Thermal Metrology for Semiconductor Packaging and Beyond

Dr. Amy Marconnet

Professor of Mechanical Engineering

Professor of Materials Engineering (by courtesy)

Perry Academic Excellent Scholar

Date: Wednesday, October 23 @ 2.00 pm in BRK 1001

Coffee and snacks served before seminar

Zoom Link: https://purdue-edu.zoom.us/j/95283400606

Abstract:

To increase performance of electronic devices, package designs are moving to 2.5D and 3D where the active components are assembled together in dense configurations. A key challenge is dissipating the heat from the devices to maintain the system at temperatures where the system will not degrade. When the active components are stacked vertically, the interfaces between layers become even more crucial from a heat transfer perspective as heat must transfer pacross multiple materials and interfaces out to the exterior surfaces where heat can be dissipated. Quantifying the ability to spread heat with a material is critical for both the active device layers and the packaging materials such as the lid or interposers. While numerous techniques exist for measuring the through-thickness thermal conductivities and interface resistances near the surface of a system, key thermal metrology challenges include measuring the thermal interface conductance buried within the 3D chip stacks and measuring the in-plane thermal conductivity of each layer in the electronics package. This presentation will discuss techniques we developed to address each of these metrology challenges. Both techniques leverage periodic laser heating and thermal imaging with infrared cameras to quantify thermal properties of interest. Analysis with conventional data fitting tools is supplemented with machine learning techniques that are more robust to noise in temperature measurements.

Bio:

Amy Marconnet is a professor of Mechanical Engineering and professor of Materials Engineering (by Courtesy), as well as a Perry Academic Excellence Scholar, at Purdue University. She received a B.S. in Mechanical Engineering from the University of Wisconsin – Madison in 2007, and an M.S. and a PhD in Mechanical Engineering at Stanford University in 2009 and 2012, respectively. Her dissertation focused on thermal phenomena in nanostructured materials. She then worked briefly as a postdoctoral associate at the Massachusetts Institute of Technology, before joining the faculty at Purdue University in August 2013. Her work has won outstanding paper awards at ITherm 2012, InterPACK 2017, ITherm 2019, and ITherm 2023. In 2017, she won the Woman in Engineering Award from the ASME Electronics & Photonics Packaging Division (EPPD). In 2020, she won the Bergles-Rohsenow Young Investigator Award in Heat Transfer and the Outstanding Graduate Student Mentor from the Official Mechanical Engineering Graduate Association (OMEGA) and the College of Engineering. She recently won a Humboldt Fellowship for Experienced Researchers and conducted research at Karlsruhe Institute of Technology in the 2021-22 academic year.

Host: Neil Dilley, Research Manager | Email: ndilley@purdue.edu