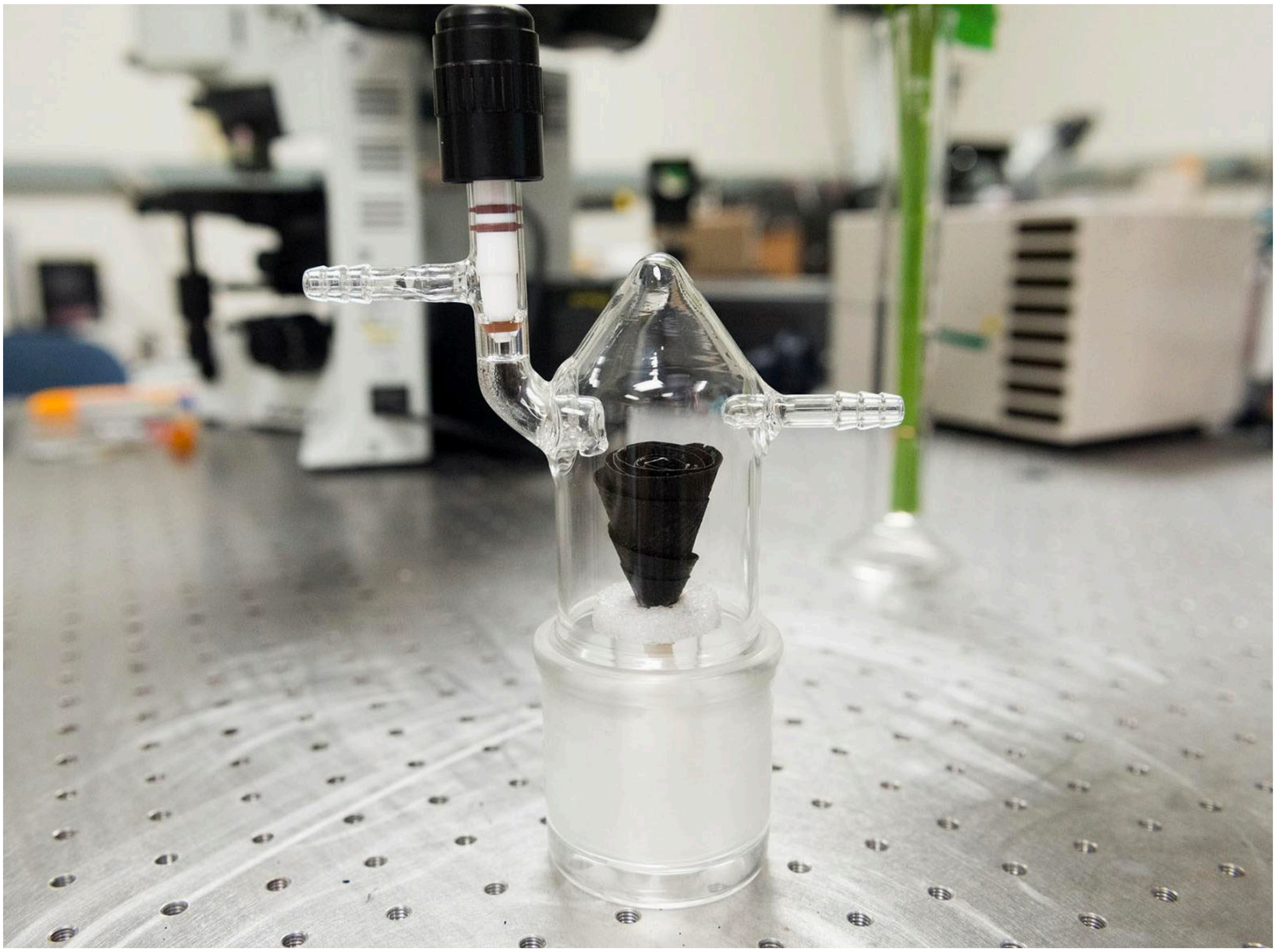
TEXAS MATERIALS INSTITUTE

Materials Science & Engineering

THE UNIVERSITY OF TEXAS AT AUSTIN



Newsletter 2018 -2019

Greetings from the Director

Greetings!

I am pleased to present to you the Materials Science and Engineering Program and Texas Materials Institute (TMI) Newsletter for the 2018 - 2019 academic year. The accomplishments of our students, faculty, and staff reflect the innovation, service, and dedication to education and research at the forefront of our field. I am thrilled to share the wonderful advances we have made during the year.

This year, we had the opportunity to participate in more outreach efforts than ever before. From the annual Girl Day, a K-12 program for students and teachers that feature hands-on STEM activities, to the GREAT Program, which welcomes local Austin Community College students to UT Austin, we hope to inspire future generations to pursue careers in Materials Science and Engineering.

We are constantly striving to expand our materials characterization facilities to advance our mission and provide faculty and students with instrumentation needed for cutting-edge materials research. In the Fall of 2018, we were awarded an NSF Major Research Instrumentation grant to acquire a Scios 2 HiVac, a state-of-the-art electron microscope, from Fisher Scientific for materials research. This equipment is a high-resolution dual focused ion beam (FIB)/scanning electron microscope (SEM) system equipped with an electron-beam lithography (EBL) package for 2D and 3D materials fabrication and characterization.

As we devote ourselves to be a top-tier research unit and graduate program, it is our goal to seek the best and brightest minds in materials research to join our faculty. Our unit is thrilled to announce that we added three new faculty to our program this year and we look forward to seeing the positive impact they will bring to our program.

Our faculty and students had another great year in regards to awards and recognitions, which you will be able to read more about. In addition, our Materials Science and Engineering graduate program brought in a Ph.D. class of 18 students while graduating 8 Ph.D. and 3 M.S. students whom we were proud to prepare for jobs in both industry and academia.

As I look back on another year, I want to thank everyone at TMI for their active role in the success of our research unit and graduate program.

Sincerely,

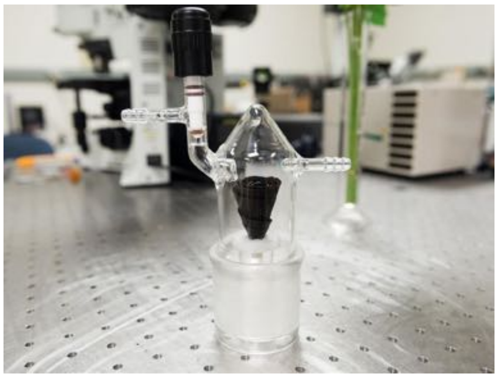
Arumugam Manthiram
TMI Director

IN THIS ISSUE

Editing and Design
Krista Seidel
MS&E Graduate Program Coordinator

Table of Contents

ON THE COVER



The rose may be one of the most iconic symbols of the fragility of love in popular culture, but now the flower could hold more than just symbolic value. A new device for collecting and purifying water, developed at The University of Texas at Austin, was inspired by a rose and, while more engineered than enchanted, is a dramatic improvement on current methods. Each flower-like structure costs less than 2 cents and can produce more than half a gallon of water per hour per square meter.

A team led by associate professor Donglei (Emma) Fan in the Cockrell School of Engineering's Walker Department of Mechanical Engineering developed a new approach to solar steaming for water production – a technique that uses energy from sunlight to separate salt and other impurities from water through evaporation.

In a paper published in the most recent issue of the journal Advanced Materials, the authors outline how an origami rose provided the inspiration for developing a new kind of solar-steaming system made from layered, black paper sheets shaped into petals. Attached to a stem-like tube that collects untreated water from any water source, the 3D rose shape makes it easier for the structure to collect and retain more liquid.

Current solar-steaming technologies are usually expensive, bulky and produce limited results. The team's method uses inexpensive materials that are portable and lightweight. Oh, and it also looks just like a black-petaled rose in a glass jar. Those in the know would more accurately describe it as a portable low-pressure controlled solar-steaming-collection "unisystem." But its resemblance to a flower is no coincidence.

"We were searching for more efficient ways to apply the solar-steaming technique for water production by using black filtered paper coated with a special type of polymer, known as polypyrrole," Fan said. Polypyrrole is a material known for its photothermal properties, meaning it's particularly good at converting solar light into thermal heat.

Fan and her team experimented with a number of different ways to shape the paper to see what was best for achieving optimal water retention levels. They began by placing single, round layers of the coated paper flat on the ground under direct sunlight. The single sheets showed promise as water collectors but not in sufficient amounts. After toying with a few other shapes, Fan was inspired by a book she read in high school. Although not about roses per se, "The Black Tulip" by Alexandre Dumas gave her the idea to try using a flower-like shape, and she discovered the rose to be ideal. Its structure allowed more direct sunlight to hit the photothermic material – with more internal reflections – than other floral shapes and also provided enlarged surface area for water vapor to dissipate from the material.

The device collects water through its stem-like tube – feeding it to the flower-shaped structure on top. It can also collect rain drops coming from above. Water finds its way to the petals where the polypyrrole material coating the flower turns the water into steam. Impurities naturally separate from water when condensed in this way. "We designed the purification-collection unisystem to include a connection point for a low-pressure pump to help condense the water more effectively," said Weigu Li, a Ph.D. candidate in Fan's lab and lead author on the paper. "Once it is condensed, the glass jar is designed to be compact, sturdy and secure for storing clean water." The device removes any contamination from heavy metals and bacteria, and it removes salt from seawater, producing clean water that meets drinking standard requirements set by the World Health Organization.

"Our rational design and low-cost fabrication of 3D origami photothermal materials represents a first-of-its-kind portable low-pressure solar-steaming-collection system," Li said. "This could inspire new paradigms of solar-steaming technologies in clean water production for individuals and homes." *The research was funded by the National Science Foundation and the Welch Foundation.*

Original article from Cockrell School of Engineering Communications.

2018-2019 SEMINAR SERIES

FALL 2018

Dr. Judy Jeevarajan - Underwriter's Laboratories
Safety of Aged Lithiun-ion Cells and Molecules

Dr. Robert Grubbs - California Institute of Technology
Synthesis of Polymers with Controlled Structures- Brush-Block Co-Polymers

Dr. George T. (Rusty) Gray III - Los Alamos National Laboratory
Structure/Property (Constitutive and Dynamic Strength/Damage) Behavior of Additively Manufactured Tantalum

Dr. Steven Zinkle - University of Tennessee
Materials Science for Extreme Environments: Fission and Fusion Energy

Dr. Yongmin Liu - Northeastern University
Chiral Light-matter Interactions: From Chiral Metamaterials to All-optical Switching of Magnetization

Dr. Shu Yang - Northeastern University
Standing up Atomic Thin Nanosheets to Store More Energy Using Soft Forces

SPRING 2019

Dr. Michael McAlpine - University of Minnesota
3D Printing Functional Materials & Devices

Dr. James Batteas - Texas A&M University
Studies of Friction and Mechanochemical Reactivity of 2D Nanomaterials

Dr. James Friend - University of California San Diego
Enabling Neuroinntervention with Microscale Soft Robotics

Dr. Eran Rabani - University of California, Berkeley
The Role of Confinement on Auger Recombination and Multiexciton Generation Processes

Dr. Feng Ding - Ulsan National Institute of Science and Technology, Republic of Korea
Strategies Towards the Synthesis of Wafer Scale Single Crystalline 2D materials—From Theoretical Prediction to Experimental Realization

Dr. Haw Yang - Princeton University
Real-Time 3D Single-Particle Tracking: Spectroscopy, Imaging, and Control

Outreach Efforts

GIRL DAY AT UT AUSTIN

Girl Day at UT Austin, including Introduce a Girl to Engineering Day and the Girl Day STEM Festival, is an annual free event hosted by the Women in Engineering Program (WEP).

Girl Day gives elementary and middle school students a chance to explore STEM through grade-appropriate, hands-on activities hosted by volunteer scientists, engineers, and STEM enthusiasts from over 160 student organizations, research centers, corporate partners, and community organizations. It is specifically designed for girls, but boys are also welcome.

This year TMI facility managers, Dr. Karalee Jarvis and Dr. Raluca Gearba, guided students in exploring the world of atoms, molecules, and crystals. The students discovered how atoms can be arranged in different ways to form crystals and materials with different physical properties (e.g., Diamond vs Graphite). They examined a wide variety of solid objects such as synthetic crystals (e.g., alum crystals), kitchen salt, transistors, and metallic films over a wide range of magnifications. starting with unaided eyes (zero magnification), light microscopes and going over to scanning electron microscopes. Students played with atom model kits and visualized computerized crystal models.

Dr. Raluca Gearba shows students how to use an SEM to image transistors and crystals.

Girl Day attendee participates in an activity demonstrted by TMI.

Girl Day banners in the EER building.

Dr. Karalee Jarvis explains to students how atoms are arranged in a crystal.

HIGHLIGHTS:

- *8,781 K - 8th Grade Registrants: 89% Girls, 33% Latina/ Latino, 9% African American, 13% Asian, 72% from Central Texas, 12% from Greater San Antonio, 8% from Greater Houston, 5% from Dallas/Fort Worth*
- *3,150 (36%) Girl Scouts*
- *29 corporate partners with year with Halliburton, Texas Instruments, BASF and BAE Systems as presenting partners and Cisco Systems, Google Fiber, Intel and State Street as Area Partners*
- *164 companies, non-profits, colleges, student organizations, research groups & community partners including*
- *156 hands-on activities, shows, demonstrations and information areas*
- *1569 high school, college, alumni, corporate and community volunteers*

ALICE IN WONDERLAND AND GREAT PROGRAMS

During the Summer of 2019, TMI participated in two outreach programs designed to connect high school and college students with STEM efforts at UT Austin.

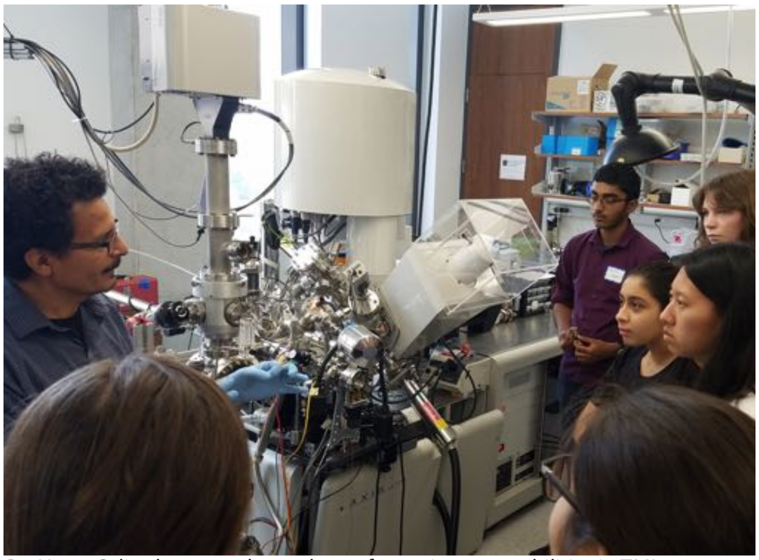
In June 2019, approximately 20 high school students from the "Alice in Wonderland" program visited for demo activities and a tour of our facilities. The "Alice in Wonderland" program, which started back in 2005, is an outreach program within the Department of Physics led by Professor Alexander Demkov. With a pressing concern about the gender imbalance in physics, the goal of this program is to attract women to physics by getting high-school students involved in research over the summer before they make decisions about colleges.

The Alice in Wonderland internship consists of a series of lectures on various topics by UT professors from the Department of Physics and Engineering departments together with facilities and lab tours. These lectures and tours are followed by an actual internship for a total of 80 hours in a research lab of choice.

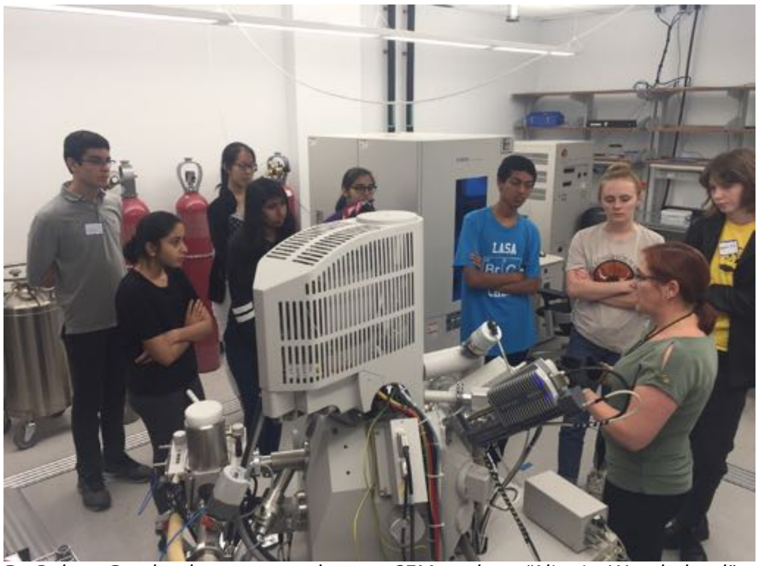
TMI's director, Dr. Arumugam Manthiram, presented a lecture entitled "Chemistry and Batteries" meant to introduce the students to exciting research in the batteries field. The lecture was followed by a tour of the TMI facilities where Dr. Raluca Gearba and Dr. Hugo Celio, both TMI facility managers, showed students how to image battery materials using a Scanning Electron Microscope and an Atomic Force Microscope as well as other techniques used to study the battery materials.

Additionally in July 2019, Dr. Raluca Gearba presented a microscopy seminar to students from the Green Energy at Texas (GREAT) program. The seminar highlighted the cutting edge microscopy techniques in TMI and also included a tour of the microscopy facilities coupled with demo activities. In particular, Dr. Gearba highlighted the capabilities of the Scios 2HiVac microscope recently acquired by TMI using NSF/MRI funding.

The GREAT program is designed to connect Austin Community College (ACC) students with UT Austin researchers from the Department of Chemistry and Chemical Engineering in the area of green energy.



Dr. Hugo Celio shows students the surface science capabilities in TMI.



Dr. Raluca Gearba demonstrates how an SEM works to "Alice in Wonderland" students, while also showing them TMI's electron microscopy facilitites.

GREAT students from ACC on a tour of the TMI microscopy facilities.

TMI Purchases New Electron Microscopy System

In the Fall of 2018, TMI was awarded one of the NSF's Major Research Instrumentation grants for purchasing a state-of-the-art electron microscope for materials research, the Scios 2 HiVac from Fisher Scientific. The Scios 2 HiVac is a high-resolution dual focused ion beam (FIB)/scanning electron microscope (SEM) system equipped with an electron-beam lithography (EBL) package for 2D and 3D materials fabrication and characterization.

The new Scios 2HiVac electron microscope offers innovative electron and ion optics with state-of-the-art patterning control. Specifically, the instrument combines several key features onto a single platform: (i) device fabrication and testing with both ion-beam (~ 3 nm resolution) and e-beam (~ 20 nm resolution) patterning, (ii) high throughput traditional (cross-sectional) and plan-view (lamella parallel to the surface) site-specific thin TEM sample preparation with minimal sample damage, (iii) nano-device fabrication and testing, (iv) gas-chemistry technology for material deposition, and (v) 3D imaging of complex structures with parallel detection of various signals.

The Scios system is equipped with a pre-aligned NICol electron column optimized for high resolution and stability. The source is a Schottky field emitter gun with accelerating voltages from 350 eV to 30 kV and beam currents range from 1 to 400 nA. In addition, the system is equipped with a deceleration mode (20 eV landing energy), which is necessary for imaging non-conductive samples. The ion column is equipped with a field emission focused ion beam with a liquid gallium emitter. The beam voltage ranges from 500 eV to 30 kV with beam currents from 1.5 pA to 65 nA. The column is also equipped with drift-suppression mode, which is important for cross-sectioning/patterning of non-conductive samples. The imaging resolution is 3 nm; however, the finest slice thickness that can be obtained is about 6 nm at 65 nA. These characteristics of the ion column together with the ability to cool down the samples will allow us to prepare beam-sensitive TEM samples with minimum 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 NEOARM Scanning/Transmission Electron Microscope (S/TEM), one of the first systems in the US for ultra-high-resolution imaging of beam-sensitive materials. The microscope is equipped with the AutoTEM capability, an automation software for TEM sample preparation, which allows the users to obtain TEM lamella quickly while minimally to interacting with the instrument.

The system is equipped with a variety of detectors for secondary electrons (Everhart-Thornley, ETD) and ions. The In-lens Trinity detection system with a lower (T1) and an upper (T2) in-lens detectors offers 1 nm resolution at 30 kV and 1.6 nm

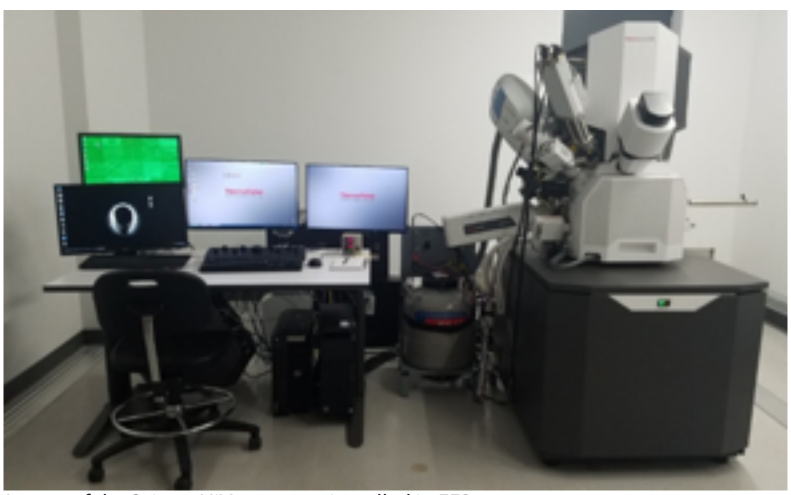
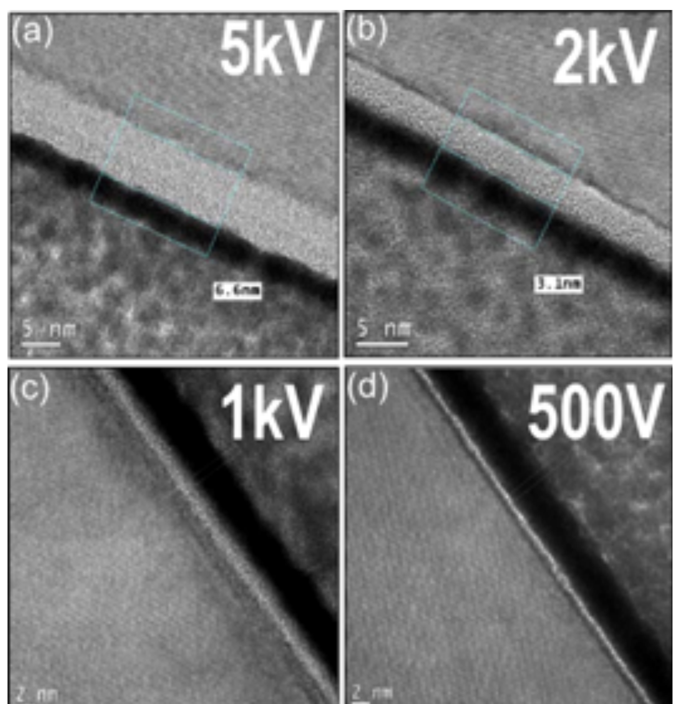
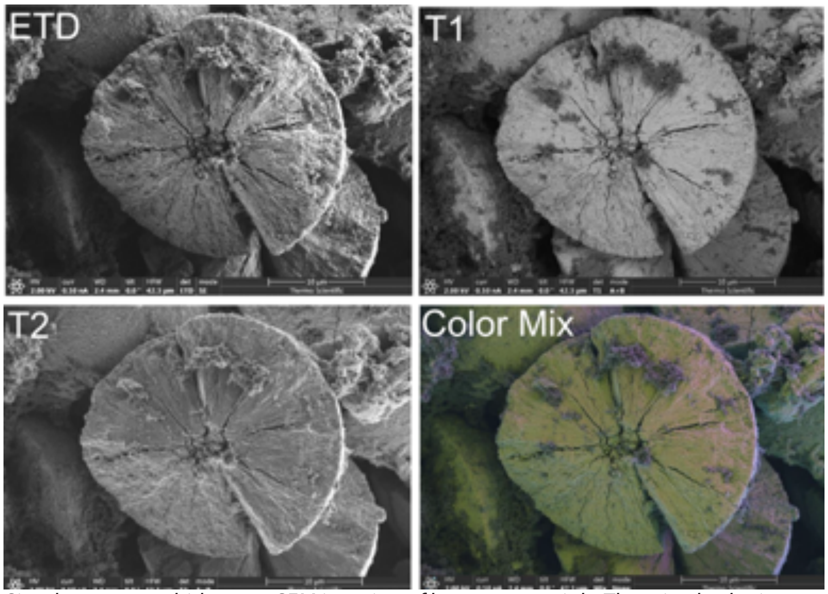


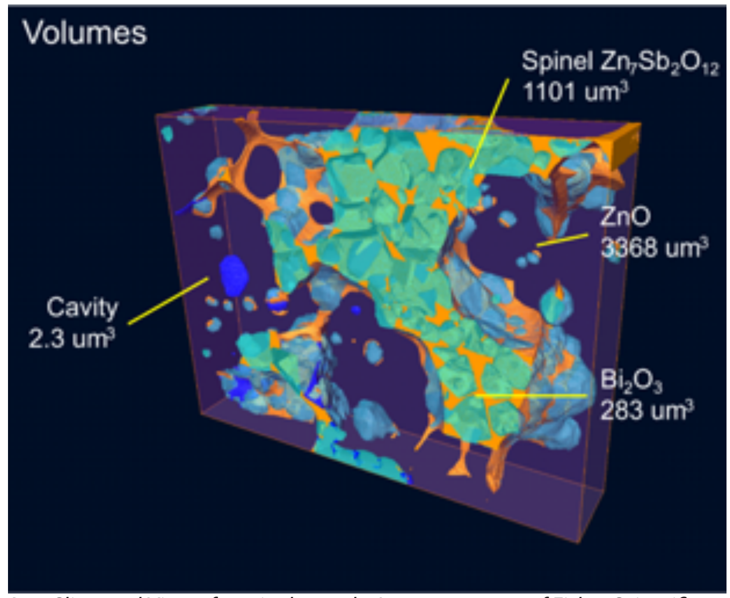
Image of the Scios 2 HiVac system installed in EER 0.756.



Cross-sections of a Si thinned sample cleaner at various KeVs. The damaged layer goes down from (a) ~ 6 nm (b) to ~3 nm, (c) to ~1.5 nm, and (d) finally to ~ 0.7 nm. Image courtesy of Fisher Scientific.



Simultaneous multidetector SEM imaging of battery materials. The mixed color image: ETD signal is magenta, T1 is yellow, and T2 blue. The battery sample was provided by Dr. Manthiram, UT-Austin. Images courtesy of Fisher Scientific.



AutoSlice and View of a spinel sample. Image courtesy of Fisher Scientific.

resolution at 1 kV for optimum working distance. The system is also equipped with two retractable detectors: a directional back-scattering (DBS) detector and a STEM detector. The DBS detector coupled with deceleration mode enables the acquisition of SEM images with enhanced topographic contrast on a variety of samples, such as block-copolymers, photoresists, and composite materials. Signal for multiple detectors can be acquired simultaneously with mixing of the signals also possible.

In addition, the Scios is equipped with a complete elemental analysis suite, 30 mm windowless 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 Electron Backscatter Detector (EBSD) for crystal structure/orientation and phase identification.

The microscope is also equipped with the AutoSlice and View automation software, which will allow imaging and 3D reconstruction of the sliced volume. Simultaneous information can be recorded for every slice. This capability, which is nonexistent at UT Austin, will allow the study of buried morphologies for a variety of materials.

As far as the E-beam lithography capability goes, the finest line that can be patterned with the Scios system is ~ 20 nm. The largest writing field for the Scios at 7 mm working distance is 4 mm for 10 and 30 kV. For most SEMs, including the Scios, the finest features (< 50 nm) are written with a field size of ~ 100 x 100 μm^2. Therefore, it is important to ensure a high accuracy of stitching for large-area pattern fabrication. The system is equipped with the NPGS V9 software package and when the alignment feature in NPGS is used to register to alignment marks, accuracy is typically from 1 : 1000 to 1 : 3000. Therefore, for a 90 μm field of view, the alignment accuracy will typically be from ~ 90 to 30 nm.

Other unique features of the system include the stage, which has 5 motorized-axes (x-y-z-tilt (from -15 to 90 degrees)-rotation) and is equipped with cryogenic capabilities down to -60 °C. The large multi-purpose sample holder can accommodate a variety of samples: 6 X 1/2 inch stubs, 3 x 1/2 inch stubs pre-tilted at 45°, 1 horizontal row holder slot, 1 pre-tilted row holder slot, and 1 clamp holder. These holders will allow for top down as well as tilted specimen and cross-sectional imaging.

The system also features a load-lock for sample transfer into the system's chamber without breaking vacuum, which can be interfaced with TMI's already existing air-free sample transfer of air-sensitive samples from gloveboxes. TMI is also in the process of purchasing an air-free sample transfer from Leica, which will allow the transfer of samples between the Scios and the aberration-corrected TEM via a glovebox.

The microscope is currently in the process of being installed and will be available in the Fall of 2019. We are excited to see the cutting edge work that will come out of this new instrument.

Article by Raluca Gearba-Dolocan, TMI Facilities Manager.

TMI Welcomes New Faculty

TANYA HUTTER

Dr. Tanya Hutter obtained B.Sc. in Chemical Engineering from Ben-Gurion University (2007), M.Sc. in Materials Science and Engineering from Tel-Aviv University (2009) and Ph.D. in Physical Chemistry from the University of Cambridge (2013). Since completing her PhD, Tanya worked as a Senior Teaching Fellow to develop the Doctoral Training Centre for Sensor Technologies and Applications, and as a Research Fellow in Physical Chemistry at the University of Cambridge, having received several prestigious fellowships to develop her independent research.

Tanya's research interests lie in the fields of emerging molecular sensing technologies, nanomaterials, microfabrication, and nanophotonics with applications in environmental and industrial sensing, homeland security and medical diagnostics. Tanya has a track record of successful industrial and clinical collaborations, and her research attracted $1 million of academic and industrial funding. She has published 25 peer-reviewed papers and is an inventor on four patents. In 2016, she was awarded L'Oréal-UNESCO for Women in Science Fellowship UK & Ireland for her scientific achievements.

Tanya is also interested in entrepreneurship, she is a co-founder of two tech startups that develop gas-sensing technology for industrial and air-quality applications and a blood electrolyte test-kit for point-of-care and patient use. Her outreach activities include a children's book to encourage interest in science and co-founding a non-profit organization for inspiring women for pursue a STEM career (both funded by L'Oréal for Women in Science).

DAVID MITLIN

Dr. David Mitlin is a David Allen Cockrell Endowed Professor at Texas Materials Institute and the Walker Department of Mechanical Engineering, The University of Texas at Austin. Prior to that, he was a Professor and General Electric Chair at Clarkson University, and an Assistant, Associate, and full Professor at the University of Alberta.

Dr. Mitlin has published about 150 peer-reviewed journal articles on various aspects of energy storage and conversion materials. His work is cited at near 2000 times per year. Dr. Mitlin holds 5 granted U.S. patents and 9 more pending full applications, with all of them licensed currently or in the past. He has presented 125 invited, keynote, and plenary talks at various international conferences. Dr. Mitlin is an Associate Editor for Sustainable Energy and Fuels, a Royal Society of Chemistry Journal focused on renewables. Dr. Mitlin received a Doctorate in Materials Science from U.C. Berkeley in 2000, M.S. from Penn State in 1996, and B.S. from RPI in 1995. He grew up in upstate NY and in southern CT.

VENKAT SUBRAMANIAN

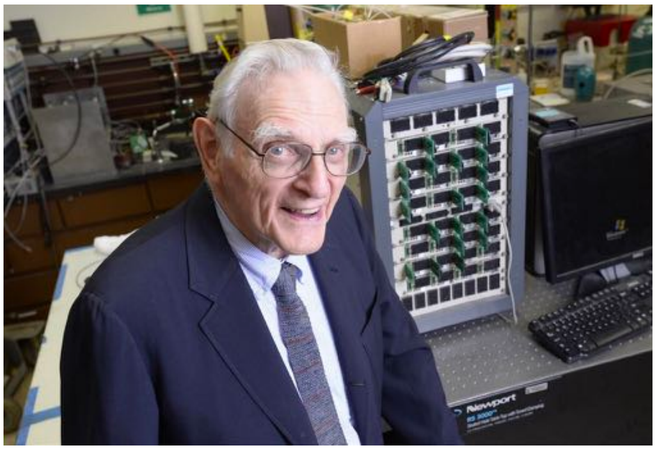
Professor Venkat R. Subramanian received his B.Tech. degree in chemical and electrochemical engineering from the Central Electrochemical Research Institute (CECRI), Karaikudi, India, in 1997 and his Ph.D. degree in chemical engineering from the University of South Carolina, Columbia, SC, in 2001. Professor Subramanian is an elected ECS Fellow, is a past elected chair of the IEEE division of the Electrochemical Society. He is also a past elected technical editor of the Electrochemical Society.

High energy and power batteries are critical for the next generation of clean energy grid and transportation technologies. Professor Subramanian's model and software will make next generation batteries safer, with higher energy storage capacity, recharge faster, and last longer.

His group aims to be the world's leading group in the area of model-based Battery Management System (BMS) and model-based design of current and next-generation energy storage devices. His group has made contributions to the fundamental science of capacity fade (KMC simulation of SEI). His current focus is on applied research funded and driven by multiple industrial sponsors and his entrepreneurial students.

Faculty Awards

JOHN B. GOODENOUGH: COPLEY MEDAL



In Spring 2019, John B. Goodenough, Texas Materials Institute and Materials Science and Enineering program faculty, won the U.K. Royal Society's Copley Medal, thought to be the world's oldest scientific prize. Already a fellow of the Royal Society, Goodenough has been honored for his exceptional contributions to materials science, including his discoveries that led to the invention of the rechargeable lithium-ion batteries used in devices such as laptops and smartphones worldwide.

The Royal Society first awarded the Copley Medal in 1731 — 170 years before the first Nobel Prize — and gives it annually for outstanding achievements in scientific research. As the 2019 recipient, Goodenough joins an elite group of past awardees including Benjamin Franklin, Charles Darwin, Louis Pasteur, Albert Einstein, and Dorothy Hodgkin. "Professor Goodenough has a rich legacy of contributions to materials science in both a fundamental capacity, with his defining work on magnetism, to a widely applicable one, with his ever-advancing work on batteries, including those powering the smartphone in your very pocket," said Venki Ramakrishnan, president of the Royal Society. "The Royal Society is delighted to recognize his achievements with the Copley Medal, our most prestigious prize."

Goodenough, who is known throughout the UT Austin and global scientific communities for his unique laugh and jovial nature, spent 10 years as head of the Inorganic Chemistry Laboratory at the University of Oxford before coming to UT Austin in 1986. As the current holder of the Virginia H. Cockrell Centennial Chair in Engineering at UT Austin, Goodenough continues to work to develop next-generation battery technologies that will advance society. Innovations in battery technology, such as the lithium-ion technology, helped liberate society from its reliance on cables. "Words are not sufficient to express my appreciation for this award," said Goodenough. "My years at Oxford were transformative for me, and I thank especially those who had the imagination to invite a U.S. nonacademic physicist to come to England to be a professor and head of the Oxford Inorganic Chemistry Laboratory."

After serving in the U.S. Army during World War II, Goodenough received a Ph.D. from the University of Chicago before starting his research career in 1952 at the Massachusetts Institute of Technology's Lincoln Laboratory. At MIT, he was part of a team that developed random-access magnetic memory (RAM) — a technology still used today in digital computing. He then went on to Oxford, where he focused on the implementation of oxide as a potential cathode material for batteries — pioneering work that was to form the basis for the first commercial lithium-ion battery. In 1986, he accepted a position at UT Austin and has remained on the faculty in the Cockrell School of Engineering ever since.

Original article from Cockrell School of Engineering Communications

FACULTY AWARDS

Deji Akinwande
- Fulbright Specialist Fellow, Department of State

Roger Bonnecaze
- Elected Fellow of The Society of Rheology

Maria Juenger
- American Concrete Institute, Board of Directors

Desiderio Kovar
- Inducted into UT Austin's Academy of Distinguished Teachers

Delia Milliron
- 2019 ACS Inorganic Nanoscience Award

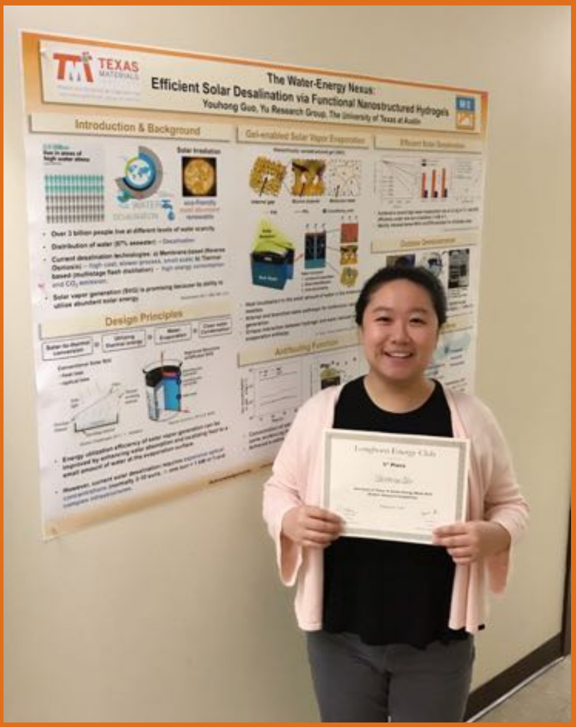
Nicholas A. Peppas
- Herman Mark Award, Polymer Science, American Chemical Society
- Honorary Doctorate, University of Santiago de Compostela, Spain
- Honorary Doctorate, University of Thessaloniki, Greece
- Elected Fellow, ACS Polymeric Materials Science
and Engineering Division
- Elected Fellow, ACS Industrial & Engineering Chemistry Division
- Adam Yarmolinsky Award for Exceptional Contributions, National Academy of Medicine
- Distinguished Pharmaceutical Scientist Award, AAPS, Washington, DC
- Elected to the Chinese Academy of Engineering
- Elected Honorary Professor, Beihang University, Beijing
- Deputy Editor, Science Advances, AAAS/Science

Sean T. Roberts
- Awarded W. M. Keck Foundation Grant

Guihua Yu
- Named IUPAC Periodic Table of Young Chemists

Yuebing Zheng
- 2019 Senior Member of the Optical Society of America
- 2019 Fellow of the Institute of Physics
- 2018 Fellow of the Royal Society of Chemistry
- 2018 Materials Today Rising Star Award, Elsevier Ltd

MS&E Student Spotlight



YOUHONG GUO

Earlier this year TMI and the MS&E Graduate Program were proud to announce that our current Ph.D. candidate Youhong Guo was awarded first place for the presentation of her research poster during UT Austin 2019 Energy Week. Youhong took home this top honor in the Environmental Sustainability category at the Student Research Poster Competition hosted by Longhorn Energy Club.

UT Energy Week, which is now in its fifth year, is organized by the student-run Longhorn Energy Club in collaboration with the university's Energy Institute, and is supported by the KBH Center for Energy, Law & Business, and the McCombs Energy Initiative, along with schools and colleges engaged in energy-related research across the UT campus. To promote the development of energy research in the academic community, UT Energy Week allows for full-time undergraduate and graduate students to participate in the interdisciplinary research poster competition.

Youhong is a part of Professor Guihua Yu's research group.

KATE RADER & EMILY BRADY

MS&E Ph.D. candidates Kate Rader and Emily Brady were given the Outstanding Poster Award in the 2019 TMS (The Minerals, Metals & Materials Society) Baldesmithing Competition. This competition was held at the 2019 TMS Annual Meeting in San Antonio.

The TMS Bladesmithing program makes such concepts as heat transfer, coke combustion, forging, welding, and quenching come to life for university students majoring in a minerals, metals, or materials discipline. Every two years, teams of university students from around the world compete to produce a blade by hand hammering or trip hammer forging. In alternative years, students have the opportunity to present their current work on bladesmithing topics at the TMS Bladesmithing Symposium, also held at the TMS Annual Meeting & Exhibition.

Kate and Emily are both members of Professor Eric Taleff's research group.

MS&E Student Awards and Graduates

STUDENT AWARDS

Emily Brady (Taleff Research Group)
- Spring 2019 Professional Development Award, The Graduate School
- 2019 TMS Bladesmithing Competition: Outstanding Poster

Abhay Gupta (Manthiram Research Group)
- Dean's Prestigious Fellowship Supplement, The Graduate School

Youhong guo (G. Yu Research Group)
- UT Austin 2019 Energy Week Student Research Poster Competition, First place: Environmental Sustainability category

Youngsun Kim (Zheng Research Group)
- 2018 Kwanjeong Educational Foundation Fellowship

Jingang Li (Zheng Research Group)
- Summer 2019 Professional Development Award, The Graduate School

Zexi Liang (Fan Research Group)
- University Graduate Continuing Fellowship, The Graduate School
- Fall 2018 Professional Development Award, The Graduate School

Yifei Liu (Fan Research Group)
- Harris L. Marcus Graduate Fellowship in MS&E

Jeremiah McCallister (Kovar Research Group)
- Harris L. Marcus Graduate Fellowship in MS&E

Kate Rader (Taleff Research Group)
- 2019 TMS Bladesmithing Competition: Outstanding Poster
- University Graduate Continuing Fellowship, The Graduate School
- Elected 2019-2020 Chair, Mechanical Engineering Graduate Student Board

Rohit Unni (Zheng Research Group)
- Cockrell School of Engineering Fellowship, 2018

Kang Yu (Liu Research Group)
- Fall 2018 Professional Development Award, The Graduate School

CONGRATULATIONS TO OUR 2018-2019 GRADUATES!

FALL 2018

Bharath Bangalore Rajeeva, Ph.D.
Plasmon-Mediated Patterning of Nanoparticles and Biomolecules for Functional Nano-Devices
Supervisor: Dr. Yuebing Zheng

Behzad Changalvaie, M.S.
Biodegradablel Nir-Active Contrast Agents With Amplifying Photoacoustic Effect For Cancer Theranostics
Supervisor: Dr. Keith Johnston

Pauline Han, Ph.D.
Advanced High-sulfur-loading, Highly-reversible Cathode Design for Lithium-sulfur Batteries
Supervisor: Dr. Arumugam Manthiram

Sean Sullivan, Ph.D.
Nonequilibrium Heat and Spin Transport in Materials with Long Carrier Relaxation Lengths
Supervisor: Dr. Li Shi

Kang Yu, Ph.D.
Understanding PEMFCs by 3D-Identical Location TEM and EELS"
Supervisor: Dr. Yuanyue Liu

SPRING 2019

Soham Agarwal, M.S.
Metal Organic Framework-derived Oxygen Reduction Reaction (ORR) and Oxygen Evolution Reaction (OER) Catalysts
Supervisor: Dr. Arumugam Manthiram

Martha Gross, Ph.D.
Development of Polysulfide Battery Systems with Low-cost Active Materials and Solid Electrolyte Separators
Supervisor: Dr. Arumugam Manthiram

David Leigh, Ph.D.
Improved Process Stability and Ductility in Laser Sintered Polyamide
Supervisor: Dr. David Bourell

SUMMER 2019

Xiaolei Peng, Ph.D.
Optothermal Manipulation of Colloidal Particles and Biological Objects
Supervisor: Dr. Yuebing Zheng

Richard Roberts, M.S.
Optical and Vibrational Properties of Low-Symmetry Two-Dimensional Materials Under Compressive Strain
Supervisor: Dr. Deji Akinwande

Yu Zhu, Ph.D.
Intercalation Chemistry and Charge Storage in Solution-Processed Layered MOPO4 (M = V, Nb) Hydrates
Supervisor: Dr. Guihua Yu

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