

MATERIALS SCIENCE AND ENGINEERING

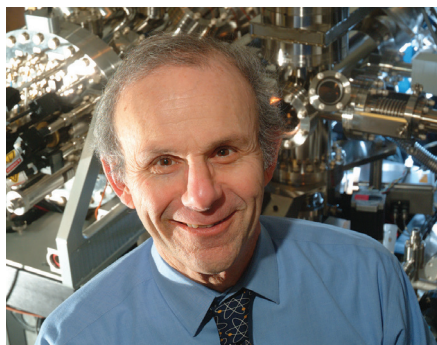
DAVID SEIDMAN ELECTED TO NATIONAL ACADEMY OF ENGINEERING

Seidman honored for his contributions to understanding materials on the atomic scale

Northwestern Engineering's **David N. Seidman**, whose work has led to an improved understanding of materials on the atomic scale, was one of 83 new members and 16 new foreign members elected to the National Academy of Engineering (NAE) in February.

Among the highest professional distinctions accorded to an engineer, Seidman was cited by NAE for "contributions to understanding of materials at the atomic scale, leading to advanced materials and processes."

Seidman is a Walter P. Murphy Professor of Materials Science and Engineering and the founding director of the Northwestern University Center for Atom-Probe Tomography (NUCAPT), the largest atom-probe tomography group in the United States. NUCAPT's equipment gives researchers the ability to see the internal structures of materials — on the subnanoscale — to help them better understand the materials' properties and



Seidman

how those properties have temporally evolved. This information can be used to improve various materials' properties, such as making them lighter and stronger.

"We are tremendously proud to see David recognized at the highest level in his field," said Julio M. Ottino, dean of the McCormick School of Engineering. "Since joining Northwestern more than 30 years ago, he has been an example of an outstanding researcher, collaborator, and colleague."

MSE 60th Anniversary Reunion

The Department celebrated 60 years of materials science at Northwestern with a two-day celebration in May for alumni, faculty, staff, and friends. [Read more about the event on page 6.](#)

Seidman's research aims to understand physical phenomena in a wide range of material systems on an atomic scale. His research group uses highly sophisticated microscopy and spectroscopy instrumentation to study interfaces on a subnanoscale level. He uses these tools to develop high-temperature cobalt-based alloys for use as turbine blades in aircrafts and for producing electricity.

Seidman has received several awards, including being selected twice as a John Simon Guggenheim Memorial Foundation Fellow and receiving an Alexander von Humboldt Stiftung Prize. He also has received an IBM Faculty Research Award, the Materials Research Society's David Turnbull Lecture Award, ASM International's Albert Sauveur Achievement Award and its Gold Medal, and the Max Planck Research Award from the Alexander von Humboldt Foundation and Max Planck Society.

He is a fellow of the American Academy of Arts and Sciences, American Association for the Advancement of Science, Materials Research Society, TMS, American Physical Society, International Field-Emission Society, Microscopy Society of America, and ASM International.

FROM THE CHAIR

Dear Friends,

The past year seems to have passed in a whirlwind of activities, and it is a pleasure to highlight some of them in this newsletter. Without a doubt, one of the highlights was the reunion and celebration of the Department of Materials Science and Engineering's 60th anniversary in May. From the alumni panel discussion on Friday — which greatly inspired alumni, students, staff, and faculty alike — to the lab tours, faculty presentations, and lively closing reception on Saturday, it was a wonderful celebration of the department and the people that have made it what it is.

Furthermore, per September 1, **Jon Emery** has been promoted to assistant professor of instruction. Jon plays an important role in modernizing our curriculum and I am happy that we can count on his continued strong involvement in the department.

On a more somber note, our universally beloved and admired faculty emerita **Julia Weertman** passed away on July 31 at the blessed age of 92. I, along with many other faculty, had the opportunity to attend her memorial, and left with a deep admiration of how a person could simultaneously be so accomplished, have so many interests, and be such a beacon for the people around her. We will greatly miss her and wish Hans and her children strength. I would like to add that we will celebrate Julia's impact on the department with a symposium on the Evanston campus on November 16, featuring friends, collaborators, and students.

As the upcoming academic year begins, we are preparing to welcome our incoming class of 39 PhD students and 23 MS students. Graduate students and postdocs form the heart of our research activities, and every year it is exciting to welcome new members to our materials science and engineering "family." I am

also happy to note that we have received the green light to proceed planning a renovation of the undergraduate teaching lab, aided by a generous donation from one of our alumni. I will keep you informed of progress on this front.

In closing, allow me to thank you again for your interest in our department. I am always happy to hear your stories and will be glad to catch up in person if you happen to be in Evanston!



Erik Luijten
Department Chair

Julia Weertman Symposium and Remembrance

Friday, November 16, 2018
8 a.m. to 5 p.m.
Guild Lounge, Evanston Campus
Reception to follow

For details, please contact Kristina Yi Lugo
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CBES Receives \$12 Million for Energy Research

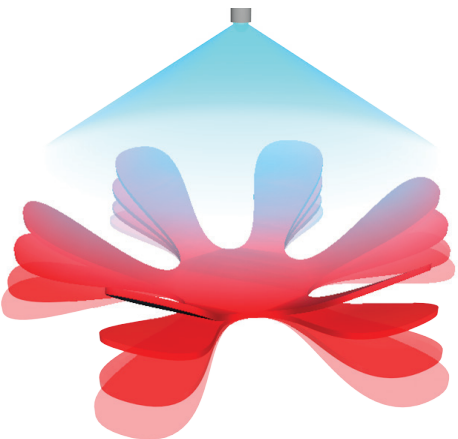
By Julianne Beck, ISEN

Northwestern's Center for Bio-Inspired Energy Science (CBES) has received \$12 million in renewal funding for a four-year term from the Department of Energy for the most recent funding round of the national Energy Frontier Research Centers (EFRC) program.

CBES is directed by **Samuel I. Stupp**, Board of Trustees Professor of Materials Science and Engineering, Chemistry, Medicine, and Biomedical Engineering at Northwestern and director of the Simpson Querrey Institute. CBES aims to discover and develop bio-inspired systems that reveal new connections between energy and matter. Funding from the EFRC will support CBES's central research objectives with a focus on six specific areas.

The new research questions address innovative approaches to photocatalysis that include hierarchical structures and mechanical enhancement of photocatalysis, synthesis of materials that behave as artificial muscles leading to the development of "robotic soft matter," and new ways to store energy that are inspired by biomolecular structures.

"Developing synthetic soft matter that can behave in an autonomous way, the way you expect living things to behave, is an enormous scientific challenge," Stupp said. "It is not the kind of research that somebody would do in isolation in a lab. It requires integrating many fields of expertise and that is the perfect configuration for an EFRC."



CBES will create materials that move like living matter in response to light or magnetic fields.
Credit: Mark Seni

PROFESSOR EMERITA JULIA WEERTMAN PASSES AWAY

Expert on nanocrystalline materials was the first woman to chair a materials science department in the United States

Julia R. Weertman, Walter P. Murphy Professor Emerita of Materials Science and Engineering at Northwestern University, passed away at age 92 on July 31. She will be remembered as a dedicated teacher, pioneering researcher, and valued colleague and friend.

Weertman made many noteworthy contributions to understanding the basic deformation processes and failure mechanisms in a wide class of materials, from nanocrystalline metals to high-temperature structural alloys. Her 1964 textbook, *Elementary Dislocation Theory* (Reprint, Oxford University Press, 1992), which she co-authored with her husband, Emeritus Professor Johannes Weertman, stands as the first book written specifically for undergraduate students on dislocation theory, an important factor in determining the behavior of crystalline materials.

She was the first woman admitted to the College of Science and Engineering at the Carnegie Institute of Technology, now Carnegie Mellon University, where she earned her bachelor's, master's, and DSc degrees in physics. She joined Northwestern's Department of Materials Science and Engineering in 1972 as an assistant professor, teaching courses at both the undergraduate and graduate levels.

"Julia was an illustrious faculty member in our department and has always been deeply committed to it," said Erik Luijten, professor and chair of the Department of Materials Science and Engineering at Northwestern's McCormick School of Engineering. "She is remembered by many of her former colleagues for her warmth, inspiration, and seminal contributions to the field."

In 1987, Weertman was appointed chair of Northwestern's Department of Materials Science and Engineering, becoming the first woman in the country to hold the position within an engineering department. During her five-year tenure, the number of materials science undergraduate students more than doubled, and she recruited two new female faculty members to join the department.

Weertman's career has been marked by many honors. In 2014, she received the prestigious John Fritz Medal from the American Association of Engineering Societies (AAES) in recognition of her role in the understanding of failure in materials and for inspiring generations of young women to pursue careers in the science and engineering fields.

That same year, the Department of Materials Science and Engineering established the Johannes and Julia Randall Weertman Graduate Fellowship in honor of the couple's impactful contributions to materials science and to Northwestern.

In 2017, The Minerals, Metals & Materials Society (TMS) renamed its TMS Educator Award to the TMS Julia and Johannes Weertman Educator Award. This award celebrates an individual who has made outstanding contributions to education in metallurgical engineering and/or materials science and engineering.

Her other honors include membership in the American Academy of Arts and Sciences as well as the National Academy of Engineering (NAE). She was also a recipient of the ASM International Gold Medal in 2005, two Special Creativity Awards for Research from the National Science Foundation, a Guggenheim Fellowship, and a Distinguished Engineering Educator Award from the Society of Women Engineers.



Julia and Johannes Weertman

"SHE IS REMEMBERED BY MANY OF HER FORMER COLLEAGUES FOR HER WARMTH, INSPIRATION, AND SEMINAL CONTRIBUTIONS TO THE FIELD."

ERIK LUIJTEN

"I can't imagine wanting any career other than engineering," Weertman wrote in 2012. "My advice to young women who are considering engineering as a major involves the usual clichés, but they are nonetheless valid: work hard and try to be the very best, keep your sense of humor active, and don't take yourself too seriously. Stick with top-notch people. And most of all, enjoy what you do."

Weertman is survived by her husband, Johannes; daughter Julia (Nicholas Zerebny); son Bruce (Leslie Miller); grandson Willem; and sister Louise Walsh. She was preceded in death by her grandson, Johannes Weertman.

Hilliard Symposium 2018

The 31st annual John F. Hilliard Symposium, organized by Professor **Jiaxing Huang**, was held on May 17 in the Krebs Classroom at Northwestern’s North Campus Parking Garage/ Academic Building. Alumnus Matthew Jones (PhD ’14, Mirkin), delivered the keynote address, “Nanoparticles as Meta-Atoms: Thinking by Analogy in Chemistry and Materials Science.” Jones joined Rice University in 2017 as assistant professor of chemistry and the Norman and Gene Hackerman Junior Chair.

Speakers

1ST PLACE

Nicholas A. Sather (Stupp) “Directed Assembly of Hybrid Nanotubes for Hierarchical Energy Storage Electrodes”

2ND PLACE

Spencer Wells (Hersam) “Reactive 2D Materials: Challenges and Opportunities”

3RD PLACE

Ha-Kyung Kwon (Olvera de la Cruz) “Electrostatic Control of Ionomer Phase Behavior”

Vuk Brajuskovic (Petford-Long) “Quasicrystal Artificial Spin Ice — A Direct Observation of High Energy States”

Pengcheng Chen (Mirkin) “Combinatorial Synthesis of Multicomponent Nanoparticles”

Seyoung Cook (Marks) “Revealing Defect-induced Behavior in Strontium Titanate Using In-situ Synchrotron X-ray Techniques”

Xuan Duo (Huang) “Self-dispersed Crumpled Graphene Balls for Lubrication Application”

Vinay Hedge (Wolverton) “Exploring the High-pressure Materials Landscape”

Mohan Liu (Wolverton) “High-throughput Hybrid-functional DFT Investigation of Materials Band Gaps and Formation Energies”

Fuyao Yan (Olson) “Materials for Additive Manufacturing — Design for Accelerated Qualification”

Che-Ning Yeh (Huang) “Stability of Graphene Oxide Membranes in Water: The Mystery, the Answer and the Implications”

Jinghan Zhu (Mirkin) “Responsive Nanoparticle Superlattices”



Matthew Jones (left) with Professor Chad Mirkin

CONTRIBUTIONS

MATERIALS SCIENCE AND ENGINEERING

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Evonik Corporation
MilliporeSigma
Questek Innovations LLC
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JOHANNES AND JULIA RANDALL WEERTMAN GRADUATE FELLOWSHIP FUND

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Jeffrey T. Gotro, PhD and Mrs. Elaine M. Grossman-Gotro
Mrs. Joanna H. Gwinn and Donald G. Gwinn, PhD
George William Nieman, PhD and Ms. Rita Nathanson
Prof. David N. Seidman
Prof. Peter W. Voorhees and Ms. Maria G. Voorhees

MORRIS E. FINE LECTURE

Rebecca Cortez, PhD
William O. Gentry, PE
Barbara M. Nichols, PhD
Joseph S. Santner, PhD and Mrs. Barbara K. Santner
Semyon Vaynman, PhD and Ms. Dora Vaynman
Anil V. Virkar, PhD

Donations made between July 21, 2017 and July 18, 2018. If you would like to contribute to MSE funds, please contact Patrick Hankey at partick.hankey@northwestern.edu.

ALUMNI HONORED

Charles Kuehmann and Nathan Guisinger received awards at the annual banquet

Two outstanding materials science alumni were honored at the 2018 Annual Alumni Celebration Banquet in May. **Charles Kuehmann** received the Distinguished Career Achievement Award, and **Nathan Guisinger** received the Early Career Achievement Award.

Charles Kuehmann

(PhD '94, Olson)

Kuehmann has been a leader in computational materials design since its inception. He currently leads the materials engineering organizations at both Tesla and SpaceX, driving material solutions to enable the world’s transition to a sustainable future, the commercialization of space, and a multi-planetary civilization.

Nathan Guisinger

(PhD '05, Hersam)

Guisinger has developed a leading effort towards materials discovery, synthesis, characterization, and processing, including the discovery of new low-dimensional materials. He is a staff scientist at the Center for Nanoscale Materials at Argonne National Laboratory.



Top: Professor Greg Olson (left) presents the award to Charles Kuehmann; bottom: Nathan Guisinger (left) with Professor Mark Hersam

Upcoming Special Lectures

Dow Lecture: Lane Martin

University of California, Berkeley
November 20, 2018

Morris E. Fine Lecture: Gerbrand Ceder

University of California, Berkeley
February 5, 2019

Jerome B. Cohen Lectures: Frederico Capasso

Harvard University
May 6-7, 2019

John E. Dorn Lecture: Karin Rabe

Rutgers University
Spring 2019

DEPARTMENT CELEBRATES 60TH ANNIVERSARY WITH ALUMNI REUNION

The event was held May 18-19 on Northwestern's Evanston campus

Northwestern Engineering's Department of Materials Science and Engineering celebrated its 60th anniversary with an alumni reunion on May 18-19, 2018. Guided by the theme, "Better Materials = Better Life," the event brought together alumni from around the world for two days of networking, lab and facility tours, research presentations, and a reception with McCormick School of Engineering Dean Julio M. Ottino and Chair Erik Luijten.



The reunion was highlighted by an alumni-led panel discussion that tackled the unique career trajectories of MSE alumni, the impact of their Northwestern materials science education, and their vision of the field of materials science in the future. Moderated by Professor **Mark Hersam**, panelists included:

Charlie Kuehmann (PhD '94), vice president of materials engineering at SpaceX and Tesla Motors

Cynthia Pierre (PhD '09), inspection, materials, corrosion, and engineering superintendent at BP

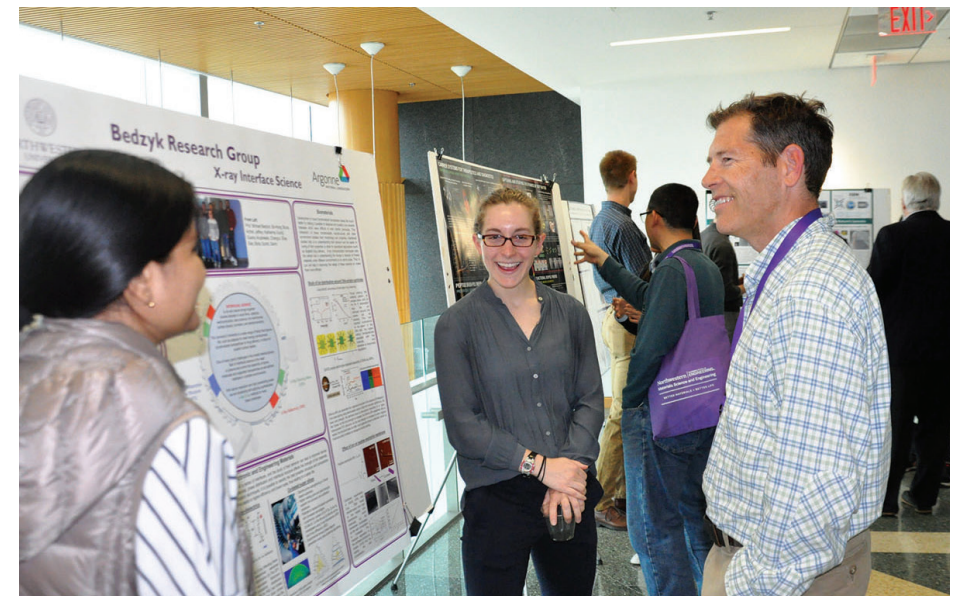
Boris Vuchic (PhD '95), principal and owner at Pennant Capital

Grace Wang (PhD '01), vice chancellor for research and economic development at State University of New York

Bryce Meredig (PhD '12), founder at Citrine Informatics

Michele St. Louis Weber (PhD '96), senior director of the Internet of Things Group at Intel

Brad Tinkham (PhD '02), manufacturing engineering manager at II-VI EpiWorks



DEPARTMENT CELEBRATES ITS RECENT PHD GRADUATES

The Department of Materials Science and Engineering celebrates its PhD candidates who graduated between September 2017 and June 2018. They are listed below with their current job placements.

Tassie Anderson (Marks)
Applied Materials

Itamar Balla (Hersam)
Intel

Amit Kishan Behera (Olson)
Questek Innovations

Sumit Bhattacharya (Seidman)
Argonne National Laboratory

Zhenyu Bo (Notestein)
Micron Technology

Jeffrey David Cain (Dravid)
Lawrence Berkeley National Laboratory

Gavin Paul Campbell (Bedzyk)
Intel

Kavita Chandra (Odom)
Boston Consulting Group

Seyoung Cook (Marks)
Intel

Lawrence Anthony Crosby (Marks)

Xuan Dou (Huang)

Antoine Alexandre Emery (Wolverton)
Solvay Chemicals

Daniel Joseph Fairfield (Stupp)

Changrui Gao (Bedzyk)
Apeel Sciences

Linda M. Guiney (Hersam)
Northwestern University

Eve Dorthea Townsend Hanson (Dravid)
Citrine Informatics

Divya Jain (Seidman)
Intel

Joohoon Kang (Hersam)
Lawrence Berkeley National Laboratory

Kyoungdoc Kim (Wolverton)
Northwestern University

Soo Kim (Wolverton)
MIT

Michael Phan Knudson (Odom)
Intel

Andrew Robert Koltonow (Huang)
Cardinal Intellectual Property

Ha-Kyung Kwon (Olvera de la Cruz)
Toyota Research Institute

Won-Kyu Lee (Odom)
Harvard University

Byunghong Lee (Chang)
Hyundai Motor Group

Qingyuan Lin (Mirkin)
Boston Consulting Group

Shuangping Liu (Olvera de la Cruz)

Zhi Lu (Wolverton)

Andrew Jacob Mannix (Hersam)
University of Chicago

Julian Juin E. McMorrow (Hersam, Marks)
CNA Corporation

Stephanie Lucille Moffitt (Bedzyk)
SLAC National Accelerator Laboratory

Liane Michelle Moreau (Bedzyk)
Lawrence Berkeley National Laboratory

Ben Myers (Dravid)
Northwestern University

Ashwin Narayanan (Stupp)
Northwestern University

Lindsay Hardt Oakley (Shull, Broadbelt)
Natural History Museum of Denmark

Xiaochen Ren (Lauhon)
Intel

Ethan Benjamin Secor (Hersam)
Sandia National Laboratories

Quentin Sherman (Voorhees)
Bain & Company

Shannon Lee Taylor (Dunand)
Desktop Metal

Hongqian Wang (Barnett)
SF Motors

Michael Lynn Whittaker (Joester)
Lawrence Berkeley National Laboratory

Fuyao Yan (Olson)
Questek Innovations

Zhenpeng Yao (Wolverton)
Harvard University

Che-Ning Yeh (Huang)
Stanford University

Chyi-Huey Joshua Yeh (Shull)
Ecole Superieure de Physique et Chimie Industrielles

Yue Yang Yu (Kung)
New York University

Min Zhang (Brinson)
L'Oreal

Northwestern Receives Mellon Foundation Grant for Scientific Studies in the Arts

The grant includes a permanent endowment to support the position of a co-director for the Center for the Scientific Studies in the Arts

Northwestern University has received a \$3.5 million grant from The Andrew W. Mellon Foundation to support the Center for the Scientific Studies in the Arts, a collaborative partnership with the Art Institute of Chicago to investigate and conserve art. The grant includes two components: \$2.5 million in spendable funds to support the center over five years, and \$1 million as a permanent endowment to support the position of a center co-director at Northwestern. In order to receive the permanent endowment, the University must raise \$2 million in matching funds

over the next four years. All funds count toward We Will. The Campaign for Northwestern. “The fundraising effort is an exciting part of the grant,” said **Marc Walton**, the center’s co-director and research professor of materials science and engineering in Northwestern’s McCormick School of Engineering. “The University is putting support and infrastructure into this goal because it sees value in work taking place at the intersection of art and science.” With the Mellon Foundation’s continued support, the center will expand its core program to offer scientific tools and



One of the Center’s projects discovered that ancient artists used the pigment Egyptian blue for underdrawings.

expertise to institutions across the country as well as bolster its educational efforts with additional classes, workshops, and conferences. The grant will fund a new program called Idea Labs, which will support new collaborations among scientists and art conservators, historians, curators, and others who could benefit from exploring artistic objects through scientific analysis.

Researchers Predict Materials to Stabilize Record-high Capacity Lithium-ion Battery

Advancement could pave the way for less expensive, longer-lasting batteries for electric vehicles



Professor Christopher Wolverton

Professor **Christopher Wolverton** has found ways to stabilize a new battery with a record-high charge capacity. Based on a lithium-manganese-oxide cathode, the breakthrough could enable smartphones and battery-powered automobiles to last more than twice as long between charges. “This battery electrode has realized one of the highest-ever reported capacities for all transition-metal-oxide-based electrodes. It’s more than double the capacity of materials currently in your cell phone or laptop,” said Wolverton. A French research team first reported the large-capacity lithium-manganese-oxide compound in 2016 after developing a cheaper electrode with more than double the capacity. But they did not fully understand the chemical origin of the large capacity.

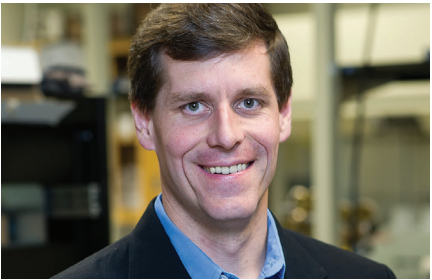
After composing a detailed, atom-by-atom picture of the cathode, Wolverton’s team discovered the reason behind the material’s high capacity: It forces oxygen to participate in the reaction process. By using oxygen — in addition to the transition metal — to store and release electrical energy, the battery has a higher capacity to store and use more lithium. Next, the Northwestern team used high-throughput computations to scan through the periodic table to find new ways to alloy the compound with other elements that could enhance the battery’s performance and prevent swift degradation. The computations pinpointed two elements: chromium and vanadium. The team predicts that mixing either element with lithium-manganese-oxide will produce stable compounds that maintain the cathode’s high capacity.

FACULTY NEWS



Professor Sossina Haile

Sossina Haile was elected fellow of the Materials Research Society for her leadership in engaging the international community of materials researchers.



Professor Mark Hersam

Mark Hersam was elected to the National Academy of Inventors. He also received the 2017 Nanotechnology Recognition Award from the American Vacuum Society (AVS).



Professor Yonggang Huang

Yonggang Huang was selected as a foreign member of the Chinese Academy of Sciences.

Tobin Marks received the Harvey Prize in Science and Technology.

Chad Mirkin was selected as a foreign member of the Chinese Academy of Sciences. He also received the 2018 Nano Research Award at the 5th Annual Nano Research Awards at the 2018 Sino-US Nano Forum in Chengdu, China.



Professor Monica Olvera de la Cruz

Monica Olvera de la Cruz received \$4.5 million from the Sherman Fairchild Foundation to accelerate the discovery of new functions and application of synthetic structures.

John Rogers's innovative "Lab on the Skin" invention was featured as part of an art exhibit at the Museum of Modern Art (MoMA).

Research Professor **Semyon Vaynman** (PhD '87) and Christopher Hahin, engineer with the Illinois Department of Transportation, will receive the 2018 Engineering Materials Achievement Award from ASM, International.

Chris Wolverton was named Jerome B. Cohen Professor of Engineering.

STUDENT NEWS

Eric Anderson, Kyle Bushick, Jose Martinez, and **Yakira Mirabito** received second place in the 2017 ASM Undergraduate Design Competition for their project, "TRIP Ti alloys for Additive Manufacturing," supervised by graduate student **Fan Meng** and Professor Greg Olson.

Kyle Bushick (Wolverton) received the Hilliard Award for Research and Design. **Yakira Mirabito** received the Hilliard Award for Leadership, Scholarship, and Service.

NSF Graduate Fellowships were awarded to **Matthew Cheng** (Dravid), **Thomas Cotey** (Stupp), **Liban Jibril** (Mirkin), **Jacob Kupferberg** (Stupp), **Kelly Parker** (Dravid), **Melissa Puga** (Mirkin), and **Kristen Wek** (Stupp).

Graduate student **Jennifer DiStefano** (Dravid) won the fall 2017 Materials Research Society's Science as Art competition for her image of two-dimensional crystals.

Peter Hosbein received the Outstanding MSE Junior Award.

Undergraduate students **Elizabeth Jensen** (Shull, Walton) and **William Jeang** (Rogers) were awarded Meister Summer Research Awards.

Ha-Kyung Kwon (Olvera de la Cruz) received the 2017 Johannes and Julia Randall Weertman Fellowship.

Junior **Daniel Ng** was awarded the 2018 MML Student Intern Accolade from the National Institute of Standards and Technology.

ALUMNI NEWS

Gregg Damminga (BS '83, MS '85) was promoted to vice president of foundry services for the newly created company SkyWater Technology Foundry.

Doreen Edwards (PhD '96, Mason) will receive the 2018 ACerS Outstanding Educator Award.



Emily Hoffman

Emily Hoffman (PhD '16, Marks) received the Outstanding Collegiate Member Award from the Society of Women Engineers.

Brian Ingram (PhD '04, Mason) and **George Crabtree** (advisory board) represented the Joint Center for Energy Storage Research (JCESR) team led by Argonne in receiving the Secretary of Energy's Achievement Award.

Deep Jariwala (PhD '15, Hersam) was named to *Forbes*' "30 Under 30: Science" for 2018.

John Quintana (PhD '91, Cohen) was recently named Argonne National Laboratory's deputy laboratory director for operations and chief operations officer.

Jake Song (BS '17) was recognized as the 2017 USA and Canada Regional Winner in Engineering from The Undergraduate Awards.

Todd Steyer (PhD '93, Faber) was named to the 2018 American Ceramics Society Class of Fellows.

Kelsey Stoerzinger (BS '10) was named assistant professor of chemical engineering at Oregon State University.

Chantal Sudbrack (PhD '05, Seidman) accepted a position as senior materials design engineer with QuesTek Innovations LLC.

Former post-doc researcher in Professor David Dunand's group, **Cong Wang**, received the 2018 Early Career Faculty Fellow Award from The Minerals, Metals & Materials Society.

New Fuel Cell has Exceptional Power Density and Stability

Discovery presents a significant step toward lower fuel cell costs and more sustainable energy

A team of researchers led by Professor **Sossina Haile** has created a new fuel cell that offers both exceptional power densities and long-term stability at optimal temperatures, a discovery that heightens the viability of incorporating fuel cells into a sustainable energy future.

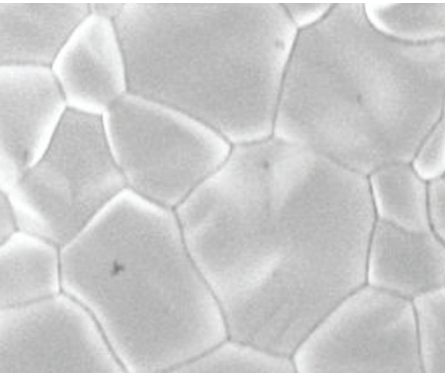
"For years, industry has told us that the holy grail is getting fuel cells to work at 500 degrees Celsius and with high power density, which means a longer life and less expensive components," Haile said.

"WITH THIS RESEARCH, WE CAN NOW ENVISION A PATH TO MAKING COST-EFFECTIVE FUEL CELLS AND TRANSFORMING THE ENERGY LANDSCAPE."

SOSSINA HAILE

"With this research, we can now envision a path to making cost-effective fuel cells and transforming the energy landscape."

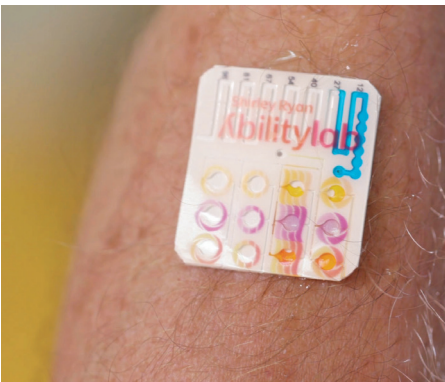
The new fuel cell combines a high-activity cathode with a new electrolyte that allows ions to move quickly. Unlike previous fuel cells, the new cell remained stable even when operated for hundreds of hours.



An SEM image of the electrolyte material

Stretchable Electronics a 'Game Changer' for Stroke Recovery Treatment

New wearable device developed in partnership with Shirley Ryan AbilityLab



The new sensor measures stroke patients' patterns of speech.

A groundbreaking new sensor designed to be worn on the throat could be a game changer in the field of stroke rehabilitation. Developed in the lab of Professor **John A. Rogers**, in partnership with Shirley Ryan AbilityLab, the sensor is the latest in Rogers's growing portfolio of stretchable electronics.

"Stretchable electronics allow us to see what is going on inside patients' bodies at a level traditional wearables simply cannot achieve," Rogers said. "The key is to make them as integrated as possible with the human body."

The new bandage-like throat sensor measures patients' swallowing ability and patterns of speech. The sensors aid in

the diagnosis and treatment of aphasia, a communication disorder associated with stroke. Shirley Ryan AbilityLab, a research hospital in Chicago, uses the throat sensor in conjunction with electronic biosensors — also developed in Rogers's lab — on the legs, arms, and chest to monitor stroke patients' recovery progress. The intermodal system of sensors streams data wirelessly to clinicians' phones and computers, providing a quantitative, full-body picture of patients' advanced physical and physiological responses in real time.

Graphene Finds New Application: Hair Dye

Dyeing your hair too often can damage those silky strands irreparably. Professor **Jiaxing Huang** and his team have leveraged the super material graphene to develop a new non-damaging hair dye that lasts through many washes without fading. Huang and his team bypassed harmful chemicals altogether by leveraging the natural geometry of graphene sheets.

While currently available hair dyes use a cocktail of small molecules that work by chemically altering the hair, graphene sheets are soft and flexible, so they wrap around each strand of hair for an even coat. Huang's ink formula also incorporates edible, non-toxic polymer binders to ensure that the graphene sticks — and lasts through at least 30 washes. Graphene is anti-static, so it keeps winter-weather flyaways to a minimum, and its conductive nature opens up new opportunities for hair, such as turning it into in situ electrodes or integrating it with wearable electronic devices.

