UC RIVERSIDE UNIVERSITY OF CALIFORNIA | Materials Science and Engineering

FALL 2020 COLLOQUIUM SPEAKER

OCTOBER 28, 2020

Wednesday's 1-1:50pm ZOOM

Thermal Transport and Calorimetry at Micro- and Nano- scale: from Nanowires to Single Cells

Heat transfer plays an important role in a variety of phenomena such as thermal energy conversion and storage, concentrating solar power, building energy efficiency, cooling of microelectronics, and personal thermal comfort. These processes exhibit a diverse range of heat fluxes, from picowatts (e.g., heat conduction in molecules) and nanowatt (e.g., metabolic heat generation from single cells) to kilowatt (e.g., building HVAC systems) and Gigawatt (e.g., power plants). Regardless of the size and heat flux of these processes, the fundamental length scales associated with the basic heat carriers, such as phonons, photons, electrons, and fluidic molecules, generally fall in the range of nanometer to microns. Therefore, precise measurement of basic micro- and nano- scale thermal transport phenomena is important to understand these phenomena for various applications. In this presentation, I will first give an overview of our recent work involving engineering applications of microscale heat transfer. Then I will focus on specific examples showing the development of high-resolution micro-calorimetry platforms and their applications in probing microscale thermal transport phenomena. Specifically, we developed calorimetry devices with picowatt resolution to probe conductive and radiative thermal transport mediated by phonon and surface phonon polariton in individual nanowires [1,2,3]. We also devised a microfluidic calorimetry platform with sub-nanowatt resolution, more than 10x better than the state-of-the-art calorimeters, and successfully applied it for the first calorimetric measurement of single cells [4]. I will conclude the talk by envisioning how these instrumentation development and basic understanding could impact the technological developments in engineering and biological materials and systems.

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Dr. Renkun Chen
Associate Professor, Dept of Mechanical and Aerospace Engineering, UC, San Diego

Renkun Chen is an associate professor at the University of California, San Diego. He received his B.S. degree in Engineering Thermo-physics from Tsinghua University in 2004, and Ph.D. degree in Mechanical Engineering from the University of California, Berkeley in 2008. Following a one-year stint as a postdoctoral fellow at Lawrence Berkeley National Laboratory, he joined the faculty of UC San Diego in the Department of Mechanical and Aerospace Engineering in 2009. His research group is interested in fundamental micro- and nano- scale heat transfer as well as engineering applications of heat transfer in energy and biological systems.

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