VCU Research spotlights....

Nanomaterials Core Characterization Facility

August 2012

Virginia Commonwealth University

The Nanomaterials Core Characterization Facility (NCC) is a multiuser facility where researchers from both VCU campuses, as well as other universities along the East Coast — are able to use state-of-the-art instrumentation for nanomaterials characterization. "We have created a user center, and we're hoping that the facility will essentially be a one-stop shop for researchers working in materials science," says Everett Carpenter, PhD, professor of chemistry and director of the NCC. The facility is staffed with an application scientist to help maintain the instruments, train users and provide guidance designing experiments. The NCC is a collaborative effort between the Departments of Chemistry, Physics and School of Engineering.

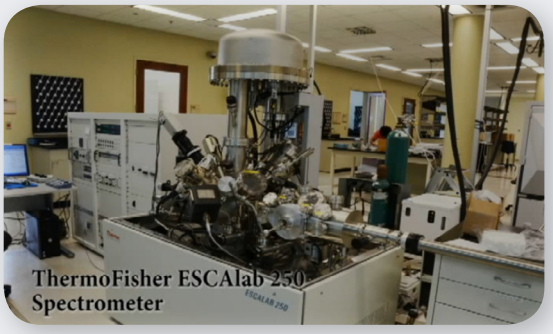
Services

- Electron Surface Chemical Analysis
- X-Ray Powder Diffraction
- Scanning Electron Microscopy
- Transmission Electron Microscopy
- Atomic Force Microscopy

Instrumentation

Thermo ESCAlab 250 Spectrometer

Probably our most unique instrument is this X-Ray photoelectron spectrometer which is an extremely versatile instrument. It can analyze samples with a wide variety of different analysis techniques such as



- Auger Electron Spectroscopy
- Ion Scattering Spectroscopy
- Ultraviolet Photoelectron Spectroscopy
- X-Ray Photoelectron Spectroscopy

The chamber features variable temperature capabilities from 77K to 600K and the ability to argon ion mill samples to get depth profiling. These techniques allow researchers the ability to determine the chemical composition of single monolayers absorbed on the surface of samples.

PANalytical MPD X'Pert Pro System

This system is a great tool for identification and quantification of phases for crystalline powders, where the crystallite size is greater than 5nm. It has optics to allow for measurement of samples as small as 1mg, as well as watching crystal structure change as a function of temperature up to 1200C. The NCC has a large powder diffraction file library allowing for identification of over 130,000 different materials.

Scanning Electron Microscopes

- **Hitachi SU-70**
- **JEOL 5610-LV SEM**

These instruments have the ability not only to image samples as large as a 5 in diameter wafer with less than 3nm resolution, they also feature many different analytical tools such as energy dispersive spectroscopy, backscatter imaging for Z-contrast, and scanning transmission electron microscopy allow for quantitative composition determination and mapping of the elemental content of the sample.

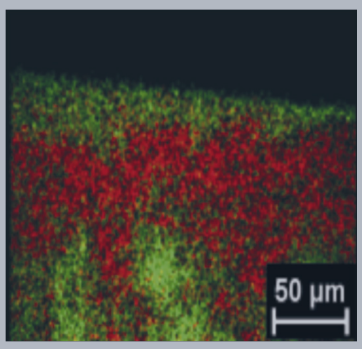
Carl Zeiss Libra 120 Plus Field Emission TEM

This scope provides high resolution images with less than a 0.3 nm resolution but at 120KV to prevent sample damage. As with the SEMs, the instrument is also equipped with analytical tools such as energy electron loss spectroscopy and scanning transmission electron microscopy which allow for elemental analysis on the nanometer scale.

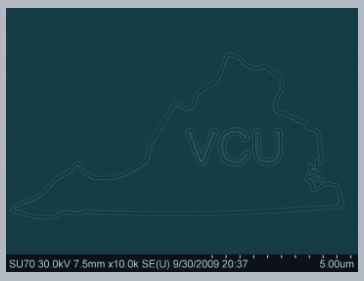
VEECO Icon Atomic Force Microscope

The AFM while being capable of traditional tapping or contact mode imaging, also features a wet cell allowing for imaging in solution.

Results



A chemical composition map of a polyethylene-polypropylene film using the ESCAlab 250. This shows how the propylene (in red) migrates into the polyethylene film as the sample is heated.



An example of the Nability e-beam lithography on the Hitachi SU-70. A photoresistance was spin coated on a wafer and then developed using the electron beam. The lines are 100nm in width.

Contact Us! We encourage investigators to contact the NCC for more information regarding specific instrumentation capabilities and for training opportunities.

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