Electrical & Computer ENGINEERING

Carnegie Mellon University

Seminar

DSN-I Seminar Series - Interface Mediated Thermal Transport: From Hybrid Materials to Hard Disk Driv

Jonathan Malen

September 18, 2015 | 3:30 - 4:30 PM | Scaife Hall 125

Seminar abstract

Operating temperature, and hence heat dissipation, impact the performance of energy convers technologies and electronic devices. Thermal transport in advanced materials for these technologies cannot be described simply by Fourier's law when the mean free paths of energy carriers are commensurate to feature sizes. Instead, interfaces and non-diffusive transport can govern macroscopic quantities like thermal conductivity. The objective of my research group is experimentally measure these effects, to better design and understand these materials. I will b with an introduction to the nanoscale heat carriers, and I will then present two projects where interfaces influence performance. (1) Nanocrystal arrays (NCAs) are self assembled organic-inorganic hybrid materials with novel electronic and optical properties. Our measurem reveal that thermal transport in NCAs is mediated by surface chemistry defined interfaces betw neighboring nanocrystals. Complementary measurements of self assembled monolayers (SAM shed light on phonon transport at the organic-inorganic interface. (2) Heat assisted magnetic recording (HAMR) is a new data storage technology that exemplifies the need to minimize ther interface resistance in concert with optimizing other interface functions. In the case of HAMR, unique plasmonic properties of Au-dielectric interfaces are critical to operation, and metals with inherently lower thermal interface resistance are unsuitable. To remedy this, we are studying tradeoffs in thermal and plasmonic performance of Au-dielectric interfaces enhanced by adhes layers or through alloying with other metals.

The DSN-I Seminar Series is hosted by the Device Science and Nanofabrication Initiative. DSN-I Seminars target researchers in micro and nanofabrication technologies or devices, with the goal of strengthening the user community of the new Scot Hall nanofabrication facility and other shared infrastructure.

Speaker bio

Jon recieved his Ph.D in Mechanical Engineering at the University of California, Berk under the co-advisory of Professors Arun Majumdar (ME, MSE) and Rachel Segalma (ChemE). He investigated thermoelectricity in single molecule junctions, in an effort learn more about electronic transport in molecular electronics and organic-inorganic hybrid materials. Jon received his B.S. in Mechanical Engineering at the University c Michigan, Ann Arbor in 2000 and an S.M. in Nuclear Engineering (2003) from MIT, w he studied transport at the macroscopic reactor scale under the advisory of Professo Todreas. He spent one year as an intern at the Lawrence Livermore National Labora from 2003-2004, and was an NDSEG Fellow from 2005-2008. Since his arrival at Carnegie Mellon in 2009, Jon has received the AFOSR Young Investigator Award (2 ARO Young Investigator Award (2014), ACS PRF Doctoral New Investigator Award (2011), NSF CAREER Award (2012), and ASME Bergles-Rohsenhow Young Investi Award in Heat Transfer (2014).

Seminar notes: Light snack and beverages will be served.