Tuesday Morning, October 30, 2012

Exhibitor Technology Spotlight
Room: West Hall - Session EW-TuM

Exhibitor Technology Spotlight
Moderator: D. Surman, Kratos Analytical Inc.

10:00am **EW-TuM7 ORION Nanofab: Fabricating sub 10 nm Nanostructures using the Helium Ion Microscope**, ***D. Elswick***, Carl Zeiss

The helium ion microscope (HIM) takes advantage of an atomically sharp source to emit a beam of focused He ions so the microscopist today can go beyond imaging resolutions achieved in the Scanning Electron Microscope (SEM). Imaging with ions rather than electrons offers many advantages including the ability to image uncoated non conducting samples at high resolution without damage. Additionally, helium ions can be used to sputter material for nanolithography and nanopatterning applications where sub 10 nm structures are desired. A gallery of helium ion microscopy results will be presented to showcase the capability and performance of this novel microscope. The HIM has proven invaluable at characterizing uncoated biological samples as well as other soft materials. Features sizes and material removal via conventional Ga FIB systems is now surpassed using HIM. The HIM-FIB has touched a wide array of applications that range from nanomachining 5 nm pores for single molecule detection to patterning devices in graphene and creating nanophotonic devices in thin films.

10:20am **EW-TuM8 AM-FM and Loss Tangent Imaging–Two New Tools for Quantitative Nanomechanical Properties**, *R. Proksch, I. Revenko, S. Hohlbauch, J. Cleveland, N. Geisse, A. Moshar, J. Bemis, C. Callahan,* ***K. Jones***, Asylum Research

Amplitude-modulated Atomic Force Microscopy (AM-AFM), also known as tapping mode, is a reliable and gentle imaging method with widespread applications. Previously, the contrast in AM-AFM has been difficult to quantify. In this work, we introduce two new techniques that allow unambiguous interpretation of material properties. AM-FM imaging combines the features and benefits of normal tapping mode with quantitative and high sensitivity of frequency modulated (FM) mode. Briefly, the topographic feedback operates in AM mode while the second resonant mode drive frequency is adjusted to keep the phase at 90 degrees, on resonance. With this approach, frequency feedback on the second resonant mode and topographic feedback on the first are decoupled, allowing stable, robust operation. The FM image returns a quantitative value of the frequency shift that in turn depends on the sample stiffness and can be applied to a variety of physical models. Loss tangent imaging is a recently introduced quantitative technique that recasts phase imaging into a term that includes both the dissipated and stored energy of the tip sample interactions. Quantifying the loss tangent depends solely on the measurement of cantilever parameters as a reference position. These two quantitative techniques can be performed simultaneously. To illustrate this, we will present an example of a micro-cryotomed, cross-sectioned area of a coffee bag packaging material that has been imaged. The loss tangent image shows the highly lossy "tie" layers connecting the low loss metal layer with two vapor-barrier polymer layers. The AM-FM image shows the relative stiffness of the five layers, with the metal layer being the stiffest and the tie layers the softest. As a second example, we imaged graphene deposited onto SiO_2, where the softer graphene layer showed a lowered resonance and the loss tangent imaging revealed a dissipative region between SiO_2 and graphene.

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