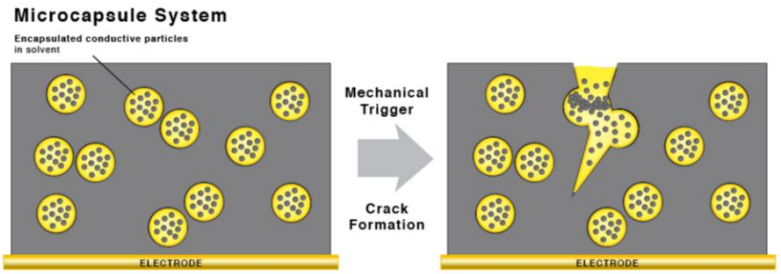
NANOHOUR

Wednesday, December 7, 2011 3:00 pm
Beckman Institute - Room 3269

A Conductive Particle Based Healing System for Restoration of Electrical Interfaces

Sen Kang, Materials Science and Engineering

Graduate Student with Professor Nancy Sottos

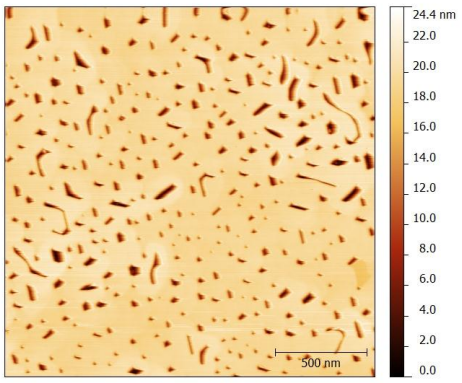


In Li-ion batteries, silicon (Si) anodes undergo enormous volume expansion and contraction upon cycling, which results in cracking or pulverization of the Si, and ultimately destruction of the conductive network. Here, we consider an approach to increase cycle lifetimes and reliability through restoration of anode conductivity. In this study, we report the encapsulation of conductive particles and the integration of these capsules into Si anode materials. Microcapsules are prepared by the encapsulation of conductive particles and solvent via the formation of a cross-linked polymer shell by in situ emulsion polymerization. A variety of liquid cores, polymer shells, and surfactant concentrations are investigated. We identify promising encapsulated systems based on the ability to release large amount of conductive particles and survive anode fabrication. Preliminary tests are also performed to investigate conductivity restoration outside of the battery environment.

Transparent Substrates for Optically Assisted Scanning Tunneling Microscopy

Lea Nienhaus, Chemistry Department

Graduate Student with Professor Martin Gruebele



By combining scanning tunneling microscopy (STM) and laser excitation of molecules, their optical absorption can be detected by STM at a resolution well below the conventional diffraction limit. Previous studies were performed on single wall carbon nanotubes deposited by dry contact transfer (DCT) onto *in situ* prepared silicon surfaces. The 1.1 eV bandgap of silicon makes them opaque in the visible range of the spectrum, while they are transparent in the near IR. Future experiments will include measuring charge transfer in molecules labeled with organic dyes with an excitation maximum of 500-600 nm. Due to the backside illumination technique which cuts down on tip heating effects, silicon can no longer be used as a substrate. Therefore, new substrates must be investigated, which must be flat and conductive to be able to scan by STM, as well as transparent in the visible region of the spectrum. We have deposited ultrathin gold and platinum metal films (<20 nm) via e-beam evaporation onto annealed c-plane sapphire substrates. The film morphology was explored by atomic force microscopy (AFM) and STM. Our experimental setup allowed us to change several deposition conditions (substrate temperature and deposition rate) and to detect the induced changes in morphology. A further advantage of these noble metal films is their strong interaction with thiols (R-SH), which can be used to anchor molecules to the surface to avoid the STM tip picking them up and moving them around. Due to a slight roughness of the metal ultrathin films resulting from cluster formation on the surface, graphene on annealed c-plane sapphire was also investigated as a possible substrate. Here, UV-Vis measurements were performed as well as AFM and STM studies and scanning tunneling spectroscopy (STS).

Coffee and cookies will be served

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