Versatile new material to build realistic prosthetics
Read more on pg. 5
In these challenging times, we are all navigating through unforeseen difficulties and trying to adjust to the new “normal.” I hope you are all healthy and safe.

The pandemic changed everything for us right after spring break. Our faculty were indeed superstars in being able to transform each of their classes and laboratories into remote/online delivery formats. Almost all our courses were transformed within seven days to provide our students continuous learning through the spring semester.

The lab experiments were video recorded with the help of our graduate teaching assistants. Experimental data were provided to the students to prepare lab reports and answer fundamental questions.

For the first time, Texas A&M University provided a virtual graduation recognition celebration, which consisted of messages from university leadership, the dean of engineering, and each department head, it was a remarkable experience.

Upon cancellation of all undergraduate classes, employment and research experiences on campus this summer, Dr. Mike Demkowicz imagined a way to enable students to have the Research Experience for Undergraduates – REU (usually on campus) delivered online. The first of its kind online research undergraduate experience (O-REU) was a genuinely novel idea and enabled our students, faculty and researchers to remain engaged during the stay-at-home orders over the summer. The idea went viral all over the country. Students received $5,000 for 10 weeks to work with our faculty on research projects performed online, educating students in computational materials, modeling and machine learning/data science techniques.

During this uncharted time, we also welcomed three new faculty to our department: Dr. Edwin L. Thomas, professor, Dr. Qing Tu, assistant professor, and Dr. Taylor Ware, associate professor.

The pandemic has not slowed our momentum. We raised seven capstone projects totaling $50,000 in funded projects, and our annual research expenditures were over $13 million dollars in 2019.

We have experienced an 8% increase in graduate students for 2020, and our undergraduate students won the best technical report award in the Cast in Steel Competition organized by the Steel Founders’ Society of America.

Although we would love to host visitors on campus this fall, the college is minimizing the number of events on campus. We hope to welcome visitors back soon.

Wishing you and your family safe and healthy days.

Sincerely,

Dr. Ibrahim Karaman
Department Head
Chevron Professor I
RANKINGS (2021)
#14 Graduate Program Ranked No. 14 (Public) (U.S. News & World Report)

RESEARCH EXPENDITURES
$13.9 MILLION IN 2019

ENROLLMENT* (FALL 2020)
155 Undergraduates
38 M.S.
151 Ph.D.

FACULTY (FALL 2020)
9 Professors
4 Associate Professors
6 Assistant Professors
4 Endowed Professors

DIVERSITY (FALL 2020)
57% International Graduate Program Students
43% Domestic Graduate Program Students

UNDERGRADUATE
47% Underrepresented Minority Groups
34% Female Students

GRADUATE
21% Underrepresented Minority Groups
33% Female Students
Cell phone batteries often heat up, and at times, can burst into flames. In most cases, the culprit behind such incidents can be traced back to lithium batteries. Despite providing long-lasting electric currents that can keep devices powered up, lithium batteries can internally short circuit, heating up the device.

Researchers at Texas A&M University have invented a technology that can prevent lithium batteries from heating and failing. Their carbon nanotube design for the battery's conductive plate, called the anode, enables the safe storage of a large quantity of lithium ions, thereby reducing the risk of fire. Further, the researchers said that their new anode architecture will help lithium batteries charge faster than current commercially available batteries.

“Building lithium metal anodes that are safe and have long lifetimes has been a scientific challenge for many decades,” said Juran Noh, graduate student in the Department of Materials Science and Engineering. “The anodes we have developed overcome these hurdles and are an important, initial step toward commercial applications of lithium metal batteries.”

This research is funded by the National Science Foundation.
For millennia, metallurgists have been meticulously tweaking the ingredients of steel to enhance its properties. As a result, several variants of steel exist today; but one type, called martensitic steel, stands out from its steel cousins as stronger and more cost-effective to produce. Hence, martensitic steels naturally lend themselves to applications in the aerospace, automotive and defense industries.

However, for these and other applications, the metals have to be built into complex structures with minimal loss of strength and durability. Texas A&M University researchers, in collaboration with scientists in the Air Force Research Laboratory, have now developed guidelines that allow 3D printing of martensitic steels into very sturdy, defect-free objects of nearly any shape.

“Strong and tough steels have tremendous applications but the strongest ones are usually expensive — the one exception being martensitic steels that are relatively inexpensive, costing less than a dollar per pound,” said Dr. Ibrahim Karaman, Chevron Professor I and head of the Department of Materials Science and Engineering. “We have developed a framework so that 3D printing of these hard steels is possible into any desired geometry and the final object will be virtually defect-free.”

This research is funded by the Army Research Office and the Air Force Research Laboratory.
VERSATILE NEW MATERIAL TO BUILD REALISTIC PROSTHETICS

Nature's blueprint for the human limb is a carefully layered structure with stiff bone wrapped in layers of different soft tissue, like muscle and skin, all bound to each other perfectly. Achieving this kind of sophistication using synthetic materials to build biologically inspired robotic parts or multicomponent, complex machines has been an engineering challenge.

By tweaking the chemistry of a single polymer, researchers at Texas A&M University and the U.S. Army Combat Capabilities Development Command Army Research Laboratory have created a whole family of synthetic materials that range in texture from ultra-soft to extremely rigid. The researchers said their materials are 3D printable, self-healing, recyclable and they naturally adhere to each other in air or underwater.

“We have made an exciting group of materials whose properties can be fine-tuned to get either the softness of rubber or the strength of load-bearing plastics,” said Dr. Svetlana Sukhishvili, professor in the Department of Materials Science and Engineering and a corresponding author on the study. “Their other desirable characteristics, like 3D printability and the ability to self-heal within seconds, make them suited for not just more realistic prosthetics and soft robotics, but also ideal for broad military applications such as agile platforms for air vehicles and futuristic self-healing aircraft wings.”

This research is funded by the United States Combat Capabilities Development Command Army Research Laboratory.
NEEDLEMAN TOP-CITED RESEARCHER IN ENGINEERING

In a study conducted by Stanford University, Dr. Alan Needleman, university distinguished professor and holder of the Royce E. Wisenbaker ’39 Chair II, was recognized as one of the most highly cited researchers. Needleman is a preeminent leader in the area of mathematical modeling of materials. His has contributed to research in ductile fracture computational methodology, methods for fracture analysis and computational frameworks using discrete dislocation plasticity to solve general boundary value problems. He is a member of the National Academy of Engineering and the American Academy of Arts and Sciences.

HANDS-ON RESEARCH DESPITE PANDEMIC

This year, the online Research Experiences for Undergraduates (O-REU) program received over 200 applications from a diverse set of students from around the country. The 58 students who were selected for the program gained research experience under the guidance of a mentor and participated in numerous enrichment activities, such as online lectures, professional development seminars in technical communication and workshops on preparing graduate school applications. They also received a stipend of $5,000 for their work over the summer.

CASTANEDA TO SERVE AS EXPERT

Dr. Homero Castaneda, associate professor and director of the National Corrosion and Materials Reliability Lab, has been selected as one of 12 experts to serve on the Corrosion of Buried Steel at New and In-Service Infrastructure committee that is a part of the National Academies of Sciences, Engineering and Medicine. This committee will focus on technical issues related to steel corrosion in ground stabilization, pipelines and infrastructure foundations in unconsolidated rock, among other settings.

RADOVIC AWARDED GLOBAL STAR AWARD

Dr. Miladin Radovic, professor and director of the Materials Characterization Facility, has been awarded the prestigious Global Star Award by the Engineering Ceramics Division of The American Ceramic Society. The award recognizes active volunteers and their contributions to the Engineering Ceramics Division and the International Conference and Expo on Advanced Ceramics and Composites, and has been given to distinguished individuals annually since 2010.

STUDENTS WIN PRESTIGIOUS FELLOWSHIPS

Two doctoral students in the Department of Materials Science and Engineering won prestigious graduate fellowships this spring. Rebeca Gurrola received a National Science Foundation graduate research fellowship, while Ciera Cipriani won a NASA space technology graduate research fellowship.
DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING

AREAS OF FOCUS

Advanced Structural Materials
Biomaterials
Ceramics and Ceramic Composites
Computational Materials Science and Design
Corrosion Science and Engineering
Functional (Electronic, Magnetic, Optical) Materials
Materials for Energy Applications
Materials for Extreme Environments
Mechanical Behavior of Materials
Polymers and Composites

RESEARCH CENTERS

Center for Intelligent Materials and Structures
Materials Characterization Facility
Microscopy and Imaging Center
National Corrosion and Materials Reliability Lab
Polymer Technology Consortium
Soft Matter Facility