

CHEMICAL AND BIOCHEMICAL ENGINEERING

Missouri S&T | Fall 2019

CHEMICAL SUCCESS

S&T hosts
AIChE Regional
Conference

page 2



Multiphase Flow and Reactors Engineering and Applications Laboratory (mFReal)

The mFReal, developed by **Muthanna Al-Dahhan** and his students and coworkers, serves industry with its unique efficient process enabling and development capabilities. Research conducted in the lab has advanced a wide range of industrial processes, including water and wastewater treatment and reuse.

The mFReal provides unique benchmarking data to validate computational fluid dynamics (CFD) simulations, evaluation of internals, scale-up methods and design and operating conditions, validating, developing and quantifying parameters for mechanistic and CFD hybrid reactor scale models.

mFReal uses gamma ray-based imaging and visualization of multiphase flow and reactors in a non-invasive way. It is equipped with dual source/energy gamma ray-computed tomography, multiple radioactive particles tracking, single radioactive particle tracking, and gamma ray densitometry — all for up to 1 meter in diameter.

These techniques are complemented with sophisticated measurement techniques including optical fiber probes, heat and mass transfer techniques, hot wire anemometry, gas and liquid dynamics, load cells, pressure transducers, basket and slurry for catalyst testing, and kinetics. There are a wide range of experimental rigs, from bench to industrial pilot plant scales and from ambient- to high-temperature and pressure conditions.



DEAR ALUMNI, FRIENDS AND COLLEAGUES

During the past academic year, we have accomplished many distinguished achievements.

We implemented a new undergraduate curriculum to prepare our students well for both industry and graduate school. For the first time, we're offering unique undergraduate experiments that integrate industrial plant process control software and hardware of the DeltaV from Emerson into an experimental set-up with modern instrumentation and process components.

Our Industrial Advisory Council (IAC) and Student Advisory Council (SAC) have organized outstanding professional mentoring sessions that our alumni offer to our students.

I am pleased to introduce two new colleagues. Dr. **Monday Okoronkwo** joined our department as an assistant professor in fall 2018 as one of the Best In Class (BIC) hires in the area of sustainable construction materials. And Dr. **Angela Lueking**, professor and associate dean for research, joined our department in spring 2019. In addition, Dr. **Daniel Forciniti** took the role of associate provost for faculty affairs, and Dr. **Jee-Ching Wang** became our new associate chair.

Our faculty members and students continue their notable and expanded scholarships, funding, and national and international collaborations. Dr. **Liang** won the Faculty Excellent Award, Dr. **Rezaei** won the Faculty Research Award and Dr. **Luks**, who was promoted to teaching professor, won an Outstanding Teaching Award and the University Service Award.

Four graduate teaching assistants in our Undergraduate Unit Operations Laboratory — **Vineet Alexander**, **Matthew Senter**, **Humayun Sharif** and **Jared Rhodes** — won Graduate Educator Awards from the College of Engineering and Computing. Graduate student **Xiaofeng Wang** won the CEC Graduate Research Award. Six Ph.D. students won the Distinguished Dissertation Award for publishing three or more peer-reviewed papers before graduation. They are **Anirudh Krishnamurthy**, **Teresa**



Gelles, Md. Shahinuzzaman, Yingxin He, Laith Sabri and Saman Monjezi.

Our undergraduate students have remarkable extracurricular activities. The AIChE chapter organized the Regional AIChE Student Conference, April 12–13, 2019. Our Chem-E-Car teams took second and third places in regional competition and our team that won the most creative design award will advance to the national competition.

Alumni recognition includes **Bipin Doshi**, who spoke at May 2019 commencement and received an honorary doctorate. Also in May, **Charles Lyon** earned the Award of Professional Distinction. **Ernest Banks** and **Dave Sextro** received the Award of Professional Distinction during December 2018 commencement.

Moving forward, we continue to maintain our strong undergraduate program while we work on enhancing our graduate studies and scholarships.

My role as department chair ended on June 30, 2019, and my colleague Dr. **Joseph Smith** took the responsibility as interim chair during the search for our next chair.

I appreciate and wholeheartedly thank our academy, the IAC, alumni, friends, colleagues, staff and students for all the provided help and support during my 10 1/2-year tenure as chair.

Warm Regards,

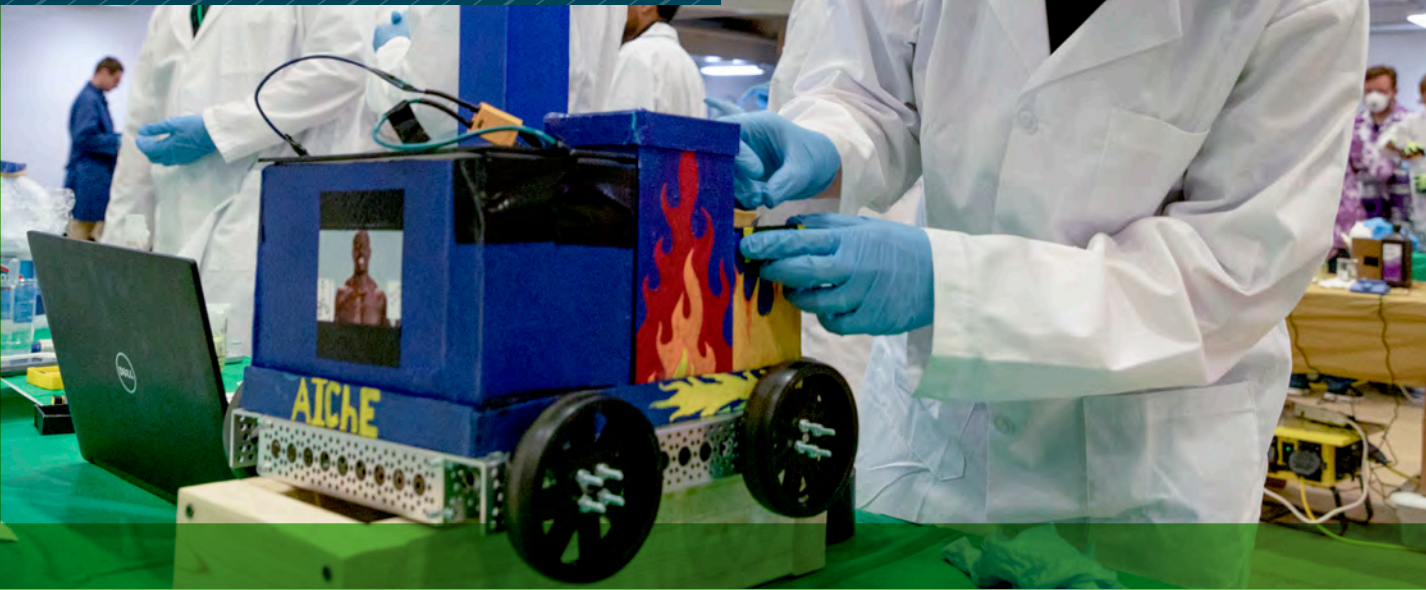
Muthanna Al-Dahhan, D.Sc.
Chair of Chemical and Biochemical
Engineering and Curators' Distinguished
Professor of Chemical and Biochemical
Engineering and of Nuclear Engineering



IN THIS ISSUE

- 2 Chemical success**
This past spring, S&T hosted the AIChE Regional Conference and its Chem-E-Car competition.
- 3 Smith takes interim seat during search for new chair**
Muthanna Al-Dahhan stepped down as chair on June 30. Joseph Smith, professor of chemical and biochemical engineering and the Wayne and Gayle Laufer Chair of Energy, will serve as interim chair.
- 4 Controlling VOCs**
Fateme Rezaei is developing an adsorbent compound that could remove aromatic volatile organic compounds from gaseous streams.
- 6 DeltaV**
To help prepare students for careers in industry, chemical and biochemical engineering built a full-scale process control lab equipped with an Emerson DeltaV DCS.
- 7 Student news**
Our students are doing great things. Here are a few of their accomplishments.
- 9 Faculty awards**
Read about just a few of the awards and accolades our faculty have garnered.

CHEMICAL SUCCESS



This past spring, Missouri S&T hosted the American Institute of Chemical Engineers' (AIChE) 2019 Regional Conference. Chemical and biochemical engineering faculty and students from Missouri and surrounding states toured local research hubs like Brewer Science and MoSci, participated in paper and poster presentations, and attended several workshops.

Phil Ling, ChE'92, general manager of acquisitions and divestments for one of Shell Oil's partnerships and a member of the Academy of Chemical Engineers at S&T, gave the keynote address.

Ling has spent 26 years in the engineering field. He joined Lyondell Petrochemicals as a process engineer after graduation. Then in 2001, he joined Shell Oil, working in process and production engineering, economics and scheduling, business development, and mergers and acquisitions. He now serves as general manager.

"The department was pleased to host the regional conference for its first time," says **Muthanna Al-Dahhan**, former chair and Curators' Distinguished Professor of chemical and biochemical engineering and of nuclear engineering at S&T. "It was great to share ideas with our colleagues from the area and see the amount of engagement from our students during the conference."

Designed to achieve

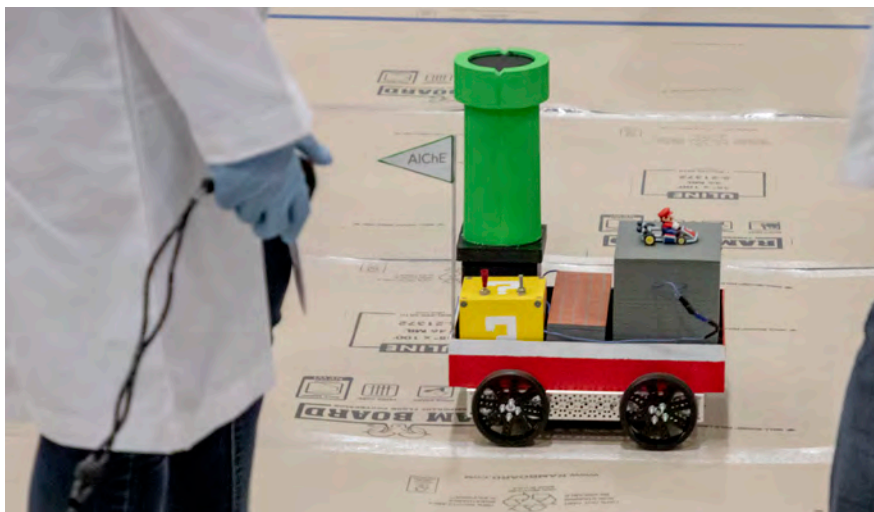
A big part of the regional AIChE conference is the Chem-E-Car competition. S&T's team entered two vehicles in the competition, which challenges teams to design and build a shoebox-sized car

that uses a chemical reaction to travel a target distance and then stop — all while carrying a certain amount of weight. Because the final destination distance is randomized, team members must adapt quickly and perform calculations on the fly.

Students have to calculate the average velocity of their vehicle and decide how much of the chemical solution it takes to activate the battery power. The car that stops closest to the finish line at the end of the race wins. And winning teams qualify to move on to the national competition.

S&T's first vehicle, *Terry Cruise*, used a dye-changing RedOx reaction of bleach and black food coloring to power a six-cell lead-acid battery. Its second team, *Glo-Kart*, used a luminol chemiluminescence reaction to power its same battery. S&T's cars finished second and third out of 14, and *Glo-Kart* won the Most Creative Car Design Award.

"By placing so high, both team's entries qualified to compete at the national conference, however the rules only allow us to send one entry," says **Trevor Vogan**, a senior in chemical engineering and president of the Chem-E-Car Design Team. "So, the *Glo-Kart* will represent Missouri S&T in Orlando this November."



SMITH TAKES INTERIM SEAT DURING SEARCH

Joseph Smith, professor of chemical and biochemical engineering and the Wayne and Gayle Laufer Chair of Energy at Missouri S&T, is serving as interim chair of chemical and biochemical engineering, effective July 1.

Smith took over for **Muthanna Al-Dahhan**, Curators' Distinguished Professor of chemical and biochemical engineering and nuclear engineering, who stepped down as department chair on June 30.

Al-Dahhan joined the faculty as chair and professor in January 2009 and was named Curators' Distinguished Professor in January 2017. Under his leadership, the department moved into Bertelsmeyer Hall, increased collaboration within and outside the university, increased enrollment and nearly tripled the number of bachelor's, master's and Ph.D. degrees granted. He expanded the department and increased its diversity by hiring 10 faculty members. The department established state-of-the-art teaching and research labs, changed the curriculum to benefit students for industry and graduate school and enhanced the scholarship of both student and faculty.

Smith studies next-generation hybrid energy systems to combine small modular nuclear reactors with conventional and renewable energy sources and the design and optimization of industrial-scale coal gasification systems. His other research interests include industrial gas flare design, process modeling and optimization, and process monitoring, control and operation.

Smith holds Ph.D., master of science and bachelor of science degrees in chemical engineering from Brigham Young University.

An external search for a new permanent chair will begin this fall.

Above left: S&T Chem-E-Car *Terry Cruise* finished second out of 14 cars.

Top: S&T's *Glo-Kart* finished third and won the Most Creative Car Design Award. *Glo-Kart* was chosen to represent S&T's Chem-E-Car Design Team in the national competition in November.

Middle and bottom: Student teams from 10 universities competed in the AIChE Regional Conference held in the Missouri S&T Gale Bullman Building this past spring.



WELCOME TO S&T, DR. OKORONKWO

Last August, we welcomed **Monday U. Okoronkwo**, to the faculty as an assistant professor of chemical and biochemical engineering. Before joining S&T, he was a postdoctoral researcher at the University of California Los Angeles.

Okoronkwo, who teaches CHEM ENG 2100, Materials and Energy Balances, has a variety of research interests. Of particular interest is understanding the relationship between composition, structure and property of materials. He also looks for ways to use a combination of computational and experimental approaches to create reliable new materials with improved performance.

His other research interests include nanocomposites and functional materials for environmental remediation, chemical admixture interactions in cement and rheology of cement-based materials and complex fluids, as well as waste immobilization and wastewater treatment and carbon dioxide conversion and usage.

He holds a bachelor of science degree in industrial chemistry from Abia State University in Nigeria and a Ph.D. in chemistry from the University of Aberdeen.

IN SEARCH OF THE HOLY GRAIL OF THE CHEMICAL PROCESS INDUSTRY

With funding from the National Science Foundation, associate professors **Xinhua Liang** and **Jee-Ching Wang** are developing catalysts that are highly selective, highly active and highly stable. This will dramatically increase reaction selectivity without significantly decreasing catalyst activity.

"This is the holy grail of various research in the chemical process industry carried out by chemical engineers and scientists," Liang says.

The researchers are using an innovative strategy to coat catalytically active metal nanoparticles with an ultra-thin porous shell that provides reaction selectivity based on the size and orientation of the reactants.

"Similar to traffic controls, only the reactant molecules with proper sizes and orientations would be allowed to reach the reaction sites through the porous shell whose pores have specific sizes," Wang says.

Liang and Wang use a molecular layer deposition (MLD) technique to create highly porous overlayers with precise thickness control and well-defined porous structures. Pore size is controlled by altering MLD chemistry, oxide types and methods of forming porous structures.

During synthesis, gaps will be introduced between the porous shells and the metal cores to avoid any loss in catalyst surface area.

"This is the first time that porous shells have been proposed to control the alignment of individual molecules above catalyst surfaces to control selectivity of the reaction of a single molecule like cinnamaldehyde," Liang says.

The objective is not only to synthesize these nanostructured size-selective catalysts, but integrating experimental and molecular modeling will allow them to gain a fundamental understanding of their relationships between structure, activity and selectivity.

That fundamental understanding will have a marked scientific impact on the field of heterogeneous catalysis and on the technological advancement of the production of cost-effective value-added chemicals by the chemical industry, Wang says.

"The proposed MLD coating based on fluidized bed reactor can be applied to large quantities of ultra-fine particles, so it is highly scalable and cost-effective process for treating tons of catalyst particles."

This research will help advance knowledge of the fundamental science of surface chemistry, heterogeneous catalysis and materials development. But because the proposed strategy is universal, it can be applied to nearly any kind of supported metal catalyst or in other energy-related fields, such as sensors, fuel cells, batteries and supercapacitors.

In spring 2020, the project results will be incorporated into the chemical engineering curriculum as well as a new course, Catalysis and Reaction Kinetics.

CONTROLLING VOCs

With funding from the National Science Foundation, assistant professor **Fateme Rezaei** (PI) and associate professor **Xinhua Liang** (co-PI) and their team are working to eliminate volatile organic compounds, or VOCs.

"VOCs are often toxic or even deadly to humans and are detrimental to the environment at trace levels, levels in the parts-per-thousand and parts-per-million level," says Rezaei.

She is designing and synthesizing the hybrid adsorbent-catalyst materials using both the conventional wet impregnation method — adding just the right amount of liquid to fill all the pores of the solid — and atomic layer deposition, which deposits thin films of material.

"We have started process modeling and simulation of the temperature swing adsorption (TSA) process," she says. "So far, two peer-reviewed papers on the abatement of VOC compounds have been published in *Catalysis Today* journal by the students working on this project and we expect to get another paper published by the end of the summer."

The next step will be to optimize design and development to find the materials that best perform in adsorption capacity, kinetics, and catalytic activity in capture and destruction of VOCs to less harmful compounds.

"The modeling efforts will include adding an oxidation step into the TSA cycle, cycle configuration evaluation, as well as cycle synthesis and optimization," Rezaei says. "We will also consider other model compounds such as toluene and xylene."



BARUA'S POLYBALL ENTERS TESTING PHASE

Last year, **Sutapa Barua**, received a patent for her PolyBall, biocompatible and biodegradable polymer nanoparticles that can purify biopharmaceutical products. The materials are still in the testing stage, but this fall, she is working with the S&T Office of Technology Transfer and Economic Development and a pharmaceutical company to guide the technology into commercial products.

Barua also has two other ongoing research projects. Her research focuses on the development of shape-specific biomaterials that can treat or prevent illnesses like breast cancer, septic shock and burn injuries, among others.

Her current work is designing antibody-conjugated drug nanoparticles to enhance their ability to target breast cancer cells by conjugating them on the surface of cytotoxic T lymphocytes that modulate immune responses in those breast cancer cells.

She is also working to develop mammalian cell technology in liquid suspension by growing cells on the surface of polymer microcarriers. The work could lead to an efficient, scalable way of producing large volumes of mammalian cells. Mammalian cell culture technology has a variety of applications, from the production of therapeutic proteins and in vitro drug testing to cell therapy and tissue engineering.

Barua's team has recently published their research in *Scientific Reports*, *Applied Bio Materials*, *Journal of Nanobiotechnology* and *Nano LIFE*.

CHEM-E QUEEN

Chemical engineering senior **Sami Smith** has always had a passion for hair and makeup, so when she graduated high school a semester early, she took a chance and enrolled in beauty school.

After graduating from Paul Mitchell the School in St. Louis, she began work as a hairdresser — both to fuel her passion and to fund her future education.

Smith had heard good things about Missouri S&T, but decided to start out with an associate's degree in pre-engineering at Columbia College.

"When I started my associate's degree, I fell in love with all of the math and core science classes, like chemistry and physics," Smith says. "When I decided to continue on with a bachelor's degree, chemical engineering seemed to be the best fit for me. It applies all of the things I loved into one."

Smith works with **Fateme Rezaei**, assistant professor of chemical engineering, and Ph.D. student **Shane Lawson**, ChE'17, on research that involves 3-D printing and advanced materials synthesis. After graduation, she hopes to use her degree to work in the pharmaceutical industry, or maybe even cosmetics.

Smith, who serves as vice president of the General Delegation of Independents and alumni relations chair for Lambda Sigma Pi service organization, says the first organization she joined at S&T was Alpha Chi Sigma, the chemistry professional organization.

This past March, Smith represented Alpha Chi Sigma as a St. Pat's Queen candidate, and was crowned 2019 Queen of Love and Beauty during coronation.



Despite her busy college life, Smith still works full time as a hairdresser at Rolla hair salon Purple Strands.

"My secret to tackling work, college and extracurricular activities is good time management and a good support system," Smith says. "I have many family, friends and clients who have helped encourage me to keep persevering, and I couldn't do it without them."



SMITH DIRECTS PARTNERSHIP WITH KUWAIT UNIVERSITY

The Gulf University of Science and Technology (GUST), a private university near Kuwait City on the Persian Gulf, signed a \$1.9 million, five-year agreement with Missouri S&T to establish new engineering programs and monitor the programs' quality.

"This agreement brings our university to the forefront in a part of the world that is very westernized," says **Joseph Smith**, the Wayne and Gayle Laufer Chair of Energy at Missouri S&T and the program's principal investigator.

Eventually, S&T hopes students in undergraduate engineering courses in Kuwait will consider earning graduate degrees in Rolla.

In this five-year agreement, S&T faculty will help to establish undergraduate engineering programs in chemical, computer, electrical, petroleum, and civil and environmental engineering as well as engineering management. A second five-year phase will focus on creating a program in mechanical engineering.

Smith says that engineering is particularly important to countries like Kuwait because their economy is heavily based on oil revenue, and engineers are the ones who run the chemical plants and petroleum refineries that drive their economies.

"Engineering is very important to the Middle East, and most Middle Eastern countries send their engineering students abroad to study," says Smith. "As a strategic decision, Kuwait decided that they would like to evolve their local universities to teach their own students."

The agreement also allows for international visits and collaboration among students and faculty of both institutions.

DELTA V PROCESS CONTROLS LAB

To help prepare students for careers in industry, the chemical and biochemical engineering department built a full-scale process control lab complete with large tanks, centrifugal and positive-displacement pumps, variable-speed drives and a complete field instrumentation package.

The field instrumentation package includes level-, flow-, pressure- and temperature-transmitters, automatic and manual block valves, control valves, and pressure safety devices. The instrument transmitters communicate with a state-of-the-art distributed control system (DCS).

We use an Emerson DeltaV DCS, which is widely used in the chemical, petrochemical, biotech and pharmaceutical industries. Working with the DeltaV gives the students a unique advantage – they get experience on the same control systems they will encounter in industry.

The DeltaV communicates with field instrumentation and is used to maintain the steady state of the system.

For example, we can establish a flow of liquid from one of the storage tanks through a heat exchanger and back to the storage tank, using a flow-controller to maintain the constant flow-rate. The DeltaV DCS has the input/output capabilities and the control software needed to successfully maintain a constant flow-rate in this loop.

We teach the applied fundamentals of process control. Students who enroll in the process control lab also enroll in the Process Modeling, Dynamics and Control course during their senior year. The lab experiment schedule follows the Process Control course syllabus. When a new concept is introduced in the control course, the students get to immediately apply it in the control lab and see how the control system actually works.

STUDENT NEWS



Morgan Fender, ChE'19, a project engineer for USG in Kansas City, Mo., spoke during the Saturday, May 18, morning commencement ceremony. A leader for Preview, Registration and Orientation (PRO), Fender served as president of Christian Campus Fellowship and was a member of the American Institute of Chemical Engineers. She held internships at New York University's Tandon School of Engineering in Brooklyn and at Brewer Science in Rolla.

"When I was a little girl, I saw my brother memorizing the periodic table for his high school chemistry class," she told her fellow graduates. "As I gazed at the compilation of letters and numbers, I was blown away that this seemingly giant crossword puzzle somehow accounted for what made up everything I had ever touched or seen. I started memorizing the periodic table too, and chemistry began captivating my little mind. When I discovered chemical engineering, I knew this career was the perfect fit."

Shyam Paudel, chemical engineering graduate student was one of two students chosen to lead the Next Generation Scientists for Biodiesel Program, and in

January attended the National Biodiesel Board conference in San Diego.

"The National Biodiesel Conference is a highlight because I get to meet industry experts, hear about key biodiesel issues, and gain a better understanding of the industry dynamics," said Paudel in a press release about the conference. "I got the opportunity to present my research and validate my hypothesis by talking to chemists, plant managers, and other biodiesel leaders. Through conversation, I gained insights into the biodiesel supply chain and how policy like the biodiesel tax credit affects the market."

Chemical engineering juniors **Alex Daues**, **Steven Gibbons** and **Jasmine Monroe** and senior **Zaid Haha** took first place in the engineering poster presentation during the 15th annual Undergraduate Research Conference for research titled "Extractive Metallurgy from Industrial Wastewater." Advisors are **Muthanna Al-Dahhan**, chair and Curators' Distinguished Professor of chemical and biochemical engineering and nuclear engineering, and **Qusay Al-Obaidi**, a Ph.D. student in chemical engineering.

Junior **Kayla Bruemmer** placed third with research titled "Resident-Time Distributions for Trickle Bed Reactors." Advisor is Muthanna Al-Dahhan, Curators' Distinguished Professor, and **Humayun Shariff**, a Ph.D. student in chemical engineering.

Senior **Kaelyn Yarbrough** won first place in the research poster presentation for research titled "Modeling of Structure-Controllable Optical Nanofluids." Advisor is **Joontaek Park**, an assistant professor of chemical and biochemical engineering.

Emily Johnson, a senior in chemical engineering, presented research titled "Discovering Mixed Transition Metal Based Selenides as Novel Oxygen Evolution Electrocatalysts," directed by **Manashi Nath**, an associate professor of chemistry, to Missouri legislators during Undergraduate Research Day at the Capitol in April.

Two S&T students received scholarship awards from the American Institute of Chemical Engineers. **Brent Johnston**, ChE'19, received the 2019 AiChE Virtus Dynamica Chemical Engineering Student Award for outstanding contributions to AiChE while maintaining an excellent academic record. The award is sponsored by Emerson Automation Solutions. **Leah Amos**, a junior in chemical engineering, received the 2019 AiChE Rising Star Student Scholarship for her outstanding contributions to the organization.

Ph.D. candidate **Sidharth Razdan** won the 2018 AiChE Separations Division Graduate Student Research Award. His project was one of 10 chosen for the second round of the Entrepreneur Quest Competition.

Graduate **Xiaofeng Wang** was awarded the Chinese Government Award for Outstanding Self-financed Students Abroad after a competitive two-tier evaluation process by Consulate General of The People's Republic of China in Chicago and China Scholarship Council. He is the first S&T student to receive this award.

MINER CHEM E GRADS HONORED FOR PROFESSIONAL ACHIEVEMENT

An article titled "Effect of Post-Functionalization Conditions on the Carbon Dioxide Adsorption Properties of Aminosilane-Grafted Zirconia/Titania/Silica-Poly(amide-imide) Composite Hollow Fiber Sorbents" published by **Patrick Brennan**, ChE'17, in *Energy Technology*, was named one of the top articles of the year. The ranking is based on downloads and feedback of the journal's editorial office.

Todd Hunt, ChE'99, was promoted to principal at Burns & McDonnell's Construction Design-Build group.

John Black, ChE'74, retired as general counsel for the Springfield, Mo., city utilities in February 2018 and was elected Missouri State Representative, District 137 in November 2018.

Matt Dorsey, ChE'17, spent a year in Germany as part of the Congress-Bundestag Fellowship.

Brian Straus, ChE'10, was ordained a Catholic priest in Springfield, Mo.

Richard Altice, ChE'86, was named president and CEO of NatureWorks.

Kaitlyn Watts, a senior in chemical engineering, received a scholarship from Ash Grove Cement. Watts interned for Ash Grove in Overland Park, Kan., last summer.

WELCOME, NEW ACADEMY MEMBERS

This past April, we welcomed nine professionals with ties to chemical and biochemical engineering into Missouri S&T's Academy of Chemical Engineers.

Academy membership is an honor in recognition of members' contribution to their profession, leadership and involvement with S&T.

The 2019 inductees are:

- » **Farhad Adib**, ChE'84, MS ChE'85, PhD ChE'91, senior material development engineer for Freudenberg-NOK
- » **Edward Bonney**, ChE'79, retired from quality management integration at Corteva AgriScience
- » **Ralph E. Grant**, ChE'93, director of business development for Clark Richardson and Biskup Engineering, Architecture, Construction and Consulting
- » **Marvin R. Havens**, ChE'71, MS ChE'73, PhD ChE'76, retired research associate for Sealed Air Corp.
- » **John Hegger**, ChE'86, engineer and brewer for Anheuser Busch InBev
- » **Daniel J. Klingenberg**, ChE'85, professor of chemical engineering at the University of Wisconsin
- » **David Neuwirth**, ChE'71, president of Neuwirth Consulting Group
- » **Ed Palmer**, ChE'68, manager of downstream process engineering, downstream and chemicals for Wood Group Mustang
- » **Gerald R. Thiessen**, ChE'68, MS EMgt'74, a retired U.S. Army colonel.

Award of Professional Distinction



Ernest K. Banks, ChE'81, global operational excellence director for Curium, the recently formed union between Mallinckrodt Nuclear Medicine and IBA Molecular, received the Award of Professional Distinction during December commencement ceremonies.



David Charles Sextro, ChE'82, vice president of engineering for process simulation in the Process systems and Solutions group at Emerson Automation Solutions, received the Award of Professional Distinction during December commencement ceremonies.



Charles W. Lyon, ChE'84, MS EMgt'91, business director for the Americas and Asia Pacific for INEOS, received the Award of Professional Distinction during May commencement ceremonies. The award recognizes outstanding S&T graduates for career achievement.

MISSOURI

S&T



DOSHI SHARES LIFE LESSONS WITH MAY GRADS

Our own **Bipin Doshi**, ChE'62, MS ChE'63, retired chairman, president and CEO of Schafer Industries, delivered the commencement address to over 1,000 S&T graduates during three ceremonies in May. He was also presented with the doctor of engineering, honoris causa.

Doshi assured the graduates that they were prepared for the next phase of their lives.

"The administration and faculty have done their utmost to prepare you for this exciting and challenging world," said Doshi. "You are prepared to successfully tackle any problems and make a mark in your chosen field. You are prepared not only with the academic knowledge required, but with the practical, midwestern, approach to life that Missouri S&T prides itself on. Students here are trained to solve problems and excel in whatever vocation they choose and whatever challenges they might face."

He encouraged the students to find balance, follow their own moral compass and not to fear failure.

"You may face some unusual problems, so remember that there is more than one way to solve a problem," said Doshi. "Do not fear failures. Treat those as opportunities to learn. Take calculated risks that help you develop sound judgement."

Doshi and his wife, Linda, provided the major gift that named the Frank Conrad Unit Operations Laboratory in Bertelsmeyer Hall in memory of Doshi's mentor, advisor and friend.

FACULTY AWARDS



Muthanna H. Al-Dahhan, chair and Curators' Distinguished Professor, is serving as an international advisor to the Smart Tomographic Sensors for

Advanced Industrial Process Control, a Ph.D. networking program based in Europe.



Sutapa Barua, assistant professor, was recognized during a College of Engineering and Computing awards ceremony for being awarded a patent.



Xinhua Liang, associate professor, received the Faculty Excellence Award and the Research Exergy Award.



Christi Luks, associate teaching professor, received the Outstanding Teaching Award and the University Service Award. In June, she began a two-year term as chair

of the Professional Interest Council 1 for the American Society for Engineering Education.



Fateme Rezaei, assistant professor, received a Tier 3 Faculty External Recognition Award for \$500 and a Faculty Research Award.



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Brent Johnston, ChE'18, is pursuing a master's degree in chemical engineering at S&T.

GRADUATION DOESN'T MEAN GOODBYE

Tell us how you're doing. We'd love to hear about new appointments, job promotions, degrees earned, and other family or professional news.

It's easy to stay in touch with your department. Just say hello when a student representative calls from Phonathon or drop us a note at chemeng@mst.edu.

With your support, there's no limit to what we can achieve.