

Materials Characterization Tools

Connecting Processing, Structure, and Properties



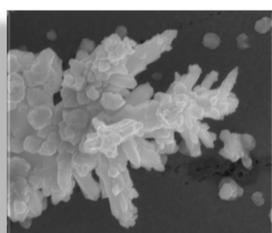
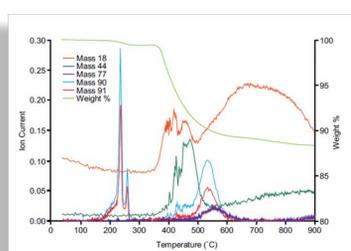
S&T Campaign: Materials Research
Unique ARL Facilities (APG)

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The Rodman Materials Research Laboratory at Aberdeen Proving Ground has a full suite of characterization tools to investigate new phenomena across ARL's materials research portfolio

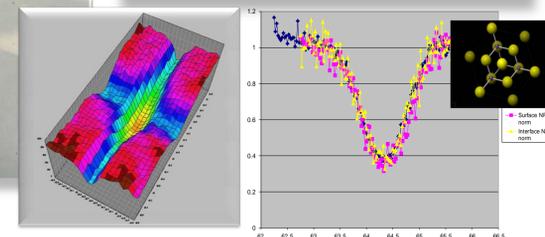
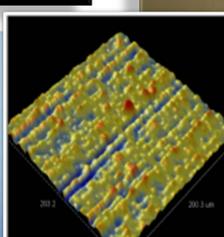
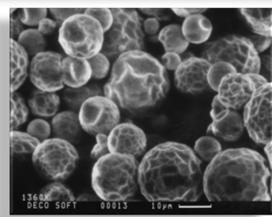
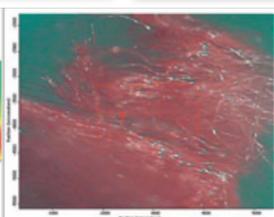
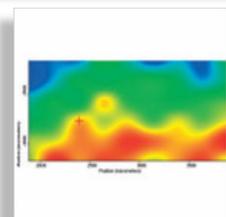
1) Chemical Characterization

Raman, FTIR, UV-VIS, NMR, Fluorescence, TGA-MS, PM-IRRAS



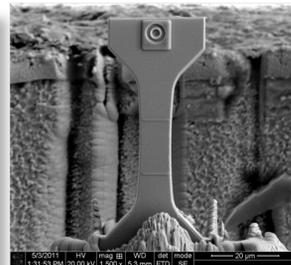
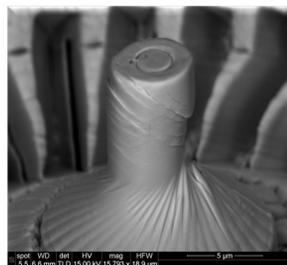
2) Surface and Interface Tools

MV ion accelerator (RBS, NRA, PIXE), XPS, AES, SECM, AFM, STM, contact angle



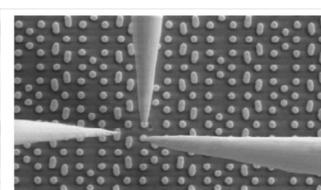
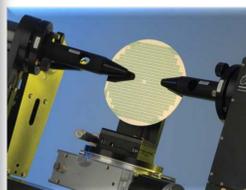
3) Micro- and Nanostructure

TEM, FESEM, SAXS, HRXRD, FIB, fs-laser milling and nanoscale testing



4) Electrical & Optical Properties

Spectrophotometry, VASE, sMIM, high T and cryogenic probe stations, microwave and THz spectroscopy, SEM-based nanoprobe



Unique ARL Facilities

- TGA-MS (TA Instruments Discovery Series) – benchtop evolved gas spectrometer with <100 ppb sensitivity
- FTIR/Raman/PM-IRRAS (Thermo Nicolet iS50) – multispectral IR microscope with integrated Raman mapping and Polarization Modulation Infrared Reflection Absorption Spectroscopy to explore molecular orientation in thin films
- Ion Accelerator (National Electrostatics 5SDH-2) – 1.7 MV accelerator for ion beam analysis, including RBS, resonant nuclear reaction analysis, PIXE, and ion beam channeling for nondestructive depth profiling with isotopic sensitivity and <10 nm depth resolution
- XPS (PHI Versaprobe II) – scanning x-ray microprobe for photoelectron or Auger electron spectroscopy, including chemical or secondary electron mapping with micron-scale lateral resolution, vacuum sample transfer & UPS (Summer 2015)
- FIB (FEI Nova 600i NanoLab) and Femtosecond Laser Milling (Clark MXR CPA) – micron-scale machining for tensile & compressive testing of nanocrystalline metals, or fast serial sectioning with EBSD measurements for rendering and analysis of 3D microstructures
- SAXS (Rigaku S-MAX3000) – temperature- and humidity-controlled chamber with monochromator and simultaneous SAXS/WAXS
- XRD (Bruker D8 DISCOVER) – X-Ray Reflectometry, HRXRD, Reciprocal Space Mapping, In-Plane Grazing Incidence Diffraction, or Small Angle X-ray Scattering with Eulerian cradle, Göbel Mirror, and Soller collimator
- sMIM (PrimeNano) – 3 GHz module on Asylum Cypher / Asylum 3D AFM for 50-nm resolution permittivity & conductivity measure
- THz spectrometer (Menlo Systems TERA K15) – dielectric properties up to 4 THz with >75 dB dynamic range
- Electrical probe stations (microwave, low frequency & DC impedance, polarization) from 4K to 350K
- Nanoprobe (Zyvx sProber) – electrical probing of sub-100 nm features on semiconductor devices with 5 nm positioning sensitivity

Complementary Expertise Sought

Emerging ion beam and x-ray analysis techniques
 Characterization of complex surfaces and 3D interfaces

Development of advanced nanoscale test methods
 Modeling and measurement of microwave and THz properties