Advanced Materials Characterization Core

Director: Dr. Paul A. Baker, Department of Physics, CAS.
Contact emails: pabaker@uab.edu, vthomas@uab.edu, charita@uab.edu

Materials Characterization Services:

❑ Scanning Electron Microscope (SEM):

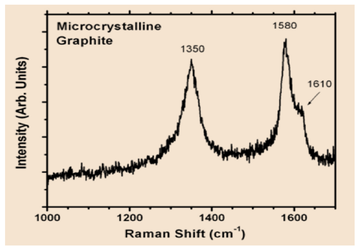
- Image surface features of metals, biomaterials, thin films, particles, polymers, grain boundaries, composites etc.
- Energy dispersive X-ray spectroscopy (EDX) to identify elemental composition of materials
- Can perform analysis on biological samples using environmental mode (ESEM)

❑ Multi-Purpose X-ray Diffraction (XRD):

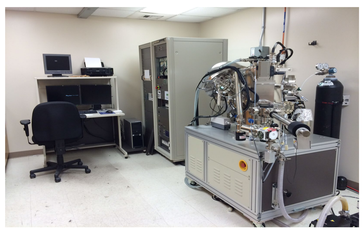
- Multi-purpose X-ray Diffractometer is non-destructive method to characterize materials' composition, crystal structure, phase change, grain-size and stress analyses of thin films, polymers and ceramics
- Can also perform particle size analysis using small angle X-ray scattering (SAXS)
- Epitaxial film analysis can be performed using Ultra Fast Reciprocal Space Mapping (URSM)

❑ Raman Spectroscopy

- Micro-Raman/Photoluminescence Spectrometer for non-destructive characterization of materials.
- Very effective in characterizing carbon materials (CNTs and Diamonds)
- Complimentary to FT-IR.



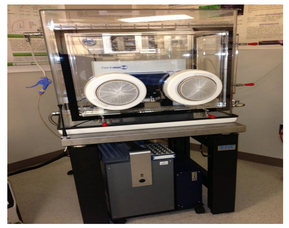
❑ X-ray Photoelectron Spectroscopy (XPS):

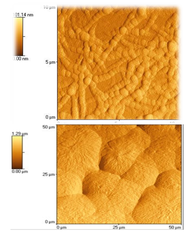


- PHI-5000 Versaprobe is equipped with dual Al/Mg anode, focused (10 - 100 µm) and scanned X-ray beam for sample imaging and analysis, hemispherical energy analyzer with multi-channel detection, depth profiling capability
- Useful for chemical elemental analysis and quantification, Bonding characteristics
- Operative Modes- Qualitative survey scan, quantitative high-resolution scan and depth profiling by simultaneous surface etching scanning.

❑ Atomic Force Microscopy (AFM):

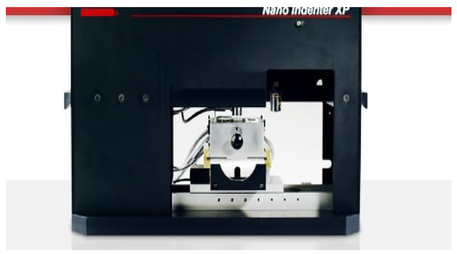
- Image nanocale surface features and morphologies of metals, biomaterials, thin films, particles, polymers, proteins and other biometrices, grain boundaries, composites etc.
- Two AFM instruments with tapping and contact modes are available for topographic and phase imaging and roughness measurements





AFM instrument and images of collagen nanomatrix and polymer spherullites

❑ Nano-indenter :



- Measurement of nanomechanical properties such as hardness and Young's modulus of nanostructured materials and thin films by a nano-tip indentation

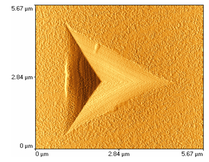
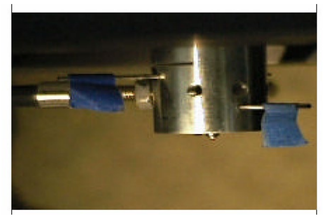
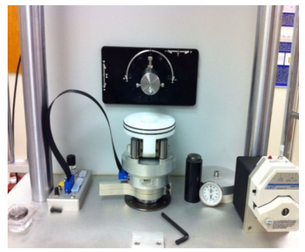


Image after indentation



❑ Orthopedic and Dental Joints Wear Simulator:

AMTI Force 5



- AMTI Force 5 - An industry standard simulator which can replicate the loading and multi-axis motions associated with joints (Hip, Knee &TMJ)
- Performs wear simulation of articulation components such as metal-on- metal, diamond-on-metal, metal-on-polymer, and diamond-on-diamond
- Operated in both force and displacement control modes and allows the continuous or periodic measurement of the forces and moments of the x, y, and z axes under physiological serum conditions