



## DEPARTMENT NUMBERS

- **30 Faculty**
- **184 Graduate students**
- **364 Undergraduate students**
- **81 Research associates/  
postdoctoral scholars**
- **\$14,964,727 Annual research  
expenditures**



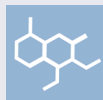
## DEPARTMENT LIFE

- A Note from the Department Head
- In Memoriam: Erwin Vogler
- Carlo Pantano Retirement



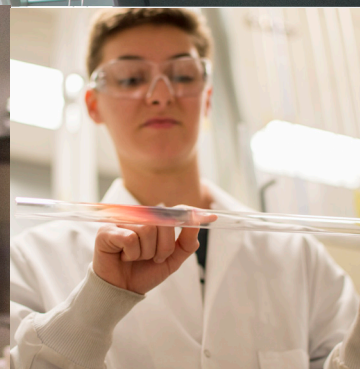
## FACULTY, STUDENT, & ALUMNI NEWS

- Alumni Support
- Award Winners
- New External Advisory Board Member
- New Faculty
- TOTEMS 2017



## RESEARCH UPDATES

- Graduate mentoring helps materials science students reach research dreams
- Scalable, high-temperature dielectrics combine polymers and nanosheets
- Low-cost, scalable water-splitting fuels the future hydrogen economy



Undergraduate student Katy Gerace working in a laboratory in the Materials Research Institute.

## GRADUATE MENTORING HELPS MATERIALS SCIENCE STUDENTS REACH RESEARCH DREAMS

The future looks bright for Katy Gerace, who will graduate in May with an undergraduate degree in materials science and engineering in just three years.

Already she's entertaining job offers at several elite companies.

But the path to this point, she admits, didn't seem so certain. As she navigated through her academic and research path, she relied on graduate mentors to take her from a bright, promising high school graduate who never set foot in a lab to an experienced researcher, working on 2D materials with Professor Joan Redwing.

In the lab, she met Zakaria Al-Balushi, now a postdoc at Caltech. Gerace said Al-Balushi took an immediate interest in advancing her laboratory skills and her knowledge of materials science.

"We hit it off immediately," Gerace said. "We were great friends. He was really fun to work with, but he was also a great mentor. He was definitely my go-to person to guide me through research. He was very instrumental to my success."

Al-Balushi taught Gerace lab protocols and procedures as well as the process for synthesizing materials. She's completing her senior thesis on a novel, rather unexplored semiconductor called indium selenide, a 2D layered material.

"We didn't just work together," Gerace said. "We definitely established a really good relationship. It's amazing to work with someone like that. Thankfully, I had someone like him in the lab. I know people who have pursued research without that mentoring relationship and it's a completely different dynamic."

Through the graduate program and the accelerated graduate program, the department is continuing the pipeline of graduate students capable of mentoring undergraduates while advancing their studies.

Read more on undergraduates who have benefited from the experience.

[matse.psu.edu/mentoring](http://matse.psu.edu/mentoring)

This publication is available in alternative media on request.

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## A NOTE FROM THE DEPARTMENT HEAD

As the new semester starts here in beautiful State College, change is definitely in the air. The college welcomed

Lee Kump as our new dean after a national search. Lee was previously the department head of geosciences at Penn State. In MatSE we marked the retirement of Distinguished Professor Carlo Pantano and welcomed John Mauro to the faculty. John was at Corning for his entire professional career before joining Penn State and we are thrilled that the tradition of giving students a strong educational experience in glass science and technology will continue under John's expert leadership. Todd Palmer also takes on a new role with the department, as he transitions from being a full-time staff member with the Applied Research Laboratory and a MatSE adjunct associate professor to being a tenured professor with a split appointment between MatSE and the Department of Engineering Science and Mechanics. Todd is an expert in metallurgy and additive manufacturing who has plans for center-level activity in metallurgy across multiple departments. Hayley Colyer also joins MatSE as the new graduate program coordinator and is already proving to be a valuable addition to our amazing staff.

The new semester also marks the launch of the our accelerated master's degree program as well as the online launch of the master of engineering degree program in Additive Manufacturing. Our new first-year students are one of the largest, most diverse, and academically strongest group that we have seen in several years. It was truly inspirational for me to welcome them, along with some of our alumni, at TOTEMS this year.

I am happy to report on the establishment of the Carlo Pantano Endowed Graduate Fellowship as a result of a generous gift from Mark and Theresa Kotanchek and the Guy Rindone Graduate Research Fund following a generous gift from Katherine Faber and Thomas Rosenbaum. These fellowships enable MatSE to compete for the best graduate students in the country. I am also pleased to note that Penn State recently launched an attractive 2-to-1 and 1-to-1 matching program for new gifts that is in effect through June 30, 2018. Please find more information at [giveto.psu.edu](http://giveto.psu.edu) under Publications and Matching Program Materials.

As always, I look forward to hearing from alumni and friends of MatSE at [sbs5563@matse.psu.edu](mailto:sbs5563@matse.psu.edu) and 814-863-3117. Do not hesitate to drop me a line to share your story or to let me know when you will be in State College; I will be happy to arrange for you to tour the impressive Millennium Science Complex or the newly renovated Steidle Building.

*Susan B. Sinnott*

Susan B. Sinnott  
Department Head and Professor of Materials Science and Engineering

## IN MEMORIAM



**Erwin A. Vogler**, professor of materials science and engineering and bioengineering, died on Monday, April 3, 2017, at the Tyrone hospital. He was 64.

At Penn State he developed collaborative research programs focused on the biophysical chemistry of protein adsorption, blood coagulation, and orthopedic biomaterials.

"He was my undergraduate research adviser, and the person who convinced me to get my Ph.D.," said alumnae Allison Cheng. "I could not have had the confidence and enthusiasm for research without his trust and support. While I wish he were still here, I know his soul is in a happy place, deriving formulas while humming 70s music with gusto!"

[matse.psu.edu/vogler-remember](http://matse.psu.edu/vogler-remember)

## ALUMNI SUPPORT



### GRADUATE RESEARCH FUNDS

**Theresa Kotanchek** '84, '87g, '91g and her husband, **Mark Kotanchek** '81, '85g, '95g, established the Carlo Pantano Graduate Fellowship in Materials Science and Engineering. The Kotancheks both studied under Pantano, earning undergraduate and graduate degrees in materials science in engineering. Their "love and admiration" for Pantano's mentorship prompted them to establish this fellowship in his name. The fellowship is designed to offer graduate student support for those exhibiting academic excellence in materials science.

**Katherine Faber** '78 and her husband, **Thomas Rosenbaum**, established the Guy Rindone Graduate Research Fund to further graduate education in the department. The fund was established in honor of Guy E. Rindone, professor emeritus of ceramic science and engineering, who died in 2015 at age 93. The new fund is designed to assist graduate students in conducting research related to their theses.

[matse.psu.edu/grad-giving](http://matse.psu.edu/grad-giving)

## LEADERS CHANGING THE WORLD

### FACULTY AWARDS

#### MESSING NAMED HONORARY FELLOW OF EUROPEA CERAMIC SOCIETY



Distinguished Professor Gary Messing is one of eight named an inaugural Honorary Fellow of the European Ceramic Society. He received the award at the society's annual Conference & Exhibition held in Budapest, Hungary. Fellows are selected for their outstanding contributions to both ceramics and to sharing knowledge within the society.

[matse.psu.edu/messing-ecs](http://matse.psu.edu/messing-ecs)

#### CHEN RECEIVES HUMBOLDT AWARD



Donald W. Hamer Professor Long-Qing Chen has been awarded a Humboldt Research Award by the Alexander von Humboldt Foundation of Germany. The award recognizes Chen's entire achievements to date. The Humboldt Research Award also fosters international scientific collaboration and award winners are invited to spend up to one year cooperating on a research project in Germany.

[matse.psu.edu/humboldt](http://matse.psu.edu/humboldt)

#### BEESE RECOGNIZED FOR ADDITIVE MANUFACTURING, MENTORING



Assistant professor Allison Beese earned the International Outstanding Young Researcher in Freeform and Additive Manufacturing Award for her research on characterizing and understanding the properties of objects formed using 3D printing. The award, sponsored by the Solid Freeform Fabrication Symposium, is given to researchers under age 35 who show potential for a successful career in the field while being a positive role model for others.

[matse.psu.edu/beese-mentoring](http://matse.psu.edu/beese-mentoring)

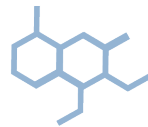
### UNDERGRADUATE AWARDS

Schreyer Scholar **Hannah Pohlmann** received an Astronaut Scholarship, one of the most prestigious scholarships awarded to undergraduate STEM students, for her leadership, imagination, and research excellence. She was also elected to the 2017 Senior Homecoming court.

[matse.psu.edu/pohlmann](http://matse.psu.edu/pohlmann)

**Hala Al-Sadeg** received second place at a speaking competition at MS&T.

# INVENTING TOMORROW: FOCUS ON MATERIALS RESEARCH

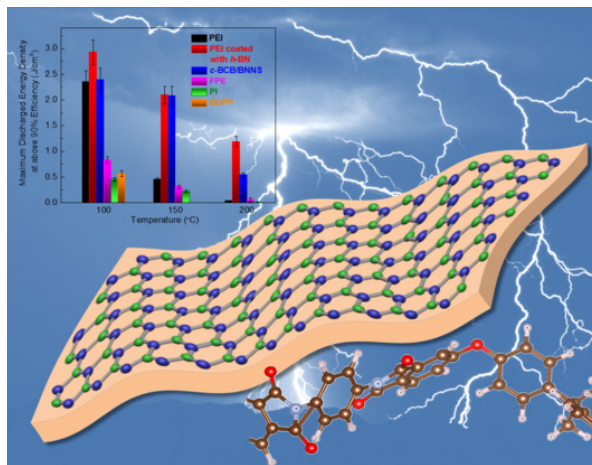


## SCALABLE, HIGH-TEMPERATURE DIELECTRICS COMBINE POLYMERS AND NANOSHEETS

A new, lightweight composite material for energy storage in flexible electronics has been experimentally shown to store energy at operating temperatures well above current commercial polymers.

This research by Professor Qing Wang, Assistant Professor Nasim Alem, Hamer Professor Long-Qing Chen, and their team is the first robust experiment in which a soft polymeric material and a hard 2D crystalline material have come together to create a functional dielectric device.

This polymer-based, ultrathin material can be produced using techniques already used in industry. The team developed a technique using chemical vapor deposition to make multilayer, hexagonal boron-nitride nanocrystal films and transfer the films to both sides of a polyetherimide (PEI) film. The films are then bonded together using pressure into



PEI coated with hexagonal boron nitride (hBN) nanosheets significantly outperforms competitive polymers at operating temperatures needed for electric vehicles and aerospace power applications. Image: Feihua Liu.

a three-layer sandwich structure. This is done without any chemical bonding and is strong enough to potentially be manufactured in a high-throughput, roll-to-roll process.

[matse.psu.edu/nanosheets](http://matse.psu.edu/nanosheets)  
<https://doi.org/10.1002/adma.201701864>

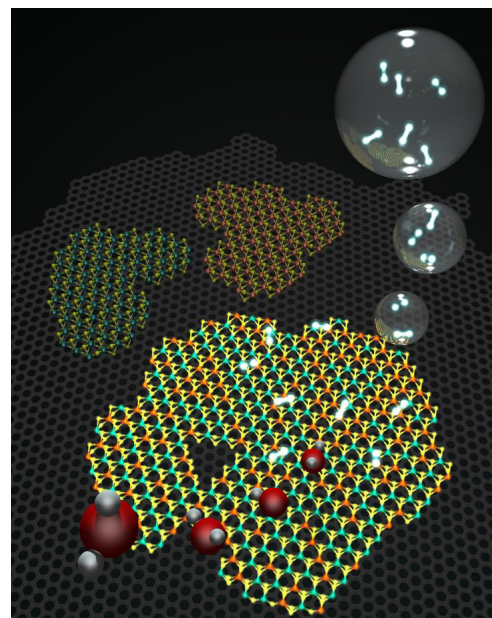
## LOW COST, SCALABLE WATER-SPLITTING FUELS THE FUTURE HYDROGEN ECONOMY

Doctoral student Yu Lei and Professor Mauricio Terrones, along with a team of international scientists have come one step closer to inexpensive, clean hydrogen fuel with a lower-cost, industrially scalable catalyst that produces pure hydrogen through a low-energy water-splitting process.

Using the semiconductor molybdenum disulfide as a catalyst, the team added reduced graphene oxide, a highly conducting form of carbon. Then, to further decrease the free energy, they alloyed the molybdenum disulfide with tungsten to create a thin film with alternating graphene and tungsten-molybdenum disulfide layers. The addition of tungsten lowers the electrical voltage required to split water by half, from 200 millivolts with pure molybdenum disulfide, to 96 millivolts with the tungsten-molybdenum alloy.

The water-splitting process uses a very small amount of electrical energy applied to an electrode immersed in water. Using this small potential, the protons in the solution can be absorbed onto the surface of the catalyst. Then two protons will migrate together to form a hydrogen bubble that rises to the surface and releases the hydrogen.

[matse.psu.edu/water-splitting](http://matse.psu.edu/water-splitting)  
<http://pubs.acs.org/doi/abs/10.1021/acsnano.7b02060>



Molecular models representing a 2D heterostructure made of graphene (gray background hexagonal lattice), and islands on top of hexagonal  $WS_2$  and  $MoS_2$ , as well as an alloy of the two. Water ( $H_2O$ ) molecules in red (oxygen) and gray (hydrogen) come from the bottom left hand side and get transformed catalytically after interacting with the heterostructures into  $H_2$  bubbles (top right hand side).

## GRADUATE AWARDS

**Christopher Cheng** and **Lourdes Bobbio** received the National Defense Science & Engineering Graduate Fellowship.

**Kayla Cooley** received an National Science Foundation (NSF) Graduate Research Fellowship.

**Brooke Kuei** received a fellowship from the National Physical Science Consortium.

**Natalie Briggs** received a Semiconductor Research Corporation Fellowship.

## NEW FACULTY

Professor **John Mauro** joined the department in August 2017. Mauro is an expert in fundamental and applied glass science, statistical mechanics, computational and condensed matter physics, thermodynamics, and the topology of disordered networks.



Mauro earned a B.S. in glass engineering science (2001), B.A. in computer science (2001), and Ph.D. in glass science (2006), all from Alfred University. He joined Corning Incorporated in 1999, where he was the inventor or co-inventor of several new glass compositions including Corning Gorilla Glass products.

[matse.psu.edu/welcome-mauro](http://matse.psu.edu/welcome-mauro)



## CELEBRATING THE RETIREMENT OF DISTINGUISHED PROFESSOR CARLO PANTANO

On retirement, Pantano said he hopes, as the "glass guru," he'll still be called on to help other researchers at Penn State and beyond, as well as to continue his pet research projects. But he also knows it's time to let others take the reins.

He plans to spend more time doing the things he loves, like glassblowing with the students, cooking, and spending more time with family and friends.

On Thursday, August 10, the department held an event to honor his legacy.

[matse.psu.edu/retirement](http://matse.psu.edu/retirement)

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## Newsletter of Penn State's Department of Materials Science and Engineering



### LUCILLE A. GIANNUZZI JOINS THE EXTERNAL ADVISORY BOARD

**LUCILLE A. GIANNUZZI,**  
PRESIDENT, EXPRESSLO LLC



Lucille Giannuzzi holds a B.E. in engineering science and M.S. in materials science and engineering from Stony Brook University. She received her Ph.D. from Penn State in metals science and engineering and was a postdoc at Penn State's Center for Advanced Materials. She was a professor at the University of Central Florida for ten years where she was a recipient of an NSF CAREER award. She then joined FEI Company as a product marketing engineer and worked there for seven years before founding her own consulting and product companies. She maintains professional affiliations in AVS, ACerS, ASM Intl., TMS, MRS, MSA, and MAS and is a Fellow of AVS and MSA. She has authored or co-authored more than 125 publications; holds several FIB-related patents, contributed to several invited book chapters, and is co-editor of the book Introduction to Focused Ion Beams.



Department of Materials  
Science and Engineering

**TOTEMS 2017**

MatSE welcomed forty-five new first-year students this fall — our most impressive incoming class to date —boasting the largest percentage of female students (33 percent) the department has ever seen. In August, members of this group were joined by alumni, faculty, and staff at TOTEMS (Total Orientation to Earth and Mineral Sciences), a new student orientation program held at Lake Raystown Resort (above).



Our alumni lead extraordinary careers, and celebrating their success is our priority. Please write to us anytime; we want to stay in touch. Contact: [multimedia@matse.psu.edu](mailto:multimedia@matse.psu.edu).