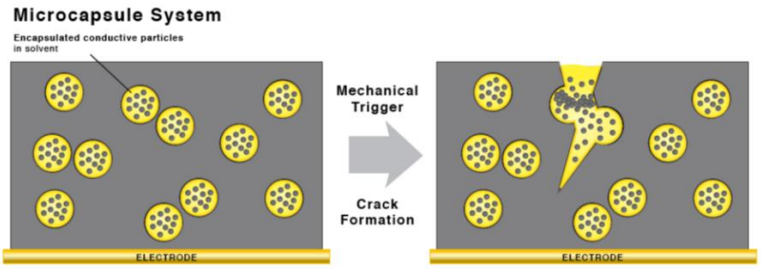
NANOHOUR

Wednesday, November 14, 2012 at 3:00 pm
Beckman Institute - Room 2269

Carbon Black Filled Microcapsules for Restoration of Electrical Interfaces

Sen Kang, Materials Science and Engineering
Graduate Student with Professor Nancy Sottos

Restoration of electrical interfaces has potential to increase the reliability and safety of high performance batteries. In Li-ion batteries, continued cycling of silicon anodes results in cracking or pulverization of the particles, and ultimately destruction of the conductive network. Here, we consider an approach to increase cycle lifetimes and reliability through restoration of anode conductance via the use of microencapsulated components that form a conductive network when released. In this study, robust microcapsules were prepared with high carbon black loading (up to 20 w/v %) present in liquid core via the formation of cross-linked polymer shell by in situ emulsion polymerization. Increased hydrophobicity of carbon black was achieved through the functionalization of oxidized carbon black with octadecylamine. Upon crushing, functionalized carbon black (FCB) filled microcapsules demonstrated improved particle release compared to unfunctionalized carbon black. The potential for conductance restoration of Si electrodes was evaluated by crushing FCB microcapsules on electrode line cracks introduced by a fiber removal method, with a maximum recovery of 100 % of original conductance.



Thermal Imaging and Analysis of Carbon Nanotube Composites

Feifei Lian, Electrical and Computer Engineering
Graduate Student with Professor Eric Pop

Manipulating the thermal conductivity of composites and nanomaterials is highly desirable not only for thermal insulation or conduction, but also for thermoelectric (TE) applications. In naturally occurring materials, the thermal conductivity is primarily determined by atomic structure and interatomic forces. By contrast, nanomaterial composites could be tuned for either high or low thermal conductivity by manipulating the orientation, density, doping or functionalization of their nanoscale components.

In this study, we develop a suspended infrared (IR) thermometry platform combined with a computational model for rapid analysis of nanomaterial thermal properties. In particular, we use aerosol synthesized single-wall carbon nanotubes (SWCNT) to fabricate networks (CNNs) by a dry deposition technique. Such CNN samples are transferred to our measurement platform, between two large Cu blocks serving both as electrical contacts and heat sinks, separated by an adjustable gap to vary the length of the suspended CNN. We also measure the thermal properties of similar samples embedded in a dielectric (AlO_x) using a 3-omega method.

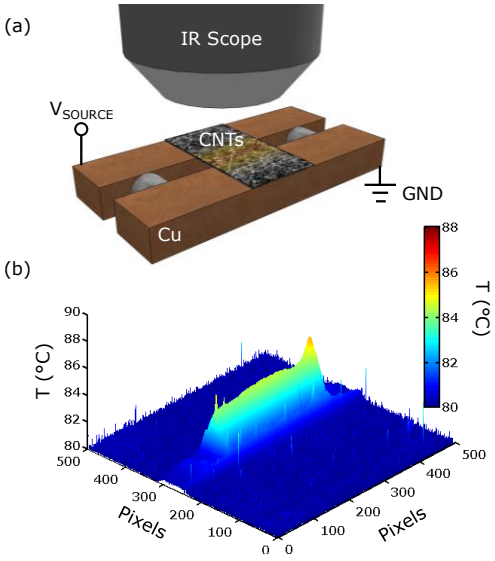


Fig.1: (a) Schematic of in-plane measurement platform. (b) IR temperature profile of CNT film suspended over a 1.35 mm gap.

Coffee and cookies will be served

http://nanohour.beckman.illinois.edu