

TEAM **M** MSE

Have a great summer!

This will be our last issue of the 2020-21 school year. In this pre-hiatus issue, we share some research and faculty news, take a look at more capstone design projects as well as last week's outreach event, and give you an update on the cicada invasion in Ann Arbor (which is projected to be Michigan's epicenter). Creepy bugs aside, have a fantastic and relaxing summer and we look forward to seeing you IN PERSON in the fall! (woohoo!) Team MSE will begin publishing again in late August.

Questions, comments or ideas for TeamMSE? Contact Kristen at krisfres@umich.edu.

We'd love to hear from you!



Campus COVID Status

Changes in U-M mask/distancing policies expected soon

The university is currently deciding how all of the recent changes in the State of Michigan and CDC guidelines on gathering sizes, distancing and face coverings will impact U-M's policies. Look for new campus masking and distancing policy guidelines in the coming weeks.

Got your shot? Don't forget to let U-M know.

More than 13,600 students have reported their [vaccination information via Wolverine Access](#). Please continue to report your vaccine status. Fully vaccinated students will be granted an exemption from mandatory testing requirements for spring/summer terms and beyond.

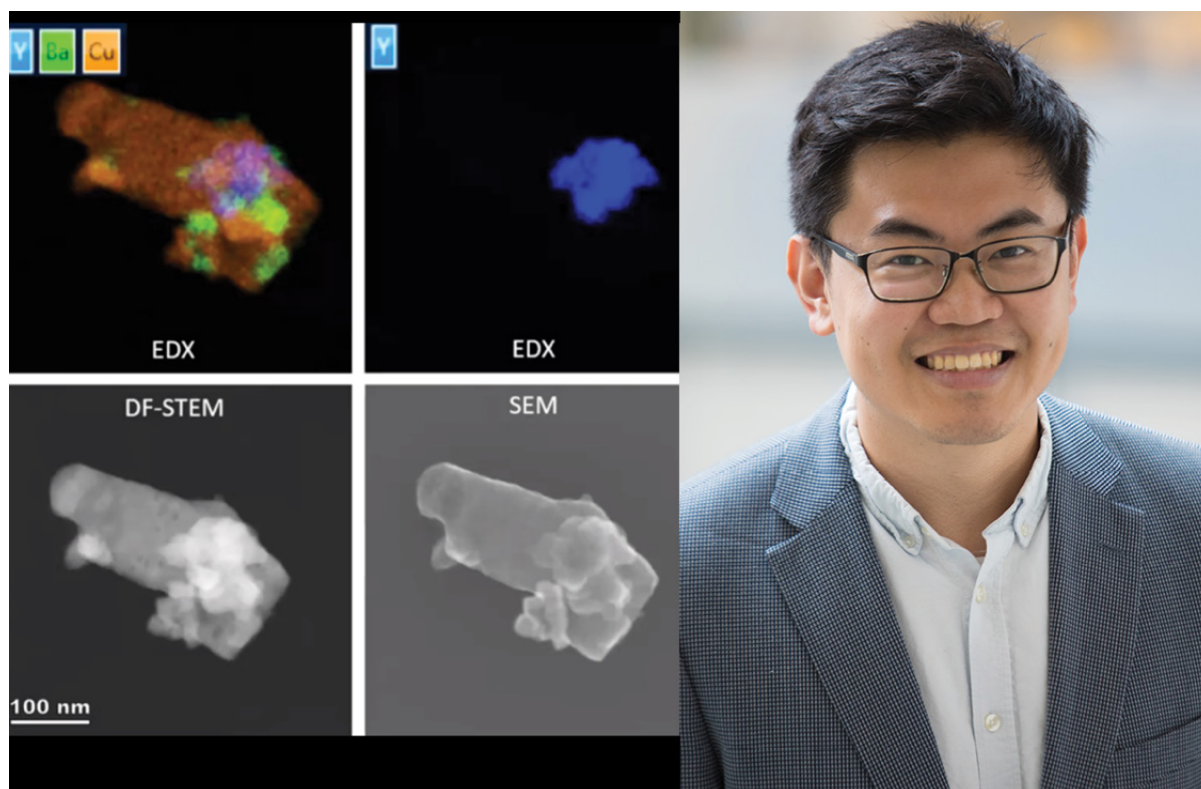
The Big House will return to FULL capacity in the fall!

Last week Michigan Governor announced that as of July 1, all indoor and outdoor capacity limits will be eliminated, thereby clearing the path for athletic events to return to full capacity beginning in the fall. This includes Michigan Stadium. Future public health guidelines may require changes, but for now, the anticipation is for fans at all Wolverine sporting events this fall. Go Blue!

[Click here for U-M's COVID-19 Dashboard](#)

Research Highlights

From the Sun group: Accelerating the ceramic synthesis of a classic semiconductor



The Sun group is leading an international team in developing a new computational model to design ceramic reactions, which can be broadly applied to accelerate the manufacturing and development of functional

materials. [Read more.](#)

Faculty News & Recognition

MSE faculty promotions recently announced

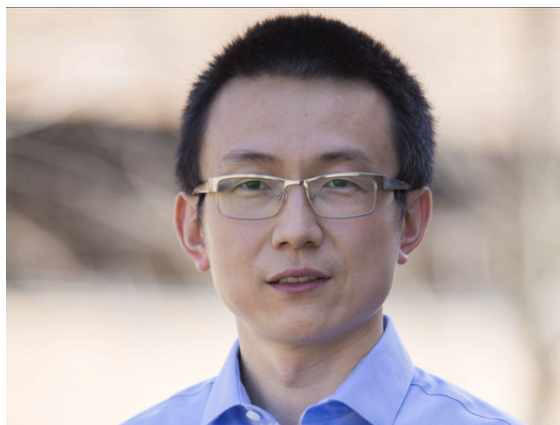


The U-M Board of Regents on Thursday approved the promotion of **Anish Tuteja** to Professor of Materials Science and Engineering, with tenure.

Congratulations, Anish!

The U-M Board of Regents on Thursday approved the promotion of **Liang Qi** to Associate Professor of Materials Science and Engineering, with tenure.

Congratulations, Liang!



Student News

Final Analysis: MSE 482 senior capstone design projects - PART II

Today we present two more of the 2021 MSE 482 senior capstone design projects: the projects sponsored by **Apple** and **GM**.

Project title: Anodizable Die Cast Aluminum Alloy

Project sponsor: Apple

Team members: Ashton Doyle, Nathan Jarski, Harrison Price, Claudia Sandoval, Alex Shaw, Luke Sloan

Project goals:

Current production methods for many Apple products involves the machining of aluminum alloy extrusions to achieve their demanding performance and cosmetic requirements. This results in scrap that would need to be remelted in order to be formed into a useful shape. The hope is that a die casting process could reduce the amount of scrap if the aluminum alloy is cast into a shape similar to the final design with minimal machining. Therefore, the goal of the project was to select an aluminum alloy that could be die cast into a shape reasonably close to the final design and could be anodized resulting in a smooth surface finish and able to be dyed to a variety of colors. The overall appearance and feel of the alloy is very important because it is iconic to the design of Apple's aluminum products. Secondary objectives were to make the alloy have sufficient hardness and mechanical properties to withstand everyday wear and tear.

Most enjoyable part of the project:

Conducting literature research to understand how aluminum alloying elements affect the die castability and anodizability of the alloy. Literature research was also able to explain interesting observations we made with our data, such as how sufficient magnesium concentrations resulted in a much thicker anodization layer and why alloying elements are typically detrimental to a smooth surface finish.

Most challenging aspect of the project:

The most challenging aspect was balancing the two main design requirements: anodizability and die castability. Anodization works best with pure aluminum because non-aluminum elements introduce defects in the oxide layer. However, die cast alloys typically have sufficient alloying elements to lower their processing temperatures, increase their fluidity, and make their solidification more uniform. Therefore, determination of the proper alloy to use generally

became a tradeoff between anodizability and die castability. Another difficult aspect was simply coordinating with different groups to schedule lab time and to determine what equipment was available to use for assessing alloys.

Overall lessons learned:

The biggest lesson we learned was how important understanding your resources plays into designing a product. We spent a significant amount of time reaching out to various U-M departments and aluminum alloy companies to determine what kinds of testing would be feasible to conduct. We then shaped our project around the processes that were available to us.

Additional observations from instructor Yiyang Li: The Apple project aimed to solve an extremely difficult problem with significant economic and environmental impacts. The team proposed a few interesting directions that can be explored. I was very happy with their final report. It seems like they really understood the materials science behind manufacturing processes like casting and anodization. We are extremely grateful that Apple was able to show our students some of the materials science challenges that goes into the consumer electronics products that we use every day.



Pictures of the tested alloys of 319, 518, 713, and 6061 (a baseline alloy similar to what Apple currently uses).

The metal blocks are images of our anodized samples (bottom half is the anodized portion). We tailored

the current density and time to try to grow a 10 μm anodized layer. The SEM images of alloys show the extent to which non-aluminum phases are present in the alloys. With 6061 being the most uniform, the anodization surface of 319 appears to be the least uniform, and 518 and 713 are both somewhat uniform but still have some non-uniformity from the presence of intermetallics. 6061 was so much more uniform due to minimal alloying elements, but it is very difficult to die cast.

Project title: Increasing Draw Depth of a Pouch Cell Composite Laminate by Continuous Draw Testing and FEA Analysis

Project sponsor: GM

Team members: Charlie Donahue, Wes Fermanich, Dhruv Tatke, Richelle Wilson, Zane Woerner

Project goals:

The overall goal of this project was to improve the energy density of the lithium-ion pouch cells for usage in electric vehicles thereby increasing the potential range of the vehicle. Specifically, this project investigated the mechanical performance of the composite laminate material used as the outer pouch layer for these cells. Being able to draw the laminate out further leads to being able to use the same amount of laminate material for a larger cell. We laid out the framework for an in-depth finite element analysis of the laminate forming process and investigated the drawing properties of multiple laminate materials with the construction of a homemade testing setup.

Most enjoyable part of the project:

The freedom our team was given to be able to address the problem which allowed us to come up with solutions that were not expected from us when we were initially given the project.

Most challenging aspect:

Properly assessing just how productive we would be able to be throughout the semester. We were overly optimistic at the beginning of the project and underestimated how much COVID restrictions and virtual work impact our productivity.

Overall lessons learned:

- Even a seemingly basic process can prove to be incredibly complex when looking at all the factors that can impact the outcome. Truly understanding even a simple process requires a great deal of study and data collection.
- Being adaptable is incredibly important, especially during COVID times because things will often take longer than expected.
- Simply reaching out and asking a question always pays off! People are more than likely to be willing to help or offer advice if you reach out.

From Yiyang Li: The GM team dealt with a variety of challenges, but I think they were ultimately able to prevail because their team was very cohesive and were able to rely on each other. I once recommended that they drop a challenging component of their project, but they didn't listen to me and ended up solving that problem. They were a very hardworking team, too: I recall seeing them in the Van Vlack Lab the last week of classes working to test their final design.



Members of the GM group (Wes Fermanich, Charlie Donahue, Dhruv Tatke and Richelle Wilson) talk about their project with Assistant Professor Yiyang Li.

Outreach event in pictures

Last week, on May 19 and 20, MSE graduate students led an outreach event, "Metal Thermodynamics: Learn AI About It," (pun intended) with 10th and 11th graders at

Renaissance High School in Detroit. The lesson did a dive into fundamental concepts of thermodynamics such as enthalpy, entropy, and phases in materials through a live demonstration of aluminum (Al) metal casting. MSE volunteers guided the students through calculating the latent heat of fusion of the aluminum from live temperature data collected from the casting.

In addition to teaching thermodynamics, MSE students also fielded questions about transitioning to college. "They thanked us for addressing some of the kids' questions about what the transition from high school to college is like, and advice for their academics when they get to college," commented MSE PhD student Joshua Cooper.

Below are some photos from last Wednesday's lesson. [View full photo gallery here.](#)



Geordie Lindemann, Joshua Cooper and Paul Chao makes sure everything is technically set before the class begins.



Joshua Cooper begins the lesson on the fundamentals of thermodynamics in materials.



Paul Chao pours liquid aluminum into a crucible to measure its temperature as it solidifies.



Geordie Lindemann (above and below) gives students a close-up view of the aluminum as it cools while Jon Goettsch looks on.



DEI News





Thousands of tributes, services and protests will be taking place today around the country and world to mark the tragic and horrific killing of George Floyd one year ago today, May 25, 2020.

THE COVID-19 CRISIS IN INDIA

Projections, Data Needs, and Relief Efforts

A VIRTUAL PANEL DISCUSSION WITH

Wednesday, May 26
12:00 p.m. - 1:00 p.m.

[CLICK HERE TO REGISTER](#)



Dr. Bhramar Mukherjee



Dr. Krishnan Raghavendran



**Moderator
Dr. Malini Raghavan**

Hosted by Advancing Asians in Leadership Task Force, the Office for Health Equity and Inclusion, and Organizational Learning

The COVID-19 Crisis in India:

Projections, Data Needs, and Relief Efforts

Wednesday, May 26, from 12:00 p.m. – 1:00 p.m.

The discussion will focus on the current surge of COVID-19 infections in India, disease trajectories for the coming months, data needs, vaccination outlook, field hospitals, relief work and telemedicine being coordinated by U-M physicians.

Hosted by Advancing Asians in Leadership Task Force, the Office for Health Equity and Inclusion, and Organizational Learning.

A Panel Discussion with:

Dr. Bhramar Mukherjee, John D. Kalbfleisch Collegiate Professor and Chair of Biostatistics; Professor of Epidemiology and Global Public Health, University of Michigan School of Public Health; Associate Director for Quantitative Data Sciences, The University of Michigan Rogel Cancer Center; Faculty Member, Center for South Asian Studies.

Dr. Krishnan Raghavendran, Professor of Surgery and the Division Chief of Acute Care Surgery, Section of General Surgery, Michigan Medicine. Dr. Raghavendran serves a lead physician for the University of Michigan-India collaborative, and Faculty Member for the Center for South Asian Studies.

Moderator:

Dr. Malini Raghavan, Professor of Microbiology and Immunology and Acting Director, Graduate Program in Immunology, Michigan Medicine.

Register in advance for this webinar:

https://umich.zoom.us/webinar/register/WN_hbznMwS-SiSbQjdyVUXiKg

After registering, you will receive a confirmation email containing information about joining the webinar.

Cicada sightings in A2: They're heeeere!



The first of what is expected to be millions of cicadas have started emerging in Ann Arbor -- the state's epicenter of the insect invasion, which happens only every 17 years. Ann Arbor's urban forestry and natural resources planner, Tiffany Giacobazzi, said in a recent [MLive article](#), "We could see several hundred thousand to a million insects per acre." The peak of the droning noise the cicadas produce will be in mid-June. Click [here](#) to learn more about Brood X cicadas and for a state-by-state look at where they are expected to appear.

HAVE A GREAT Summer



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