

**Objective:**

The Microscopy Cluster of MRIF is a central shared facility for microanalysis. It plays an important role in providing microanalysis services and research collaborations to the researchers on the campus of University at Buffalo, as well as off-campus industries and other institutions in the Buffalo area and elsewhere in the state.

**Instrumentation:**

1. JEOL JEM 2010 High Resolution Electron Microscope (HREM)
2. JEOL SEM 5300 Scanning Electron Microscope (SEM)
3. Quesant Instruments Inc. - Resolver Atomic Force Microscope (AFM)
4. Digital Optical Microscope (DOP) - Olympus AX70TRF
5. VCR 306-1 Ion Mill
6. VCR D500 Dimpler
7. W-22 Wire Saw

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## Microscopy Facility of the Materials Research Instrument Facility (MRIF)

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JEOL JEM 2010 High Resolution Electron Microscope (HREM)

The JEM 2010 high accuracy, analytical electron microscope allows both high resolution and accurate elemental microanalysis. Its point resolution is 0.19 nm; the magnification can be varied from 50x to 1,500,000x. It is equipped with a 5-axis micro-active goniometer for convenient microstructure analysis for many kinds of crystalline



Olympus ProvisAX70 Digital Optical Microscope (DOP)



JEOL SEM 5300 Scanning Electron Microscope (SEM)

materials. The Transmission Electron Microscope (TEM) mode provides images in both bright and dark field, and the corresponding crystal structures by electron diffraction. The elemental composition of the materials (from carbon to heavier elements) can be determined by the installed EDX analysis system. The Convergent Beam Diffraction (CBD) mode is very helpful in analyzing crystal symmetry, and the Nano Beam Diffraction (NBD) mode provides crystal structure for nano-particles. TEM samples must be 3mm in diameter, and the thinned area should be less than 400nm in diameter for general images and 100nm for high resolution images.

The JEOL SEM 5300 Scanning Electron Microscope provides the possibility of studying specimens up to 5 inches in diameter at resolution down to 4.5 nm. This system also provides high quality information on surface morphology by secondary electron imaging (SEI) to 200,000x magnification, and chemical phase distribution by back-scattered electron imaging (BEI) to 200,000x magnification. It is equipped with a Voyager X-ray Quantitative Microanalysis System with Digital Imaging, which can provide near-surface elemental analysis, X-ray maps and line scans. Elements with mass number equal to or greater than carbon can be analyzed.

The Quesant Resolver TM Atomic force Microscope (AFM) is capable of scanning large samples at resolution approaching that of individual atoms. A 90° top-down view with a monocular microscope provides for easy laser alignment and the ability to quickly find sample features as small as 4mm. Samples as large as 6"x6"x2"" can be scanned at any point. Analysis of liquid/surface morphologies is also possible.

The digital interference contrast microscope, Olympus ProvisAX70 Digital Optical Microscope (DOP) Model AX70TRF, is capable of



Quesant Resolver Atomic Force Microscope (AFM)

studying the surface morphology of materials with visible optical illumination at a resolution of approximately 0.5 microns. It has Brightfield/Darkfield/Nomarski/Polarized/Fluorescence modes, and is equipped with a digital CCD camera permitting images to be viewed on a color monitor. The images can be converted to text files, saved and printed when needed.

The cluster is equipped with several necessary instruments for TEM sample preparation, such as an Ion Mill (306-1 by VCR Group, Inc.), a Dimpler (D500 by VCR Group, Inc.), a Wire Saw (WS-22 by Princeton Scientific Corp.) and grinding /polishing machines (by Struers). A full dark room can provide high quality photographic services.



VCR 306-1 Ion Mill