (BS Cer '63, MS Cer '64) as one of its Distinguished Alumni at an awards ceremony on April 16. William Payne is an engineer, entrepreneur, angel investor and educator. He has developed seminars for angels and entrepreneurs and taught over 100 workshops and seminars on angel investing in six countries. He has contributed to the ceramics industry through his service to the American Ceramic Society, National Institute of Ceramic Engineers (NICE), and the Ceramic Foundation. He has served on a number of university advisory boards and has served as entrepreneur in residence at universities, bringing his knowledge of investing and start-up companies to college students. In 1971, he co-founded Solid State Dielectrics, Inc. to manufacture dielectric powders for the multilayer ceramic capacitor business. He sold the company to DuPont in 1982; the business is now integrated into Ferro Corporation with revenues estimated at $20 million annually. Payne's honors include the John F. McMahon Award from Alfred University (1990), Hans Severiens Memorial Award for Outstanding Contributions to Angel Investing (2009), and the New Zealand Arch Angel Award, for his impact on angel investing in New Zealand (2010). He is a Fellow and Distinguished Life Member of the American Ceramic Society.

MATSE ADVANCEMENT

Ross Williams recently joined the MatSE Department as the Assistant Director of Advancement. In his role, he works with alumni and friends of MatSE to raise funds towards special projects to benefit the department. Williams is originally from Colorado but has lived in central Illinois for the past six years. He received his bachelor's degree in secondary education and history from Bradley University and is currently pursuing a master's degree in philanthropic leadership from the University of Denver. In the summer of 2014, Williams was the recipient of the Reuss Fellowship, providing the opportunity to work within the University of Illinois Foundation on various projects across campus.

Previously, he was an associate director of Annual Giving at Millikin University, where he helped engage young alumni and students. He works closely with Erin Kirby, Director of Advancement, to represent the departments of MatSE, Physics, and NPRE to their alumni base across the nation. "It is an honor to be a part of such an esteemed department, college, and university," Williams said. "Engineers at Illinois graduate and make an incredible impact around the world and I enjoy helping them reconnect and realize their passions within the department." Williams looks forward to connecting with alumni and friends to help MatSE fulfill its mission and keep its status as a global leader in materials science and engineering.

Contact Ross Williams at rwilli@illinois.edu or (217) 244-2296.

Class Notes

Kevin Schaal (BS Cer '72) retired at the end of 2014 after working 30 years at Johns Manville in Littleton, CO, as a senior process engineer involved in the manufacture of fiberglass.

Ming Wu (MS Met '83, PhD Met '86) visited the University of Illinois campus in February to participate in the Biomedical Networking Forum and gave a seminar to MatSE graduate students. He is Vice President, Engineering, at Edwards Lifesciences Corporation in Irvine, California, a leading company in heart valve and hemodynamic monitoring technologies.

My Nguyen (BS MatSE '96, MS MatSE '97) is Vice President, Quality, for Thin Film Electronics Inc. in San Jose, CA.

Ramamurthy Ramprasad (PhD MatSE '97) was named a 2015 APS Fellow, "for pioneering contributions to the computation-driven rational design of materials, especially polymeric and inorganic dielectric materials and catalysts." He is a professor of Materials Science and Engineering at the University of Connecticut.

Vanessa Li (BS MatSE '07) is a senior automotive quality engineer at Novelis North America in Novi, MI.

Antonio Mei (BS MatSE 2010, MS MatSE 2012) received the Thin Film Division Graduate Student Award from AVS last fall.

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Join us on Facebook, Twitter, and LinkedIn. The MatSE at Illinois LinkedIn group is a networking group for alumni and students of the Department of Materials Science and Engineering at the University of Illinois. Stay in touch with your classmates and find out the latest department happenings.

Decked out in her cap and gown, the Alma Mater awaits the throng of May graduates who will pose in front of her for their graduation pictures. MatSE welcomed 109 new alumni in May 2016—

87
B.S. graduates

13
M.S. graduates

9
Ph.D. graduates