MARQUETTE UNIVERSITY

Departmental Colloquium
Electrical and Computer Engineering

Shifting the Paradigm of Latent Heat Thermal Energy Storage Systems via Additive Manufacturing

Tuesday, February 13, 2024
2:00 pm – 3:00 pm
Olin 202

Reception to follow in Olin 204
3:00 pm – 3:30 pm

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ABSTRACT: Enhancing the thermal performance of phase-change materials (PCMs) for thermal energy storage and management has been a subject of great interest since the energy crisis of the 1970s. PCMs are materials that can absorb (solid to liquid) and release (liquid to solid) significant amounts of energy during the phase transition. However, the low thermal conductivity of PCMs hinders their effective heat transfer, despite their high latent heats of fusion. To address this issue, recent studies have focused on improving the thermal conductivity of PCMs through the addition of additives or other means. Nevertheless, the efficient distribution of these materials through additive manufacturing in a compact heat exchanger with a high surface-area-to-volume ratio and thin walls can mitigate the need to increase thermal conductivity. Prior studies have demonstrated the successful stabilization of PCMs with appropriate polymers through methods such as injection molding, extrusion, and casting. Alternatively, microencapsulation of PCMs in compatible materials allows them to blend with otherwise non-compatible host polymers, thereby expanding the range of 3D-printable composite materials. This presentation aims to provide an overview of polymer heat exchangers, shape-stabilized PCMs, and advances in additive manufacturing for the creation of next-generation thermal energy storage devices.

BIOGRAPHY: Sandra Boetcher is a Professor of Mechanical Engineering and College of Engineering Research Fellow at Embry-Riddle Aeronautical University. She obtained her B.M.E., M.S., and Ph.D. in Mechanical Engineering from the University of Minnesota in 2001, 2003, and 2006, respectively. Prior to her appointment at Embry-Riddle, Professor Boetcher was a founding faculty member in the newly formed Department of Mechanical and Energy Engineering at the University of North Texas and worked for several companies, including Honeywell, 3M, and Donaldson Company. Her recent research interests include realizing latent heat thermal energy storage systems utilizing advanced manufacturing, investigating the fundamental behavior of phase-change materials through numerical simulations and experiments, and characterizing the heat transfer performance of supercritical fluids. She is currently an editor of Carbon Capture Science and Technology, associate editor of International Journal of Heat and Fluid Flow, and associate editor for the ASME Open Engineering Journal. Currently, she serves as the Chair of the ASME Heat Transfer Division Executive Committee and is a Fellow of ASME.