

Project Title: Next-Generation Aerogel Materials for EV Battery Safety and Clean Technologies

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Research Area: Smart Materials, Advanced Manufacturing

Project Start Date: Fall 2025

Project Description:

Lightweight multifunctional materials are at the heart of the next generation of energy and environmental technologies. In particular, ultralight aerogel-based composites are emerging as a transformative solution for electric vehicle (EV) batteries, where high thermal insulation, fire resistance, and safety are critical, as well as for advanced filtration systems requiring high surface area and selective transport properties. The field of aerogels has been widely advanced by NASA for aerospace and aeronautics applications, including thermal insulation for spacecraft, planetary exploration, and extreme environment protection. Building on this global momentum, our research aims to translate these advanced materials into sustainable solutions for EV batteries and clean technologies. At the TSMART research center, University of Toronto, in collaboration with top industrial leaders in the EV sector, we are developing aerogel-based systems with the potential for huge impact on battery safety, performance, and sustainability. Our work has resulted in publications in prestigious journals, patents, and technology transfer opportunities toward commercialization.

We are looking for passionate and motivated MEng students to join our team in the ongoing development of sustainable ultralightweight aerogel materials. By joining our research group, you will have the opportunity to work in one of Canada's leading research labs, gain hands-on experience with advanced materials fabrication and testing, and strengthen your academic and professional profile through contributions to impactful research outputs.

Interested candidates should contact Dr. Tafreshi (tafreshi@mie.utoronto.ca) and Prof. Naguib (hani.naguib@utoronto.ca) for more information.

Qualifications and related skills:

- Experienced in material fabrication and synthesis
- Familiarity with characterization and testing of materials
- Experienced in sustainability assessment tools
- Strong problem-solving and analytical abilities
- Hands-on skills in prototyping, assembly, design, and troubleshooting