

SCHOOL OF MECHANICAL & MATERIALS ENGINEERING
GRADUATE SEMINAR SERIES

Thermal Fluids Problems in the Food, Energy, and Water Nexus: Impacts of Wettability

Presented by

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Abstract

The sustainable production of food and power requires adequate fresh water, which is a critical focus of the Food, Energy, and Water nexus. Worldwide, agriculture is responsible for two-thirds of water withdrawals and, in the US, an average of 19 gallons of water are required to produce each kWh of electricity. In much of the Central High Plains, the Ogallala Aquifer provides 90% of the irrigation water in a semi-arid region which produces corn, wheat, sorghum, and cattle. Decreasing aquifer water levels, climate and economic stressors, and depopulation require engineering and socioeconomic innovations to create resilient rural communities, which is the focus of the KSU Rural Resource Resiliency (R3) National Science Foundation Research Traineeship (NRT).

Three thermal fluid projects in the Food, Energy, and Water nexus will be highlighted in this talk. 1) Altered wettability to reduce soil evaporation is under current study. Evaporation results are presented for 2.38-mm-diameter hydrophobic and hydrophilic soil pores; hydrophobic pores extend evaporation times. Due to the importance of capillary action, X-ray imaging is used to track evaporation fronts during evaporation from a 10-mm beaker. 2) The recovery of water from cooling towers is investigated, including the impacts of vibrations and power plant water quality (e.g., Flue Gas Desulphurization and Blowdown Water) on droplet motion. 3) Mini-scale oil-water flows are investigated in glass and fluorinated ethylene propylene tubes with applications for oil-water separation. Due to wall wettability, inverted flow regimes were observed (i.e., oil in contact with the tube diameter and water in the core).

Biography

Dr. Melanie Derby graduated from Rensselaer Polytechnic Institute with a B.S. in 2008, M.S. in 2010, and Ph.D. in 2013. In 2013, she joined Kansas State University where she studies multi-phase flows and heat transfer; she is currently an Assistant Professor and holds the Hal and Mary Siegele Professorship in Engineering. Her research has been sponsored by NSF, NASA, ASHRAE, and industry. She is a recipient of a 2017 NSF CAREER Award, 2017 KSU College of Engineering Outstanding Assistant Professor Award, and 2017 ASME International Conference on Nanochannels, Microchannels and Minichannels (ICNMM) Outstanding Early Career Award. She currently directs the KSU NRT which is focused on interdisciplinary FEW research and graduate education.

Thursday, February 7, 2019

11:00am to Noon

ETRL room 101

Meet the speaker before the seminar in
ETRL room 119, 10:30am to 10:50am.
Light refreshments will be served.



The complete schedule of the MME Seminar Series can be found at <https://mme.wsu.edu/events/>.