MECHANICAL ENGINEERING SEMINAR ANNOUNCMENT

"Functional Surfaces and Devices for Sustainable Decarbonization"

Presented by: Muhammad Jahidul Hoque, Ph.D.

Date: Friday, March 1, 2024
Time: 11 a.m. – noon
Location: BROWN 241

Abstract

Recent advancements in fabrication technologies are making a significant impact in phase change heat transfer applications (boiling, evaporation, condensation, and freezing), high heat flux electronics cooling, desalination, and industrial power generation. Seventy percent of global electricity production is created using steam-cycle power plants. Utilizing a water-repellent condenser surface (hydrophobic or mixed wettability/hybrid) within the steam cycle has potential to enhance the overall cycle efficiency by 2%. Furthermore, this efficiency increase results in a reduction of 460 million tons of CO2 emissions/year with a decreased use of 2 trillion gallons of cooling water per year. However, the challenges to implementing these surfaces in power cycle condensers, or more generally to any application, are scalable fabrication and their poor durability. The talk will discuss scalable methods for creating functional surfaces, investigating the degradation mechanism of hydrophobic layers, and designing a durable coating for potential power plant applications. The second part will focus on mitigating ice/snow/frost accretion on electrified systems, demonstrating significant reductions in removal time and energy consumption through pulsed interfacial heating and controlled surface wettability. In the final segment, findings from cyclic testing will address surface degradation resulting from long-term accretion-removal cycles, offering guidelines for durable surface fabrication.

Biography:

Muhammad Jahidul (Jahid) Hoque is a Postdoctoral Researcher at the University of Illinois at UrbanaChampaign (UIUC), Urbana, IL. His core areas of competence intersect the fields of Micro/Nanomanufacturing, Thermal Science, Interfacial Science, and Electronics Cooling. He earned a Bachelor of Science and a Master of Science in Mechanical Engineering from Bangladesh University of Engineering and Technology (BUET), Dhaka, Bangladesh, in 2013 and 2016, respectively, where he also served as a faculty member in the Department of Mechanical Engineering from 2013 to 2016. He obtained his doctoral degree in Mechanical Science and Engineering from the University of Illinois Urbana-Champaign (UIUC) in 2022.