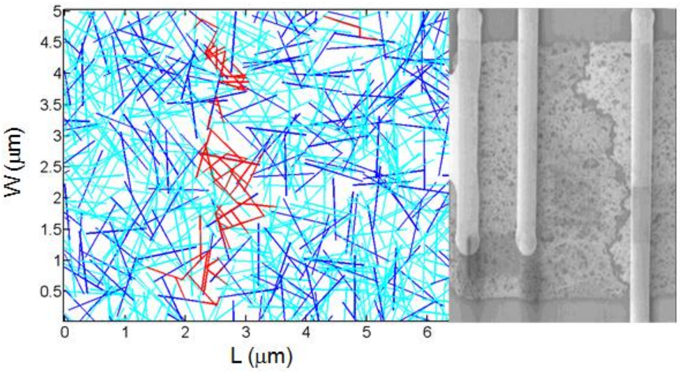
NANOHOUR

Wednesday, April 4, 2012 3:00 pm
Beckman Institute - Room 3269

Performance Limits and Degradation of Carbon Nanotube Network Transistors

Dr. Ashkan Behnam, Electrical and Computer Engineering

Post-Doctoral Associate with Professor Eric Pop



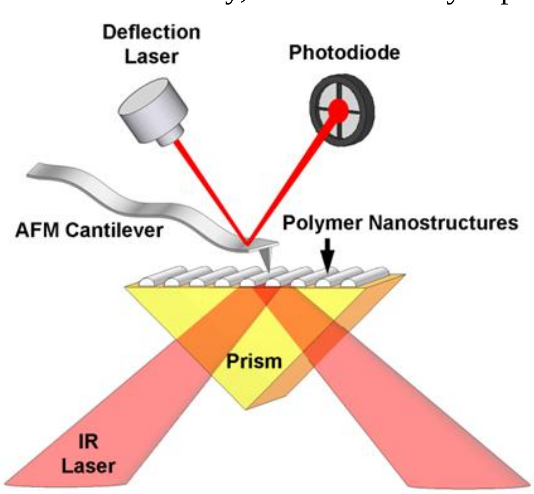
Carbon nanotube networks (CNNs) have become suitable for applications as sensors, interconnects and flexible electronics through recent development of large-scale fabrication, control of nanotube density, chirality and alignment. However, due to the complexity of their structure, performance limits and reliability of CNN-based devices are not well understood. We have combined comprehensive experiments and computational modeling to analyze high-field transport, thermal dissipation, and breakdown in CNN devices. We fabricate thin film transistors with various lengths, widths and percentage of metallic tubes on SiO_2/Si substrates. Devices are characterized electrically and imaged by microscopy techniques. We also develop a model that randomly generates tubes with a predefined distribution of orientation, position, density and type. Current and power dissipation and temperature profile are calculated by solving electrical transport equations at each network element, self-consistently with the thermal transport equations. We present the effect of various network parameters on experimental observations and simulation predictions and compare the results.

Nanometer Scale Infrared Spectroscopy of Polymer Nanostructures Fabricated with Heated Probe Tips

Jonathan Felts, Mechanical Science and Engineering

Graduate Student with Professor William P. King

Heated AFM tips are uniquely suited for nanometer scale chemical patterning by thermally processing material with a nanometer sharp tip. Heated tips can alter thin film properties by thermally modifying the film chemistry, and can directly deposit material from the tip to a substrate by melting and flowing the material. The chemical structure of patterned features has previously been inferred from electrical, optical, and surface energy measurements, but almost no research has been done to directly measure the chemical composition of nanostructures written with heated tips. We measure the chemical composition of organic nanostructures fabricated by heated tips with the photothermal induced resonance atomic force microscope technique. In this method, a cantilever measures the thermomechanical expansion of organic material irradiated by pulsed IR light. Spectra were gathered from polyethylene, polystyrene, and poly(3-dodecylthiophene-2,5-diyl) features with heights less than 100 nm and a spatial resolution of 150 nm.



Coffee and cookies will be served

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