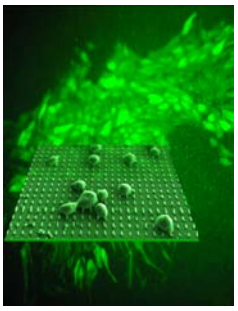
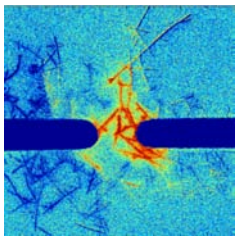
CNMS DISCOVERY SEMINAR SERIES

Thursday, May 3, 2012
4:00 pm
Iran Thomas Auditorium, 8600

Understanding the Behavior of Nanoscale Magnetic Heterostructures: How Microscopy Can Help



Amanda K. Petford-Long
Center for Nanoscale Materials
Argonne National Laboratory



Abstract:
The initial part of this presentation will highlight some of the activities at the Center for Nanoscale Materials, and I will then go on to talk about my own research on nanoscale magnetic materials. The properties of nanoscale magnetic materials depend critically on their microstructure and composition, with variations on the atomic scale leading to variations in properties. Of particular interest for technological applications in information storage systems are magnetic structures composed of thin layers, such as spin tunnel junctions. In such devices the microstructure and chemical profile across the layers are critical in determining the magnetic and transport properties, and therefore need to be critically controlled. In order to analyze the microstructure and composition profile we have used a range of transmission electron microscopy (TEM) techniques such as HREM and EFTEM mapping, in addition to atom probe tomography (APT) analysis.

However, these data are really only of interest in so far as they enable us to understand the origins of the magnetic and transport properties, and we have been using in-situ TEM to investigate these properties. We have used a combination of Lorentz TEM and in-situ magnetizing experiments to study the micromagnetic behavior at the sub-micron scale of magnetic nanostructures such as patterned exchange-biased magnetic disks and artificial spin ices. Quantitative analysis of the Lorentz TEM data has been carried out using the transport of intensity equation (TIE) approach. We have also developed in situ TEM capabilities that enable us to correlate the local tunneling properties of magnetic tunnel junctions with microstructure, and results of these studies will also be presented.

Host: Sean Smith, smithsc@ornl.gov, 865.574.5081

Center for Nanophase Materials Sciences