Mechanical Engineering Lecture in Micro/Nano Engineering

Thermal Materials Engineering from Discovery to Applications

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After nearly 25 years of intensive development of science at the nanoscale, marked by numerous important discoveries, we now have a tremendous amount of knowledge and tools to exploit nanoscience in applications. Applications in energy and microelectronics, foundations of modern society, are uniquely positioned to benefit from the different physics at the nanoscale, which, with continued efforts, may bring the miracles we need to solve some of societies most pressing challenges. I will tell the story of my lab's contributions to this journey through the lens of the following specific application. Thermal Interface Materials: Thermal management is a critical challenge for electronics. It can limit performance and operational life, and, today, poor heat transfer at the material contacts is the major problem in many commercial packages. We have developed vertically aligned carbon nanotube (CNT) and pure polymer nanotube (PNT) arrays to achieve reduced thermal contact resistance in electronic packages. Our work has discovered critical bottlenecks to heat transfer and new modes of enhanced thermal transport in these materials, and has allowed us to engineer new material combinations to mitigate thermal contact resistance in a reliable way. Our efforts are enabled by precise thermal metrology – photacoustic and time-domain thermoreflectance – and expertise in nanomaterials synthesis and characterization. I will also discuss briefly my use of research results to engage the public and build collaborative communities that expand beyond the academic campus.

Refreshments will be served before the seminar.
Please contact Tony Pulsone at pulsone@mit.edu with any questions.