Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Multi-Wall Carbon Nanotubes as Lithium Nanopipettes and SPM Probes[1] JONATHAN LARSON, Department of Physics, University of Maryland College Park, SATYAVEDA BHARATH, Department of Chemistry and Biochemistry, University of Maryland College Park, WILLIAM CULLEN, Department of Physics, University of Maryland College Park, JANICE REUTT-ROBEY, Department of Chemistry and Biochemistry, University of Maryland College Park — A multi-walled carbon nanotube (MWCNT) - terminated SPM cantilever, was utilized to perform nanolithography and surface diffusion measurements on a thin film of vapor-deposited lithium atop a silicon (111) substrate under ultra-high vacuum conditions. In these investigations the MWCNT tip was shown to act as both a lithium nanopipette and a probe for non-contact atomic force microscopy (NC-AFM) measurements. With the application of appropriate bias conditions, the MWCNT could site-selectively extract (expel) nano-scale amounts of lithium from (to) the sample surface. Depressions, mounds, and spikes were generated on the surface in this way and were azimuthally symmetric about the selected point of pipetting. Following lithium transfer to/from the substrate, the MWCNT pipette-induced features were sequentially imaged with NC-AFM using the MWCNT as the probe. Vacancy pits of ca. 300 nm diameter and 1.5 nm depth were observed to decay on a timescale of hours at room temperature, through diffusion-limited decay processes. A continuum model was utilized to simulate the island decay rates, and the lithium surface diffusion coefficient of D=7.5 ($\pm$1.3)*10^{-15} cm^2/s was extracted.

[1]U.S. Department of Energy Award Number DESC0001160

Jonathan Larson
Department of Physics, University of Maryland College Park

Date submitted: 15 Nov 2013 Electronic form version 1.4