



SURFACE ANALYSIS CAPABILITIES

TRI Austin has trained and certified in-house experts and equipment for surface examination, including Scanning Electron Microscopy (SEM), Atomic Force Microscopy (AFM), Optical Stereo Microscopy, Focussed Ion Beam Scanning Electron Microscopy, Micro-Raman Spectrometry, and Optical Profilometry. These personnel and equipment are available as surface examination services in addition to being used for in-house needs.



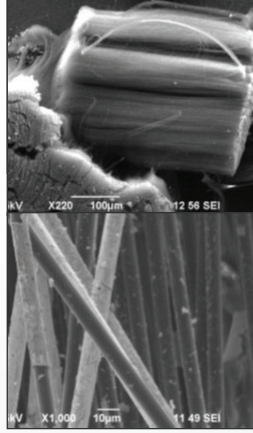
SURFACE EXAMINATION CAPABILITIES

TRI Austin's surface examination capabilities include:

- Scanning Electron Microscopy (SEM)
- Atomic Force Microscopy (AFM)
- Optical Stereo Microscopy
- Focussed Ion Beam Scanning Electron Microscopy
- Micro-Raman Spectrometry
- Optical Profilometry

SCANNING ELECTRON MICROSCOPE (SEM)

- Jeol 6390 SEM
- Magnification ~300,000x
- Resolution of ~1nm
- Specimen chamber: Up to 6" diameter
- Auto focus/auto stigmator, auto gun (saturation, bias, and alignment), and automatic contrast and brightness
- EDAX Element EDS with 30mm detector crystal



ATOMIC FORCE MICROSCOPE (AFM)

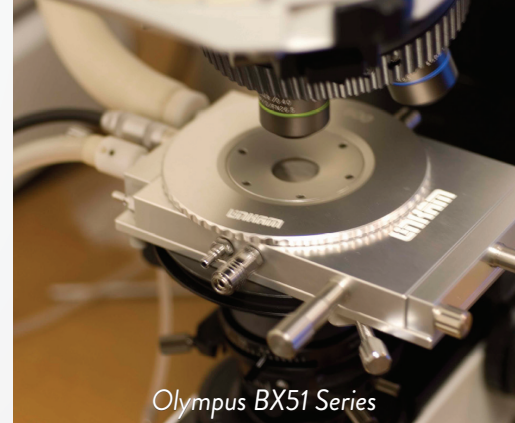
- Park Scientific AutoProbe CP-R AFM
- Manual XY stage and motorized Z stage
- 5 microns scanner
- 100 micrometers piezo scanner with a maximum vertical range of 2.5 microns
- Operates in contact and LFM mode , also tapping mode, and other AC techniques
- Coated Sharpened Microlevers MSCT-MT-A sensors



TRI Austin's Park Model CP AFM System

MICROSCOPE

- Olympus BX51 Microscope
- Vertical stage movement: 25mm stage stroke with coarse adjustment limit stopper
- Torque adjustment for coarse adjustment knobs
- Stage mounting position variable
- High sensitivity fine focusing knob (minimum adjustment gradations: 1µm)
- Built-in Koehler illumination for transmitted light
- 12V100W halogen bulb (pre-centered) Built-in filters (LBD-IF, ND6, ND25 optional)



Olympus BX51 Series



tri-austin.com

DOYLE MOTES, P.E.
 NDE DIVISION DIRECTOR
 512.615.4475
 dmotes@tri-austin.com

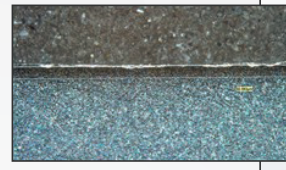




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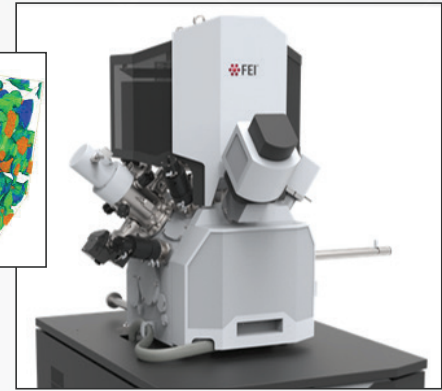
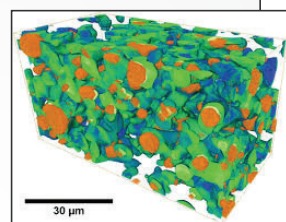
OPTICAL STEREO MICROSCOPE

- Leica M205A Stereomicroscope
- Fully automated
- 16:1 Zoom
- Structural detail resolution down to 476nm
- Numerical aperture of 0.35
- Resolution down one micrometer with 61.55mm working distance
- Indexed stage allows large area stitching and precise position measurements



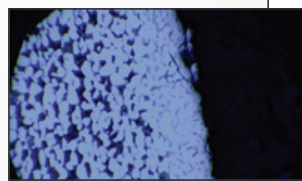
FOCUSED ION BEAM SCANNING ELECTRON MICROSCOPY

- Scios 2 HiVac FIB/SEM with EBL
- Resolution: 0.8 nm at 30keV in STEM
- Voltage: 200eV to 30 keV
- Current: 1 pA to 400nA
- Stage: 110 x110 mm with 65 mm z-travel, 360° rotation, -15° to 90° tilt
- NICol SEM column with Shottky emitter source
- Can do FIB milling of samples
- EDS and EBSD detectors



MICRO-RAMAN SPECTROMETRY

- Witec Alpha 300 Raman Spectrometer
- Confocal Raman Imaging
- Hyperspectral image generation
- Excellent lateral resolution
- Depth resolution ideally suited for 3D image generation and depth profiles
- Ultra-fast Raman imaging option with under one millisecond integration time per spectrum
- Ultra-high throughput spectroscopic system for best sensitivity and spectral resolution
- Non-destructive imaging technique: no staining or fixation of the sample required
- 3 excitation wavelengths, 488, 532, 785 nm
- Can do mapping of PL as well



OPTICAL PROFILOMETRY

- Wyko NT 9100 optical profilometer
- Vertical Measurement Range: 0.1nm to 1mm
- Vertical Resolution: $1 < \mathring{A}$
- RMS Repeatability: 20.01nm
- Vertical Scan Speed: up to 7.2 μ m/sec
- Lateral Spatial Sampling: 0.08 to 13.1 μ m
- Field- of -View: 8.24mm to 0.05mm

