Discovery Park

Birck Nanotechnology Center

Nanomanufacturing Preeminent Team Faculty Seminar

March 6, 2017 @ 9:30am

BRK, ROOM 1001

Dr. David Warsinger

Postdoctoral Fellow, MIT

Title: Can we save lives with thermodynamics? Nanoengineering and Thermofluids for the Water-Energy-Food Nexus

Bio: Dr. David Warsinger completed his B.S. and M.Eng at Cornell, and his PhD in Mechanical Engineering at MIT: he completed his graduate studies in a combined 3 years. David's research focuses on the water-energy nexus, with approaches from thermofluids and nanoengineering. Currently, David is a Postdoc at MIT and beginning a joint Postdoc at Harvard. Prior to starting his PhD, David worked at the engineering consulting firm Arup, where he performed energy and sustainability analysis and designed heating and cooling systems. David is a coauthor of 22 published and 6 submitted journal and conference papers, and a co-inventor of 13 filed or awarded patents. He is also involved with entrepreneurial endeavors, including demonstrating batch reverse osmosis with MIT startup Sandymount, and cofounding Coolify, a startup providing refrigeration via phase-change thermal storage for farmers in developing economies. Notable awards David has earned include the national dissertation award from UCOWR, the highest GPA award for his Masters, 9 presenter awards, and the MIT institute award for best research mentor for undergraduate students.

Abstract: Climate change, degrading water resources, and economic and population growth are increasing the need for new science and technologies at the Water-Energy-Food Nexus. In enabling new and improved technologies to tackle these issues, new nanomaterials designed with systems-level thermodynamics is essential to improve efficiency, allow for new power sources, and enable applications to agriculture. Following this approach, thermodynamic design of water treatment membrane technologies such as reverse osmosis (RO) and membrane distillation (MD) leads to innovations with superhydrophobic nanostructured surfaces for enhanced heat transfer, time-varying "batch" cycles, new system configurations, and optimal use of waste heat can more than double system efficiencies. Furthermore, optimization of heat and mass transfer and chemical thermodynamics in these technologies allows for nanofabricated membranes with superior flux and fouling resistance, including graphene oxide multilayer membranes. These approaches not only yield significant improvements in water treatment and associated energy use, but also in providing water and energy needs for food applications, such as pumping energy for agricultural ground water, or using phase-change thermal storage to enable refrigeration of food despite intermittent power in the developing world.