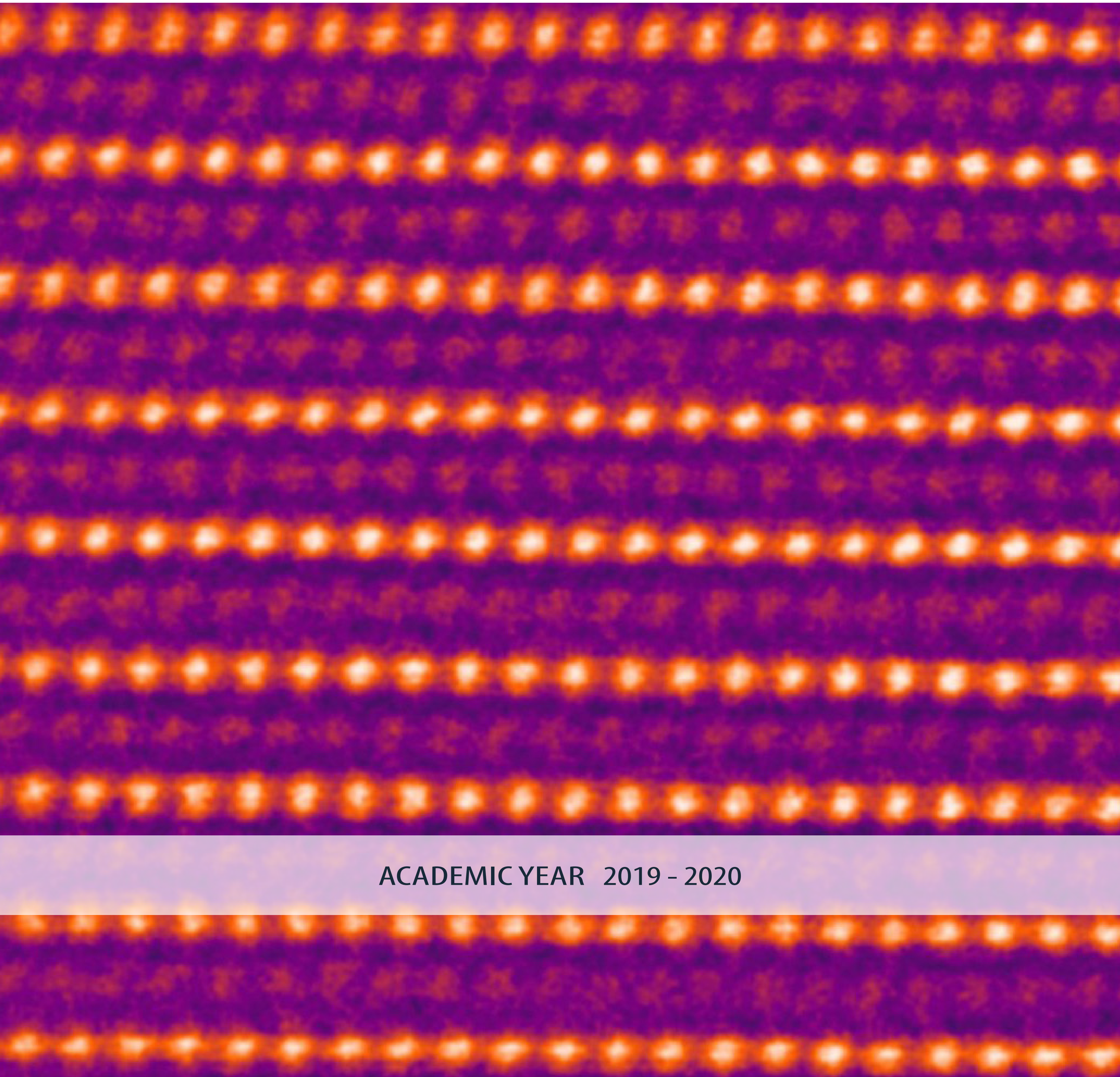
The University of Texas at Austin
Texas Materials Institute

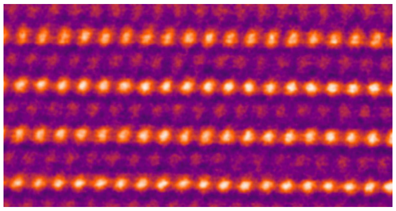
NEWSLETTER



ACADEMIC YEAR 2019 - 2020

Greetings from the Director

ON THE COVER



The cover image this year is an annular dark field scanning TEM image of the atomic lattice of $BaTiO_3$ in (210) plane obtained with the JEOL NeoARM at 200 kV. The cross-sectional sample was prepared by Focused Ion Beam (FIB) milling with the Thermo Scios 2. The bright intensities from the columns of Ba atoms, and the weak from the columns of Ti atoms. The image was taken by Dr. Hyoju Park, a postdoctoral scholar with TMI and working with Dr. Jamie Warner. You can read more about our new TEM Facility on pages 8-9.

Greetings!

I am pleased to present to you the Materials Science and Engineering Program and Texas Materials Institute (TMI) Newsletter for the 2019 - 2020 academic year. This year we celebrated the many accomplishments of our students, faculty, and staff while navigating through unprecedented times. The COVID-19 pandemic was unexpected and tragic but our unit was resilient and continued to keep TMI running and sustain our mission.

We received the extraordinary news this year when Professor John B. Goodenough was awarded the 2019 Nobel Prize in Chemistry for his development of lithium-ion batteries. This is a monumental achievement reflecting the impact of Professor Goodenough's research over the years. It is hard to imagine a contemporary society without his discoveries, and the lives of so many people have been touched by his work.

During Fall 2019, the Cockrell School of Engineering broke ground for the new Gary L. Thomas Energy Engineering Building (GLT). GLT will be home to many MS&E Graduate Program faculty and bring the entire UT campus together in pursuit of innovative solutions to solve our current energy challenges. GLT will have 184,000 square feet of space all dedicated to energy research.

As we strive to maintain top-tier research facilities, I am proud to announce our new JEOL NeoARM Scanning Transmission Electron Microscope (STEM) became operational this year. This is an upgrade to UT's electron microscopy capabilities, giving researchers cutting-edge tools for deeper analysis of their materials.

Our faculty and students continue to excel in regards to awards and recognitions, which you can read more about. It is not an easy time during a global pandemic, but I am proud of the adaptability and understanding of our students as we transitioned to a virtual learning environment.

As I look back this year, I want to thank everyone at TMI for their active role in the success of our research unit and graduate program while we shifted to a new normal. It is a challenging moment for our university community and for people across the nation and their dedication truly reflects the character of our unit.

Sincerely,

Arumugam Manthiram
Director, Texas Materials Institute

Editing and Design
Krista Seidel

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SPRING 2020

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Supervisor: Dr. Arumugam Manthiram

John B. Goodenough Wins the Nobel Prize

John B. Goodenough at a Nobel Laureate gathering in Stolkholm, Sweden. Photo by Alexander Mahmoud, Nobel Media.

John B. Goodenough, a faculty member with Texas Materials Institute and our Materials Science and Engineering program was awarded the 2019 Nobel Prize in chemistry — jointly with Stanley Whittingham of the State University of New York at Binghamton and Akira Yoshino of Meijo University — "for the development of lithium-ion batteries."

In the words of the Nobel Foundation, "Through their work, they have created the right conditions for a wireless and fossil fuel-free society, and so brought the greatest benefit to humankind."

Goodenough, who was born in 1922, identified and developed the critical materials that provided the high-energy density needed to power portable electronics, initiating the wireless revolution. Today, batteries incorporating Goodenough's cathode materials are used worldwide for mobile phones, power tools, laptops, tablets and other wireless devices, as well as electric and hybrid vehicles.

"Billions of people around the world benefit every day from John's innovations," said Gregory L. Fenves, former president of The University of Texas at Austin and former dean of the Cockrell School of Engineering. "In addition to being a world-class inventor, he's an outstanding teacher, mentor and researcher. We are grateful for John's three decades of contributions to UT Austin's mission."

"Live to 97 (years old) and you can do anything," said Goodenough. "I'm honored and humbled to win the Nobel prize. I thank all my friends for the support and assistance throughout my life."

In 1979, Goodenough showed that by using lithium cobalt oxide as the cathode of a lithium-ion rechargeable battery, it would be possible to achieve a high density of stored energy with an anode other than metallic lithium. This discovery led to the development of carbon-rich materials that allow for the use of stable and manageable negative electrodes in lithium-ion batteries.

"Professor John Goodenough is an extraordinary man and engineer, and I am delighted that his world-changing work is being recognized with the Nobel Prize," said Cockrell School Dean Sharon L. Wood. "Today, everyone in the Texas Engineering community — our faculty, staff, students and alumni around the world — are proud of his accomplishment and inspired by the example he has set."

Goodenough began his career at the Massachusetts Institute of Technology's Lincoln Laboratory in 1952, where he laid the groundwork for the development of random-access memory (RAM) for the digital computer. After leaving MIT, he became professor and head of the Inorganic Chemistry Laboratory at the University of Oxford. During this time, Goodenough made the lithium-ion battery cathode discovery.

After retiring from Oxford in 1986, Goodenough joined UT Austin,

"LIVE TO 97 (YEARS OLD) AND YOU CAN DO ANYTHING" - John B. Goodenough

where he serves as the Virginia H. Cockrell Centennial Chair in Engineering in the Cockrell School. In addition to his work with TMI, he holds faculty positions in the Walker Department of Mechanical Engineering and the Department of Electrical and Computer Engineering.

At 97 years old, Goodenough continues to push the boundaries of materials science with the goal of inventing more sustainable and energy-efficient battery materials. Goodenough and his team recently identified a new safe cathode material for use in sodium-ion batteries.

Goodenough received a bachelor's degree in mathematics from Yale University in 1944 and holds a doctorate in physics from the University of Chicago. He is the recipient of numerous national and international honors, including the Japan Prize, the Enrico Fermi Award, the Charles Stark Draper Prize and the National Medal of Science.

Goodenough joins physicist Steven Weinberg as one of two current Nobel laureates at UT Austin. Weinberg won the prize in 1979 for contributions to the theory of the unified weak and electromagnetic interaction between elementary particles. Two other UT Austin professors, both now deceased, also won Nobel Prizes: Hermann J. Muller in medicine and physiology (1946) and Ilya Prigogine in chemistry (1977). Alumnus E. Donnall Thomas won the Nobel Prize in physiology or medicine in 1990, and alumnus J.M. Coetzee won the Nobel Prize in literature in 2003. In the past two years, two UT Austin alumni have also won Nobel Prizes — Michael Young and Jim Allison, who respectively won the prize for medicine or physiology in 2017 and 2018.

The Nobels are considered to be among the most prestigious prizes in the world and have been awarded for achievements in physics, chemistry, physiology or medicine, literature and peace since 1901 by the Nobel Foundation in Stockholm, Sweden. Goodenough received a medal, cash prize and diploma at a ceremony in Stockholm in December 2019.

Article by Cockrell School of Engineering Communications Team.

John B. Goodenough pictured (from Lto R) with Jianshi Zhou, Arumugam Manthiram, Sharon L. Wood, Gregory L. Fenves, and Hadi Khani. Photo courtesy of Nobel Media.

John B. Goodenough receives his Nobel Prize from H.M. King Carl XVI Gustaf of Sweden at Konserthuset Stockholm. Photo by Alexander Mahmoud, Nobel Media.

Breaking Ground on New Engineering Building

Thanks to an extraordinary commitment from alumnus and former EOG Resources Inc. President Gary L. Thomas, the Cockrell School of Engineering at The University of Texas at Austin is officially naming its newest building the Gary L. Thomas Energy Engineering Building. Through his investment, Thomas hopes to ensure UT's position among the nation's top energy universities while helping to provide a multidisciplinary engineering education for students.

The 184,000-square-foot facility, which is under construction at Speedway and 24th Street on the UT campus, will be a multidisciplinary hub for energy-related education, research and innovation. Thomas, along with former UT President Gregory L. Fenves, Cockrell School Dean Sharon L. Wood and a large gathering of supporters and community members, celebrated the building's official groundbreaking at a ceremony on October 3, 2019. Set to open in Fall 2021, the GLT building will be home to a number of Texas Materials Institute faculty.

UT engineering has been a global leader in energy education and technology development for over a century. In the new Gary L. Thomas Energy Engineering Building, the Cockrell School will provide cutting-edge labs and classrooms, student project spaces and collaborative environments in which students and faculty members can work together to develop the energy industry solutions of the future.

"Gary Thomas has had a remarkable career as a leader in the energy industry, and with this extraordinary gift, he has made a profound investment in future generations of UT engineering students," said Gregory L. Fenves. "With the magnificent Energy Engineering Building, Gary is establishing a lasting legacy at UT by helping to ensure that our university remains at the forefront of energy innovation for decades to come."

Thomas was born in 1949 to parents who were raised during — and heavily influenced by — the Great Depression. His father left school in the sixth grade to work on the family farm before serving in World War II and returning to build a career in the oil and gas industry. His mother was a high school valedictorian who taught her children the value of a good education. Both parents strongly encouraged their children to pursue the college experience that they never had, and Thomas got his first glimpse of his future alma mater when he traveled with his high school basketball team to the state playoffs held at UT's Gregory Gym. He decided to become a Longhorn after receiving a scholarship to study petroleum engineering at UT.

Aerial view of construction site for the new Gary L. Thomas Energy Engineering Building.

After graduating with a bachelor's degree in petroleum engineering in 1972, Thomas held various engineering and production management positions with Unocal and Apache before earning an MBA from the University of Tulsa in 1983. He went on to spend over 40 years with EOG Resources Inc. and its predecessor, and he recently retired from the company as president, a role in which he was responsible for the high profitability and growth of exploration and production activities across the company's operating areas throughout a diverse portfolio of assets. Since 1999, Thomas helped EOG grow its production from 168,000 to more than 800,000 barrels of oil equivalent per day and its reserves from 600 million to more than 3 billion total barrels of oil equivalent, making it one of the largest independent crude oil and natural gas companies in the U.S.

Recognizing the impact that his UT education has had on his career, Thomas made his investment to help the Cockrell School launch energy leaders and shape future industries.

"I was so fortunate to have been

Gary L. Thomas pictured center, between Cockrell School Dean Sharon L. Wood and former UT President Gregory L. Fenves.

given a scholarship that encouraged me to go to UT, and it felt like the right thing was to return a portion of my good fortune to the university," Thomas said. "The way students are taught today is quite different than when I was in school — it is so critical to have a multidisciplinary program, and the new Energy Engineering Building will facilitate that. This building will be one of the best of its kind in the country and a great tool for education."

In addition to his career success, Thomas is also a renowned car enthusiast. He owns one of the nation's largest known private collections of Ford automobiles, with a focus on Shelby Mustangs. In the future, he plans to auction off a portion of his collection in support of his philanthropic priorities.

Thomas' commitment, which totals $25 million, caps an extraordinary fundraising effort that has secured over $60 million for the building's construction, reflecting the excitement that the facility has generated among the Cockrell School's alumni and friends. Other significant benefactors include the J.C. Anderson Family Foundation, the H.L. Brown Jr. Family Foundation, Peter and Claire Buenz, Jeff and Mindy Hildebrand, the Hoblitzelle Foundation, the estate of William D. Moore, National Oilwell Varco Incorporated, Bryan and Sharoll Sheffield, Scott and Kimberley Sheffield, Eugene and Robin Shepherd, Jeffrey and Valerie Sparks, John and Kelli Weinzierl, and Peyton and Linda Yates.

When complete, the Gary L. Thomas Energy Engineering Building will be located adjacent to the Cockrell School's 430,000-square-foot Engineering Education and Research Center (EERC), the central space for Cockrell School student groups and resources and home to Texas Materials Institute. Since its opening in 2017, the EERC has invigorated the Texas Engineering community by breaking down traditional silos and fostering collaborations among the school's departments, reaffirming the blueprint that also guided the design and construction of the new energy building.

"We have seen the EERC bring our community together like never before — encouraging community members to share ideas and collaborate on research in an open, inviting space that feels like a home away from home for students," said Cockrell School Dean Wood. "Thanks to Gary and the many other supporters who have invested in the Gary L. Thomas Energy Engineering Building, we can now apply our vision to a new energy hub that will bring some of the world's best and brightest minds together under one roof in an effort to overcome the energy challenges of tomorrow."

Article by Cockrell School of Engineering Communications.

TMI Creates New TEM Facility

The universe around us is composed of atoms, and their structures and reactions are the fundamental drivers of how materials and organisms behave. A new facility gives researchers at The University of Texas at Austin the ability to explore their projects all the way to that single atom level.

The new Texas Materials Institute-led Electron Microscopy Facility recently opened in the Cockrell School of Engineering, giving researchers cutting-edge tools for deeper analysis of their projects. The facility represents a world-class upgrade to UT's electron microscopy capabilities, bringing it to the forefront of nanotechnology research, according to the leaders of the lab.

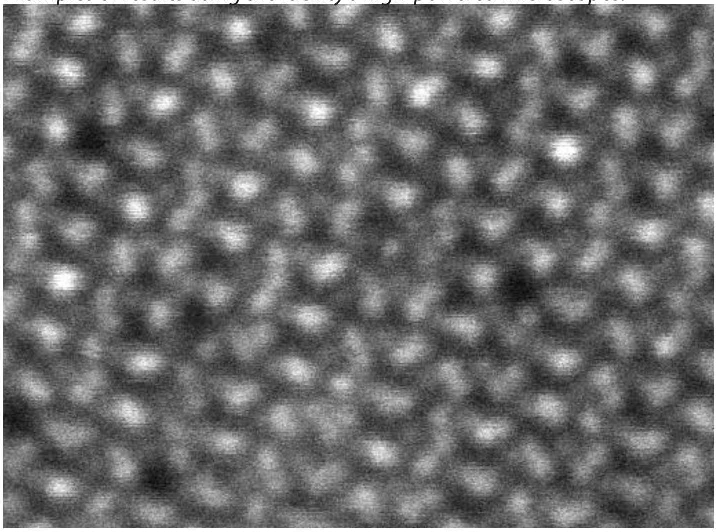
Understanding atomic structure of matter is an important aspect of building new technology. Changes in atom positioning can lead to dramatic shifts in properties that can only be observed and experimented on with powerful electron microscopy tools. This paves the way for new discoveries and applications across all disciplines of science, engineering and medicine.

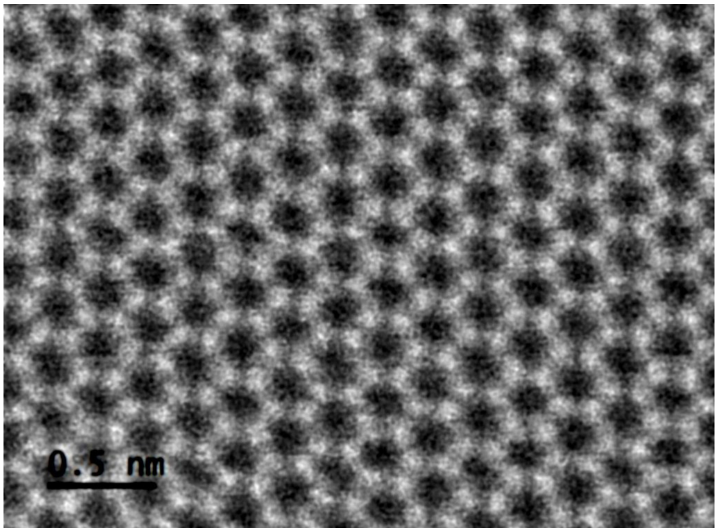
"Electron microscopy gives us the tools to see what we have made and then take this information to improve the chemical synthesis and ultimately produce new devices and technology," said Jamie Warner, director of the new facility and professor in the Walker Department of Mechanical Engineering and the Department of Electrical and Computer Engineering. "This can lead to improvements in energy storage materials, developing new quantum materials, understanding the behavior of exotic semiconducting and superconducting materials and watching chemical reactions as they happen with atomic-level vision."

The facility stands out from others because of its unique capabilities to study fragile samples that

"ELECTRON MICROSCOPY GIVES US THE TOOLS TO SEE WHAT WE HAVE MADE AND THEN TAKE THIS INFORMATION TO IMPROVE THE CHEMICAL SYNTHESIS ADND ULTIMATELY PRODUCE NEW DEVICES AND TECHNOLOGY" - Jamie Warner

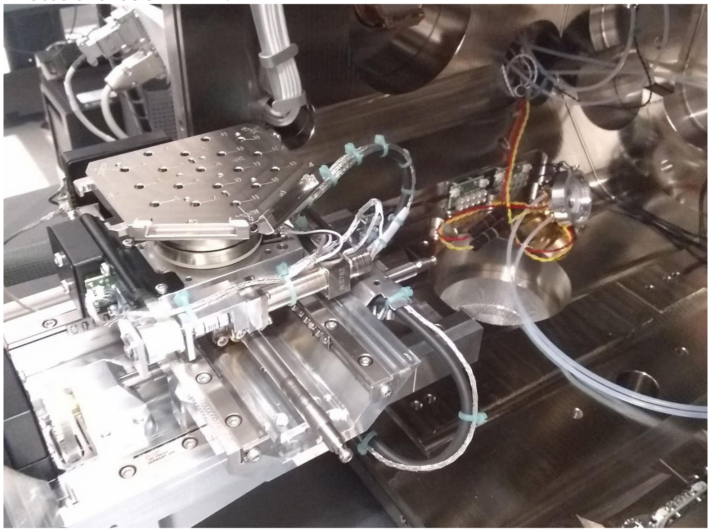
Examples of results using the facility's high-powered microscopes.





"I'M EXCITED TO SEE UT'S COMMITTMENT TO BUILIDNG TOP-NOTCH FACILITIES AND BECOMING A WORL LEADER" - Jamie Warner

Photos of the JOEL-TEM.



that would decompose in air or under the harsh conditions of the electron imaging process, using low-energy electrons and cryogenic sample preparation and imaging methods. A special, ultrafast pixelated detector can record single electrons after they interact with a sample to create atomic-scale images with much lower doses and higher energy than conventional systems, Warner said. These techniques will enhance the ability to create new, ultra-thin 2D materials and soft materials, including polymers and organics.

The centerpiece of the facility is a JEOL neoARM Scanning Transmission Electron Microscope (STEM), which offers the ability to analyze samples at the atomic level. A Focused Ion Beam Scanning Electron Microscope (FIB-SEM) uses gallium ions to cut up materials to create a cross-section for observation and analysis. A second SEM provides additional imaging capabilities.

The microscopes are capable of advanced imaging techniques such as 4D STEM and cryo-imaging that can help researchers see things normal cameras can't capture. One example of a project using these technologies involves freezing batteries, slicing them up using the FIB-SEM and analyzing the samples to learn more about why the batteries failed.

The $10 million facility is located on the ground floor of the Cockrell School's Engineering Education and Research Center and will operate under the Texas Materials Institute, UT's materials science and engineering research center and graduate program.

Warner joined the Cockrell School in January after spending 13 years at Oxford University's Department of Materials, where he led the Nanostructured Materials Group.

"Having worked with some of the top electron microscopy tech in the world at Oxford, I'm excited to see UT's commitment to building top-notch facilities and becoming a world leader," Warner said.

With the ongoing COVID-19 pandemic, classes and trainings at the facility have been postponed. A minimal onsite presence remains, and critical experiments, such as those needed for graduation or grant deadlines, receive priority.

Article by Cockrell School of Engineering Communications.

JEOL NEOARM

Key Features

Voltage: 30 kV, 80 kV, and 200 kV
STEM Resolution: 0.0783 nm at 200 kV, 0.1108 nm at 80 kV and 0.1920 nm at 30 kV
Cold Field Emission (sub 0.3 eV energy resolution)
Energy dispersion X-ray (EDX) detector (0.96 sr collection angle)
Electron energy loss spectroscopy (EELS)
Heating/Biasing Holder
High tilt holder (± 80°)

Coming 2021

Direct electron detector for 4D-STEM
Electrochemical cell in situ holder
Cryo/vacuum transfer system from the FIB to the TEM

All of the images here were acquired directly from the NEOARM at UT Austin.

The NEOARM achieves picometer resolution in scanning transmission electron microscopy (STEM) mode due to the probe spherical aberration correction. One of the first microscopes in the world to be aberration corrected at 30 kV, it allows for imaging of beam sensitive samples, such as 2D materials.

Simultaneous capture of heavy and light elements can be acquired with annular dark field and and enhanced annular bright field (e-ABF) STEM detectors. ADF and e-ABF images are directly interpretable, giving them an advantage over traditional high resolution phase contrasted imaging. In figure 1, Mn/Ni atoms are visible in the ADF image, while O and Li are visible in the e-ABF image.

Elemental, chemical binding states and diffraction maps can also be acquired on the NeoARM. The 100 mm2 solid state EDX detector with a detect solid angle of 0.96 sr allows for fast elemental mapping. The EDX spectrum image (SI) map in figure 2 was acquire with and exposure time of 0.05 s per pixel. Atomic level identification is also possible with this EDX.

For chemical binding state information, the NEOARM is equipped with an EEL spectrometer with a camera for capturing both spectra and energy filtered images. The EELS also has an ultra-fast shutter for simultaneous low and high loss spectra acquisition (known as DualEELS), which allows users to accurately correct for energy drift caused by artifacts. Thus, accurate mapping of peak changes can be acquire. For example, after correcting for energy shifts, the SI in figure 3 shows a change in the Mn oxidation state at the surface.

Diffraction mapping (4D-STEM) will soon be possible with the addition of a hybrid pixelated detector on the NeoARM. With the ability to achieve <0.5Å resolution at low beam currents, direct electron pixelated detectors have revolutionized the field of material science. 4D-STEM can be used for virtual imaging, orientation mapping, strain mapping, and differential phase contrast. Light element scan now be imaged with virtual ADF, BF, and ABF detectors and quantitative phase contrast using ptychography.

For additional information regarding access and training, please contact Dr. Karalee Jarvis, kjarvis@austin.utexas.edu. For information regarding experiment set up, please contact Prof. Jamie Warner, Jamie.Warner@austin.utexas.edu

Article by Karalee Jarvis, TMI Facility Manager.

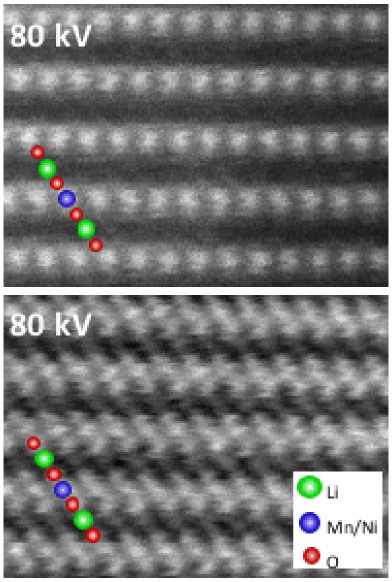


Figure 1. ADF (top) e-ABF (bottom).

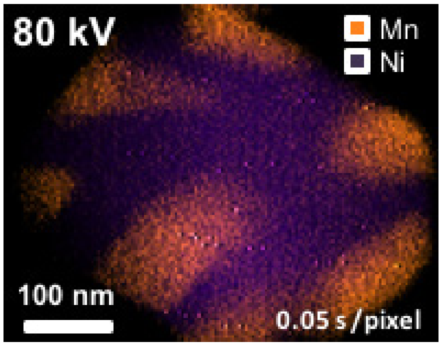


Figure 2. EDX spectrum image map.

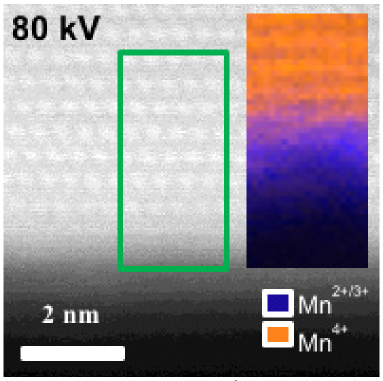


Figure 3. ADF image and EEL SI (inset).

Scios 2 HiVac FIB/SEM

In December 2018, TMI purchased a dual beam system from Thermo-Fisher Scientific, namely a Scios2 HiVac microscope, with NSF funding. The system is installed in the Engineering Education and Research Center, room 0.756 and it is fully operational since the end of July, 2020.

Configured with a pre-aligned NICol electron column (accelerating voltages from 350 eV to 30 kV and beam currents range from 1 to 400 nA), a high-stability Schottky field emitter gun and a variety of detectors and imaging modes, the Scios is the most complete scanning electron microscope for materials science on the UT campus. A total of six detectors are available for imaging, including an Everhart-Thornley secondary electron detector, an ion conversion and electron (ICE) detector, a retractable directional back-scatter detector (DBS), a retractable STEM detector and two in-lens detectors for detecting back-scatter (T1) and secondary electrons (T2). Signal for multiple detectors can be acquired simultaneously with mixing of the signals also possible. The Scios is particularly powerful for low kV imaging which derives from the unique design of the electron column: a flight tube allows for the in-column acceleration of the electron beam with an extra 8 kV followed by deceleration as it exits the column. Moreover, when coupled with beam deceleration (up to 3kV negative bias can be applied to the sample), high resolution images can be obtained at very low kV. For instance, backscatter images, which are traditionally collected at 3-5 kV, can be collected at as low as 500 V and 0.8 nm resolution in STEM.

The Scios dual beam system is used extensively for fabrication and imaging of cross-sections as well as fabrication of ultra-thin lamella for TEM imaging. The gallium ion column offers high beam currents (up to 65 nA) which are instrumental for fast bulk-out of large volumes of material. The versatility and precision of the EasyLift nanomanipulator coupled with the stage flexibility which allows 360° rotation and tilts ranging from -15° to 90° allows for fabrication of both cross-sectional and planar lamella. The low kV beams (down to 500 V) are used for the final polishing of the TEM lamella in order to reduce as much as possible the ion beam-induced damage. This capability is very important in order to fully utilize the high-resolution capability of the recently purchased 30 to 200 kV aberration-corrected JEOL NEO-ARM Scanning/Transmission Electron Microscope (S/TEM), one of the first systems in the US for ultra-high-resolution imaging of beam-sensitive materials.

In addition, the Scios is equipped with a complete elemental analysis suite consisting of a 30 mm window-less energy dispersive spectroscopy (EDS) detector with energy detection down to < 50 eV and an energy resolution of < 126 eV and a Wavelength Dispersive Spectrometer (WDS) with 5 eV resolution for solving overlapping peaks and detecting low concentration elements. Moreover, the microscope is also equipped with a 2.3 megapixels Electron Backscatter Diffraction (EBSD) detector for crystal structure/orientation and phase identification.

Article by Raluca Gearba-Dolocan, TMI Facility Manager.

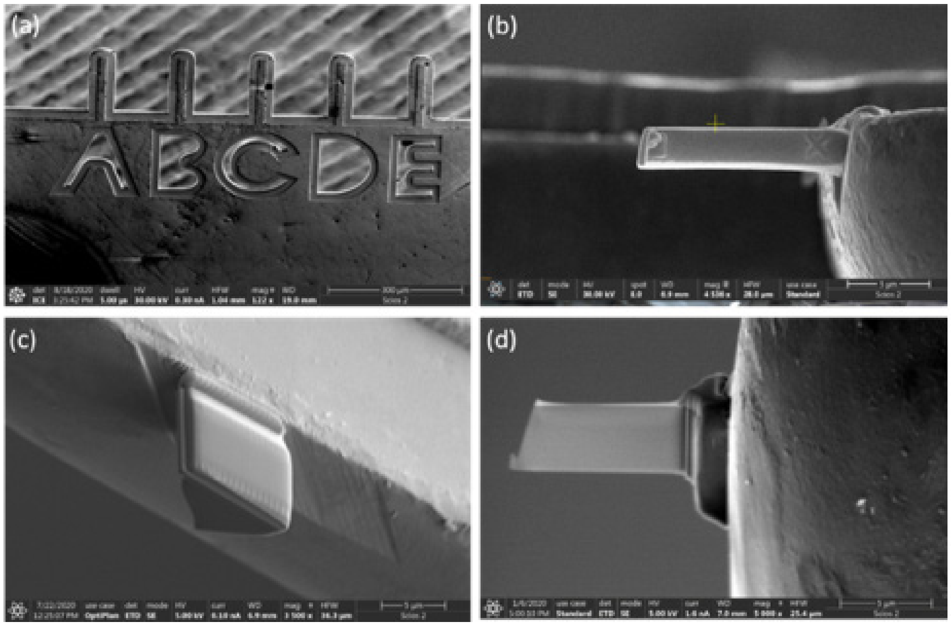


Figure 1. (a) Ion beam image of vertically mounted lift-out grids. Lamella attachment can be with different stage geometries for fabrication of (b) cross-sectional lamella or (c) planar lamella. (d) The lamella is subsequently thinned down to 80 – 100 nm.

Goodenough Materials Innovation Lecture Series

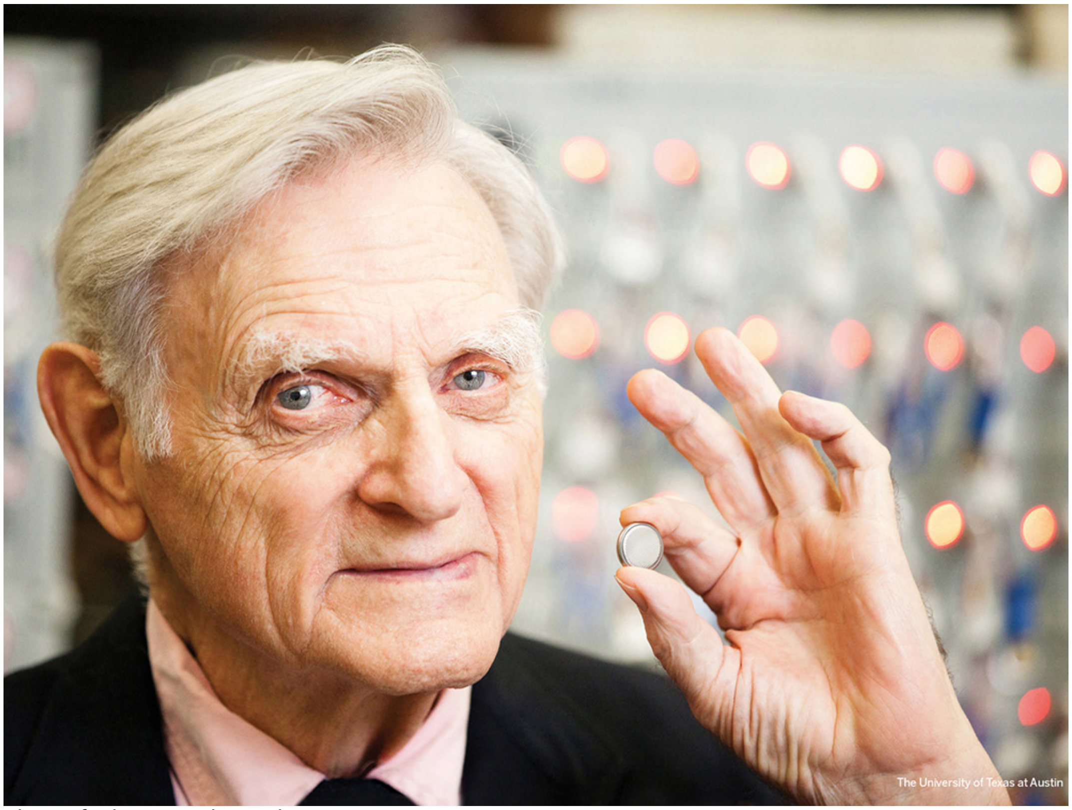


Photo of John B. Goodenough.

"I THANK PROFOUNDLY THE ORGANIZERS AND PARTICIPANTS OF THIS SERIES FOR GIVING ME THIS SPECIAL GIFT." - John B. Goodenough

During the Summer 2020 semester, TMI launched a new lecture series in honor of John B. Goodenough.

Innovation in materials has underpinned many of the technical revolutions in modern society. Advances in achieving precise materials synthesis, in-depth atomic-scale characterization, and predictive modelling have allowed materials innovators to build a bridge between fundamental understanding and real-world technologies. The 2019 Chemistry Nobel Laurette John Goodenough has illustrated this paradigm through seven decades of pioneering work beginning in the 1950s at the interface between chemistry and physics to solve engineering challenges. He has embodied the interdisciplinarity that defines materials research as he developed ceramic magnetic materials for the first random access memory in digital computers, electrode materials for high-energy-density lithium-ion batteries, and ceramic oxide solid electrolytes, to name a few.

In honor of his work, the Goodenough Materials Innovation Lecture (GMIL) series aims to bring leading experimentalists and theorists engaged in the broad field of materials to illustrate the past and present of materials research and thereby create a vision for future innovation in this space. The lecture will serve as a launching pad for both new and experienced minds to solve critical materials challenges as we march forward in the 21st century. It will emphasize the importance and benefits of bringing chemistry, physics, and biology together in the realm of materials innovation to secure a healthy future for humans and the planet.

In the Fall 2019 and Spring 2020 semesters, TMI hosted six seminars as part of our annual seminar series.

FALL 2019

Dr. Reginald M. Penner - University of California, Irvine
Introducing the Virus Bioresistor: The World's Simplest Biosensor

Dr. Xiao Cheng Zeng - University of Nebraska – Lincoln
Computer-Aided Nanomaterial Research and Discovery: Nanoice, Gold-clusters, Superhydrophobicity

Dr. Subhash Singhal - Pacific Northwest National Laboratory
Current Status of Solid Oxide Fuel Cell Technology and Commercialization

Dr. Rosa Espinosa-Marzal - University of Illinois at Urbana Champaign
Examining Soft Matter Interfaces

SPRING 2020

Dr. Fernando Luis de Araujo Machado - Universidad Federal de Pernambuco – Brazil
Diodes for Rectifying Spin-Currents

Dr. Feliciano Giustino - University of Texas at Austin
Discovering Perovskites

Image created by MS&E Ph.D. student, Richard Sim to represent the broad scope of the materials field and what the GMIL lecture series will promote.

With the development of the new lecture series, TMI hosted five seminars in the Summer 2020 semester under the Goodenough Materials Lecture Series.

SUMMER 2020

Dr. John Rogers - Northwestern University
Materials for Transient Bioelectronics

Dr. Chris Van de Walle - University of California, Santa Barbara
Hydrogen Interactions with Materials: From Transistors to Fuel Cells

Dr. Naomi Halas - Rice University
Nanomaterials and Light for Sustainability and Societal Impact

Dr. Ray Baughman - The University of Texas at Dallas
Electrochemical Artificial Muscle Yarns and Textiles that Harvest and Store Environmentally Available Energies

Dr. David Clarke - Harvard University
Materials Challenges for the Next Generation Thermal Barrier Coatings

Moving forward, we have seven scheduled seminars for the upcoming Fall 2020 semester.

FALL 2020

Dr. Harry Atwater - California Institute of Technology
Dr. Chad Mirkin - Northwestern University
Dr. Lynden Archer - Cornell University
Dr. Pablo Jarillo-Herrero - Massachusetts Institute of Technology
Dr. H.-S. Philip Wong - Stanford University
Dr. Jeff Brinker - University of New Mexico
Dr. Jennifer Lewis - Harvard University

Students and faculty attend our Fall 2019 Seminar Series.

Awards and Recognition

STUDENT AWARDS

Aminur Chowdhury – Tanya Hutter Research Group
- Texas Health Catalyst Research4Impact Student Research Competition, Second Prize

Robert Chrostowski – Filippo Mangolini Research Group
- NSF Fellowship

Derek Davies – Desiderio Kovar Research Group
- Harris Marcus Award

Jie Fang – Yuebing Zheng Research Group
- Professional Development Award, Summer 2020

Abhay Gupta – Arumugam Manthiram Research Group
- Dean's Prestigious Fellowship Supplement

Jiaming He – Jianshi Zhou Research Group
- Professional Development Award, Spring 2020

Yun Huang – Donglei Fan Research Group
- Professional Development Award, Fall 2019

Youngsun Kim – Yuebing Zheng Research Group
- Professional Development Award, Summer 2020

Zixuan Li – Filippo Mangolini Research Group
- Professional Development Award, Fall 2019
- Graduate Poster Category at the STLE Tribology Frontiers Conference, Second Place Award
- Cockrell School of Engineering Continuing Fellowship Award

Jingang Li – Yuebing Zheng Research Group
- University Graduate Continuing Fellowship, The Graduate School
- Professional Development Award, Summer 2020
- Ben Streetman Prize

Yifei Liu – Donglei Fan Research Group
- Professional Development Award, Summer 2020

Lezli Matto Gonzalez – Desiderio Kovar Research Group
- Dean's Prestigious Fellowship Supplement
- Fulbright Fellowship

Daniel Sanchez – Nanshu Lu Research Group
- Cullen M. Crain Endowed Scholarship in Engineering, The Graduate School
- Ford Foundation Dissertation Fellowship, National Academy of Sciences, Engineering, and Medicine
- Finalist Scholarship, Point Foundation: The National LGBTQ Scholarship Fund
- GLUE Mentor Award, Women in Engineering Program
- Professional Development Award, Fall 2019
- CU Boulder ACTIVE: Faculty Development and Leadership Intensive

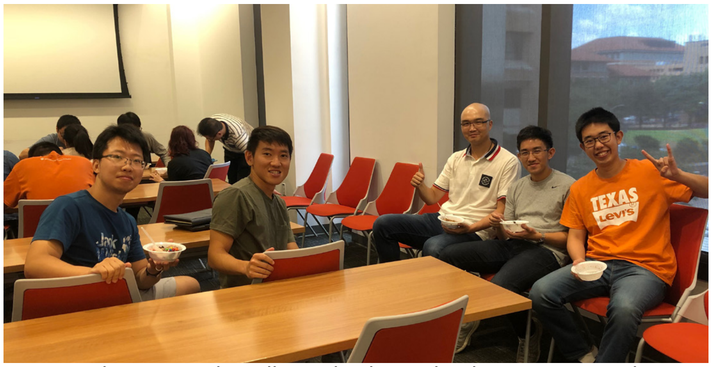
Kevin Scanlan – Arumugam Manthiram Research Group
- DoD NDSEG Fellowship
- Dean's Prestigious Fellowship Supplement

Wen Shi – Guihua Yu Research Group
- Harris Marcus Award

Richard Sim – Arumugam Manthiram Research Group
- NSF Fellowship

Jimmy Wang – Yuebing Zheng Research Group
- Professional Development Award, Fall 2019

Xingyi Zhou – Guihua Yu Research Group
- University Graduate Continuing Fellowship, The Graduate School
- Multifunctional Materials Poster Award, 2019 Materials Research Society (MRS) Fall Meeting
- Professional Development Award, Fall 2019



MS&E students enjoy the Fall 2019 back-to-school Ice Cream Social.

FACULTY AWARDS

Maria Juenger
- Concrete Sustainability award from the American Concrete Institute in 2020

John B. Goodenough
- 2019 Nobel Prize in Chemistry
- 2019 Copley Medal of the Royal Society
- Web of Science Highly Cited Researcher in Chemistry, 2019

Brian Korgel
- Outstanding Achievement in Nanoscience (ACS Division of Colloid & Surface Chemistry), 2020

Jean Incorvia
- NSF Career Award
- IEEE Society Early Career Award

Nanshu Lu
- iCANx/ACS Nano Rising Star Award

Arumugam Manthiram
- Honorary Mechanical Engineer, ME Academy of Distinguished Alumni, UT Austin
- International Battery Association Research Award
- Henry B. Linford Award for Distinguished Teaching, Electrochemical Society
- Elected Academician, World Academy of Ceramics
- Web of Science Highly Cited Researcher in Materials Science and Chemistry, 2019

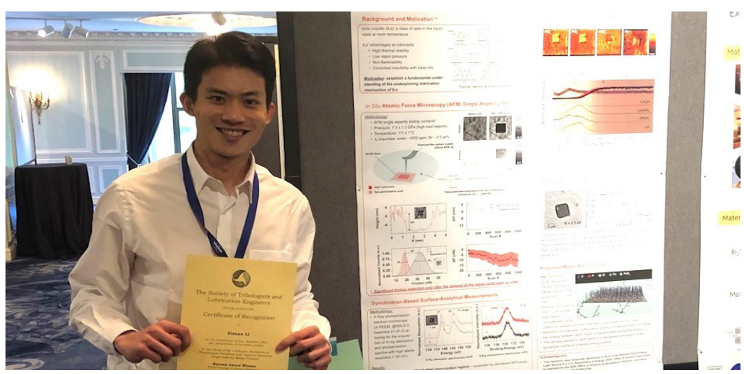
Donald R. Paul
- Top Chair in Engineering of the Year for 2020

Sean Roberts
- Sloan Fellow

Guihua Yu
- Polymer International - IUPAC Award for Creativity in Applied Polymer Science, 2020
- Outstanding Young Scientist by World Laureates Forum, 2020
- Franklin Award for Outstanding Research, Teaching and Service, 2020
- Elected Fellow of Institute of Physics, 2019
- IUPAC Periodic Table of Young Chemists (International Year of Periodic Table), 2019
- Web of Science Highly Cited Researcher in Materials Science, 2019
- Young Innovator Award in Nano Energy, Nano Research (Springer), 2019

Yuebing Zheng
- IEEE NANO Best Poster Award, 2020
- Texas Health Catalyst Award, Dell Medical School, UT Austin, 2020
- University Co-op Research Excellence Award for Best Paper, 2019
- Senior Member of the Optical Society of America, 2019
- J. Mike Walker Faculty Scholarship, Walker Department of Mechanical Engineering, UT Austin, 2019
- Fellow of the Institute of Physics, 2019
- Franklin Award for Outstanding Teaching, Research, and Service, Walker Department of Mechanical Engineering, UT Austin, 2019

MS&E student, Daniel Sanchez, with his GLUE Mentor Award.


MS&E student, Zixuan Li, at the STLE Conference with his poster award.

The University of Texas at Austin
Texas Materials Institute

Materials Science and Engineering
Texas Materials Institute
2501 Speedway, C2201
Austin, TX 78712

To stay up-to-date about Texas Materials Institute and our Materials Science and Engineering Program, visit our website at www.tmi.utexas.edu for updates, news, and events happening on campus.

The University of Texas at Austin
Cockrell School of Engineering

The University of Texas at Austin
College of Natural Sciences