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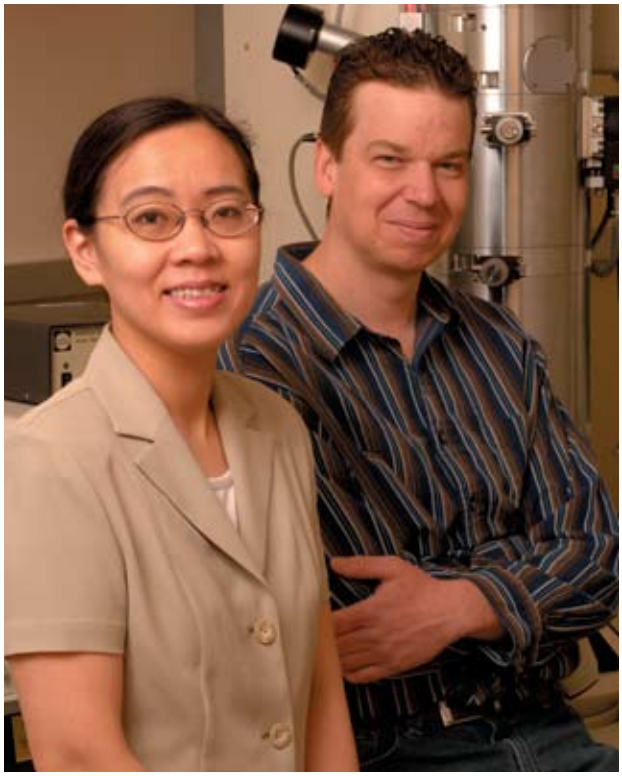


Lenore Dai, Ph.D. and Brandon Weeks, Ph.D.

CAREER award RECIPIENTS

Chemical Engineering Assistant Professors Lenore Dai and Brandon Weeks have recently received a distinguished honor of recognition from the National Science Foundation (NSF) by accepting the prestigious CAREER award. The award represents exceptional recognition from external peers as well as from the NSF. The National Science Foundation established the CAREER program in 1994 in recognition of the critical roles played by faculty members in integrating research and education, and in fostering the natural connections between the processes of learning and discovery. Competition for the award is limited to assistant professors in a tenure-track position, and the success rate is approximately 15 percent. Chemical Engineering Professor/Associate Vice President of Research Karlene Hoo received the NSF CAREER award in 1997 and Associate Professor Mark Vaughn received it in 2002.

Dr. Lenore Dai's $400,000, five-year award titled "CAREER: Heterogeneous and Competitive Self-assembly at Liquid-Liquid Interfaces," focuses on integrating research and education centering on heterogeneous and competitive self-assembly at liquid-liquid interfaces. She will investigate the self-assembly of heterogeneous colloidal lattices using Pickering emulsions as an experimental template. The two-dimensional colloidal lattices will contain colloidal particles of different wettability, size, and charge. She will also expand the concept of Pickering emulsions and use solid particles to stabilize double emulsions (self-assembly of single species solid particles at heterogeneous interfaces). Finally, she will study the heterogeneous or competitive self-assembly of nanoparticles and surfactants at liquid-liquid interfaces using molecular dynamics simulations.

This state-of-the-art research is of both fundamental and practical significance. The proposed heterogeneous colloidal lattices are anticipated to open new ways to functionalize novel materials and to provide heterogeneous 2-D experimental model for condensed matter physics study. The expansion of Pickering emulsion concept to double emulsions is another innovative usage for particles. The molecular dynamics simulations of heterogeneous or competitive self-assembly of nanoparticles and surfactants will provide in-situ and molecular information and a better understanding of the phenomenon that exists in many industrial processes.

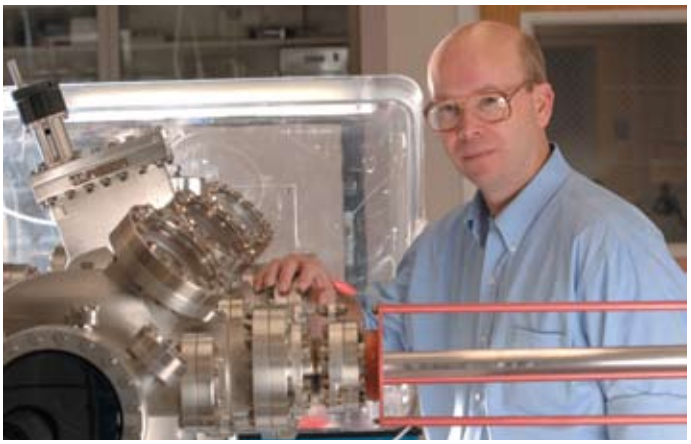
> The CAREER program recognizes the roles of faculty members in integrating research and education, and fostering the connections between the processes of learning and discovery.

Dai will also establish a new summer program to broaden the participation of under-represented groups and promote technology transfer. This project provides a unique opportunity to meet our nation's need for a cutting-edge research arena with the potential of significant expansion in the 21st century.

Dr. Brandon Weeks received a $400,000, five-year award titled "CAREER: Understanding Nanoscale Properties of Energetic Materials." This award focuses on the science required to design energetic materials whose performance critically depends upon nanoscale structures. While use of energetic materials is widespread through the resource and manufacturing industries, there have been few new materials developed in the last 100 years. The stated goals of this research are to determine properties of energetic materials experimentally at the nanometer scale, to link these findings with bulk properties, and to use these findings to develop new energetic materials.

Key techniques will be nanoscale lithography and property measurement with an atomic-force-microscopy tip and with small-angle X-ray scattering, used to study changes due to physical, chemical, or thermal loads in a nanoscale domain. Collaboration with Sandia Albuquerque is another aspect aiding the potential impact of the work.

A primary part of the CAREER award is to create substantial societal impact through its education plan. Weeks's educational plan includes participation in an undergraduate-mentoring program, working with a local seventh-grade teacher to introduce a math/science "application activity," and developing courses in energetic materials. The goal is to get students excited about science at the height of their intellectual curiosity and creativity, and encourage them to pursue education in science and engineering fields. •



Mark Holtz, Ph.D., stands next to a molecular beam epitaxy system used for crystal growth. The system is used to grow nanoscale superlattices of AlGaN.

center showcase

The Nano Tech Center (NTC) at Texas Tech University (TTU) focuses on interdisciplinary research and education in the areas of nanophotonics, materials science, optoelectronics, microfabricated optics, microelectronics and NEMS/MEMS microsystems, by fostering successful collaborations among researchers from different engineering departments, biology, chemistry, physics, and medicine. Mark Holtz, Ph.D., professor of physics and co-director of the Nano Tech Center, says that notable innovations have emerged in the area of nanophotonics. Nanophotonics involves the use of fundamental properties of materials to create, detect and manipulate light at the nanoscale. "New techniques for fabrication at the nanoscale are now available, and they allow us to manipulate surfaces, crystals, metals and various materials at an unprecedented level. These new approaches for controlling properties of materials produce completely new phenomena. We are interested in the discovery of these phenomena and applications for novel device architectures," Holtz explains.

Nanophotonics research at the NTC has focused on growing deep ultraviolet materials and fabricating aluminum gallium nitride (AlGaN) semiconductors to produce light emitting diodes (LEDs) and photodetectors in the ultraviolet (UV) range. Preparing deep ultraviolet LEDs once had been considered impossible, but Sergey Nikishin, Ph.D., associate professor in the Department of Electrical and Computer Engineering, recently led a group of researchers in developing nitride-based semiconductors to prepare LEDs in the ultraviolet. Applications of these light sources include data storage with ultrahigh capacity, replacement of conventional light sources and resonant illumination of biological hazards. Nikishin, in collaboration with Henryk Temkin, Ph.D., Horn professor and Jack Maddox Distinguished Engineering chair in the Department of Electrical and Computer Engineering and co-director of the NTC, also has prepared photodetectors in the ultraviolet range, using n-type AlGaN, (aluminum gallium nitride), which have applications in astronomy, spectroscopy and defense.

Other nanophotonics research includes Jordan Berg's, Ph.D., associate professor in the Department of Mechanical Engineering, modeling of thermal transport in nanometer-size structures and exploring ways to promote desired behaviors. Berg also develops micrometer-size structures that can be used in conjunction with nanophotonic devices to enhance functionality. Additionally, Ayrton Bernussi, Ph.D., assistant professor in the Department of Electrical and Computer Engineering concentrates on nanophotonic structures and understanding the interaction between light and matter at the nanoscale level. Bernussi's research also investigates surface nano-texturing for light enhancement of the extraction and insertion efficiencies in GaN based UV-LEDs and detectors, development of photonic crystal nanocavities for ultra-small volume chemical and biological sensors and resonator applications, active and passive surface plasmon polariton waveguides for development of nanoscale lasers and detectors and photonics-on-chip technology. — Mónica Muñoz

feature faculty profile

The Department of Industrial Engineering at Texas Tech University proudly welcomed Dr. Patrick Patterson on August 1, 2006, to serve as its chair. Dr. Patterson comes to Texas Tech from Iowa State University, where he served as the chair of the Department of Industrial and Manufacturing Systems Engineering. Patterson's research interests focus on rehabilitation engineering and ergonomics, which involve developing products that are easier to use. Patterson says, "My work involves developing equipment like wheelchairs and artificial limb control systems for persons who have limitations. I also do product design research, where I try to envision the types of errors people could make with equipment, possibly hurting themselves or others. If a human sits in it, works with it, or uses it, I have an interest in making it better."

After 22 years, Patterson is returning to Texas; he earned a Ph.D. in ergonomics from Texas A&M University at College Station. Patterson has developed control systems based on neuroelectric impulses, and he is working on devices controlled by brainwaves. Patterson states, "If we can interpret brainwave patterns we can control devices. This has potential for folks who have severe disabilities of the limbs as they would benefit from having a wider range of devices they can control. Developing devices for those with limitations translates into making life easier for those of us who don't have disabilities, so we can extend this work to everyone." Patterson was inspired to work in rehabilitation engineering during an undergraduate internship with disabled children. "I realized that I could do something here, and why hasn't anybody thought of these things before?" he shares.

Dr. Patterson and graduate student researching cumulative trauma of wrist motions in the Industrial Engineering Ergonomics Laboratory

Patterson is excited to be at Texas Tech. He recognizes the department has a lot of potential. "The department has a wonderful blend of senior and junior faculty with the skills to produce great research and provide the kind of education that graduate and undergraduate students are going to need for the future," Patterson says. — Mónica Muñoz

SPOTLIGHT on OUTREACH

The Center for Engineering Outreach at Texas Tech University (TTU) directed by A. Dean Fontenot, Ph.D. and John R. Chandler, Ph.D., boasts a number of outreach activities, including the Pre-College Engineering Academy and the Engineering Outreach Mentor program. "The purpose of the center is to make an impact in K-12 education. We want students to get interested in science, math, technology and engineering, and in getting a higher education," Fontenot explains. The Pre-College Engineering Academy provides a curriculum that includes engineering concepts as it emphasizes problem-solving, teamwork and project management. The Engineering Outreach Mentor program brings expertise directly into the classroom as TTU engineering students work with K-12 students and teachers to understand engineering principles. Fontenot explained, "We train engineering students to be mentors and facilitators, but they become much more; they really become role models for the children."

Because of the Center for Engineering Outreach's success, Provost William Marcy, Ph.D., P.E., encouraged Fontenot and Chandler to write a proposal for Texas Tech to be one of the five Texas-Science, Technology, Engineering and Math (T-STEM) Centers in the state. TTU recently was awarded a $1 million grant from the Texas Education Agency to create a T-STEM center aimed at enhancing those four disciplines in grades K-12.

T-STEM is part of the Texas High School Project, a $261 million initiative to increase high school graduation and college enrollment rates in Texas. "The T-STEM center will focus on the professional development of teachers and support of T-STEM academies," Fontenot clarified. T-STEM academies are schools focused on helping students develop higher math and science skills in order to be better prepared for higher education. "We have the responsibility to work closely with and provide resources for the T-STEM academies," she pointed out. T-STEM will specialize in project-based engineering design, and teachers will soon recognize TTU as the place to receive such specialized training. "We want to help educators make education better by giving them resource tools and support," Fontenot said. — Mónica Muñoz

SPOTLIGHT on STUDENTS

Dana Rosenbladt is the recipient of the McAuley Distinguished Engineering Student Award for 2007. The award by members of the College of Engineering Dean's Council is named in memory of James A. McAuley, a former member of the Dean's Council and a Distinguished Engineer. Rosenbladt earned her bachelor's of science degree in mechanical engineering, graduating in May 2007. She worked as a student assistant in TTU's Nano Tech Center, supported under a National Science Foundation (NSF) grant. Rosenbladt was recently awarded an NSF Graduate Fellowship that will provide three years of support in her master's program in mechanical engineering at TTU. NSF grants this fellowship to the nation's best students to ensure the vitality of science, technology, engineering, and mathematics talent.

The College of Engineering is sad to report the January 5 death of Dr. John R. Bradford, Dean of Engineering at TTU from 1955 until 1982. Brad was an important individual in the development of the College of Engineering, and was considered a significant leader on campus and in the community. Dr. Bradford touched the lives of many engineering students, personally mentoring them and encouraging them in their career and personal aspirations. He will be sorely missed. — Dean Pam Eibeck

new faculty SYNOPSIS

The College of Engineering at Texas Tech University (TTU) has welcomed Alan F. Jankowski, Ph.D. as the J.W. Wright Regents' Chair and professor of mechanical engineering. He comes to Texas Tech from Lawrence Livermore National Laboratory in Livermore, California.

Jankowski's research activities and interests are focused on mechanics and material science of nanostructures and include the synthesis and characterization of multilayer coatings and nanostructures with high strength and hardness, developing nanoporous coatings as membranes for catalysis and biocompatible surfaces and engineering materials for integrated devices as miniaturized thin-film fuel cells and field-emission displays. His work has led to innovations in oxide coatings for fusion reactors and radiation detectors, new metal target payloads for high-energy density physics experiments and the production of nanoporous coatings for energy conversion devices.

Jankowski looks forward to collaborating with members of both the Texas Tech and Lubbock communities. "My interest and background in the mechanics and material science of nanostructures fit well to both compliment and provide synergy in promoting cross-discipline interactions within engineering and the physical sciences. The opportunity for discovery is an objective that will drive and unite us," Jankowski says. Jankowski's professional record includes nearly 30 patents, both in the United States and internationally, and more than 100 refereed journal publications.

The J.W. Wright Regents' Chair was established in 2004 by Associated Supply Company, Inc. (ASCO) to help train future mechanical engineers. Jankowski plans to live up to this mission. "I have several goals for the J.W. Wright Regents' Chair position in my service to TTU and the community. Through teaching, I hope to educate and support the training of future engineers. Through existing and new curriculum, I'd like to stimulate interest in pursuing graduate work and career development in materials engineering," he states. — Mónica Muñoz

new faculty MEMBERS

Bill Lawson
Civil & Env. Eng.

Shameem Siddiqui
Petroleum Eng.

Derrick Tate
Mechanical Eng.

Euneong Youn
Computer Science

Malgorzata Ziaja
Petroleum Eng.

Delong Zuo
Civil & Env. Eng.

The Envision newsletter is a publication of the College of Engineering at Texas Tech University. Direct all inquiries to Associate Dean of Research Javad Hashemi, Ph.D. (Javad.Hashemi@ttu.edu); 806.742.3451. Dean of the College of Engineering: Pamela A. Eibeck, Ph.D.; Editors: Karlene A. Hoo, Ph.D. and Kippra D. Hopper, Writers: Mónica Muñoz, Kippra D. Hopper; Communications Coordinator: Sharon Smith; Design: Misty Pollard; Photography: Artie Limmer and Joey Hernandez

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