

Research Experience

EV Battery Pack Thermal Runaway & Ejecta Mitigation / General Motors Global R&D collaboration 09/2025 – present

- Developed a package-level thermal-runaway CFD model, predicted product gas and particle transport, retention, and venting, evaluating local overheating, secondary ignition, and thermal propagation risks.
- Led ejected particle characterization with nanoindentation and XPS analyses to quantify the chemical composition and mechanical properties of ejected particles.
- Proposed an integrated mitigation concept for thermal management, particle capture, and hazardous-gas treatment to support battery safety design.
- Quantified that ~75% of released heat remained inside the package, including ~48% absorbed by the enclosure and ~21% stored in trapped particles, identifying key sources of post-event thermal risk.

Oscillating Heat Pipe Heat Transfer & CFD Validation / NASA Jet Propulsion Laboratory collaboration 05/2024 - 01/2025

- Built a 3D two-phase CFD model of gas-liquid motion and liquid-film formation in square microchannels, including surface tension, wall wetting, film evaporation, and laminar-turbulent transition.
- Quantified circumferential liquid-film nonuniformity; improved heat transfer by 72% under enhanced wetting, increased liquid convection by ~24%, and predicted ~20% higher thermal conductance than circular channels at high heat flux.
- Results support thermal-management design for spacecraft, electronics, data centers, and other high-heat-flux systems.

Water Ingress in Industrial Thermal Pipe Insulation / Aspen Aerogels collaboration 08/2022 – 01/2025

- Co-designed, assembled, and commissioned a high-temperature pipe-insulation test rig integrating hot-oil circulation, controlled water injection/immersion, sealed jacketing, multi-point thermometry, and data acquisition.
- Led multiphase CFD simulation and experimental validation across dry, immersed, and drain-drying conditions, modeling conduction, liquid flow, vapor diffusion, capillary pressure, and phase change; identified small assembly gaps and convection as drivers of heat loss up to ~10× conduction.
- Revealed a low-saturation heat-pipe effect in which small moisture content increased local heat loss by 4-7×; predicted condensate migration rates can reach 1-2 m/day, informing energy-efficiency and corrosion-under-insulation design.

Thermochemical Heat-Storage Materials / General Motors Global R&D collaboration 11/2024 – 07/2026

- Developed hot-gas-flow experiments using thermochemical materials (TCM) and CFD simulations to evaluate their performance for battery thermal-runaway cooling and passive thermal protection.
- Used X-ray imaging and DFT to identify particle porosity, agglomeration, and chemical-bond evolution mechanisms, providing design guidance for thermal-runaway cooling media and vent structures.

Teaching Experience

Graduate Student Instructor, Heat and Mass Transfer / University of Michigan

- Led discussion and review sessions for ~200 students; achieved 95% student satisfaction and over 1,000 cumulative hours of lecture-recording watch time.

Skills

Simulation: CFD, ANSYS Fluent, multiphase flow, porous media, particle simulation (DPM), VASP, Quantum ESPRESSO

Programming: C/C++, Python, MATLAB, Java, Linux.

Hardware: DAQ, sensors, XRM, optical microscopy, nanoindentation, microcontrollers, Arduino, material polishing.

Publications & Awards

- **4 first-author publications** in Q1 journals, including *International Journal of Heat and Mass Transfer* and *Journal of Energy Storage*; 1 battery thermal-runaway manuscript under review.
- **Silver Award**, 2026 University of Michigan Electric Vehicle Center Poster Competition.
- **Best Research Poster**, 2025 ASME IMECE.
- Rackham International Student Fellowship, 2023.

Education

Ph.D. in Mechanical Engineering, University of Michigan, Ann Arbor

Expected 2027

- Advanced heat transfer, Fluid mechanics, FEM, Energy Gen & storage, Solid state physics

M.S.E. in Mechanical Engineering, University of Michigan, Ann Arbor

2024

B.S.E. in Mechanical Engineering, Minor in Computer Science, University of Pittsburgh

2021-2022

B.S. in Mechanical Engineering (transfer), Sichuan University

2018-2020