FACILITIES, EQUIPMENT AND OTHER RESOURCES

**Laboratory:** The PI has approximately 2,000 sq. ft. of laboratory space (Rms. 2548, 2550, and 2564 Engineering Development Center) in the recently completed wing of the Engineering Building. The laboratories house the PI’s major research instruments including AFMs and X-ray diffractometer. The laboratories are equipped with fume hoods, deionized water, and bench for at least 10 research stations.

**Computer:** The PI has 7 desktop and laptop computers for research with necessary software for word processing, data analysis, graphics manipulation, and reference management. Some of the computers are also used for control of instrumentation including optical microscope, AFM, and FTIR. These computers are connected to laser printers.

**Office:** The PI has approximately 100 sq. ft. of office space in College of Engineering Building (Rm. 1109).

**MAJOR EQUIPMENT**

**Facilities and Instrumentation available in the PI’s laboratory (Chemical Engineering and Materials Science, WSU)**


2. **Polarized Optical Microscopy (POM):** Olympus BX60 with Sony digital camera.

3. **Fourier Transform Infrared Spectroscopy (FTIR):** Nicolet Magna IR 560 with attenuated total reflection (ATR) attachment.

4. **Contact Angle Goniometer:** Ramé-Hart.

5. **Langmuir-Blodgett (LB) Mini-Trough:** KSV M1200 and M1003 with dipping system and microscopy trough with quartz window.

6. **High resolution X-ray diffractometer:** Rigaku SmartLab high-resolution θ/θ XRD system with in-plane diffraction attachment, small angle X-ray scattering attachment, GXRR reflectivity analysis software, and NanoSolver SAXS analysis software.


8. **Crystallization simulation software:** Materials Studio by Accelrys with materials visualizer, quantum mechanics tools, and classical simulation tools. Specifically, the software is used to visualize crystal structure, crystal face chemical composition, and predict crystal orientation at the nanoparticle surface.

**Materials characterization equipment available in the Central Instrumentation Facility (housed in the Department of Chemistry, WSU)**

1. **Transmission Electron Microscopy (TEM):** JEOL FasTEM 2010 HR with a LaB₆ thermoelectric emission gun working at 200 kV and an in situ EDAX unit. Peripherals include double tilt beryllium sample holder for chemical analysis and double tilt cryogenic and high temperature (up to 1,100°C) probes.

2. **Scanning Electron Microscopy (SEM):** JEOL JSM-7600F Thermal Field Emission Scanning Electron Microscope has been purchased in addition to the existing Hitachi S-2400 with an in situ EDAX unit.
(3) X-ray Powder Diffraction (XRD): Rigaku RU 200B equipped with a rotating anode copper source and Jade analysis software.
(4) Electron Paramagnetic Resonance (EPR) Spectroscopy: Bruker EMX model EPR spectrometer with 9.43 GHz (X-band) microwave frequency and cryogenic capabilities (liquid N\textsubscript{2} or He).
(5) X-ray Fluorescence (XRF) Analysis: Wavelength dispersive Siemens model SRS 300 spectrometer with Sr target (40 kV, 30 mA).
(7) Nuclear Magnetic Resonance: Four Fourier NMR spectrometers for routine solution-phase analysis (including multinuclear measurements and temperature-dependent studies): a QE-300, Unity-300, Mercury-400, and Unity-500; additionally, a Bruker 700 MHz NMR for biomolecular studies.
(8) Mass Spectrometry: Magnetic sector (Kratos MS80RFA, Kratos MS80, Kratos MS50TC), quadrupole (Hewlett-Packard GC/MS 5988A and a new Micromass Quatro LC) and TOF (Bruker Uniflex MALDI-TOF and Micromass Exact Mass) instruments.
(9) Small Instrumentation: UV-visible, Infrared and CD analyses.
(10) Differential Thermal Analysis (DTA).

Materials characterization equipment available in the Smart Sensors and Integrated Microsystems (SSIM) Laboratory (Housed in the Electrical and Computer Engineering Department, WSU)

(1) PHI 5500 X-ray photoelectron spectrometer with a monochromatized AlK\textalpha X-ray source (1486.6 eV) and AugerScan system control by RBD Enterprise.
(2) PHI 660 Scanning Auger electron spectrometer with LaB6 cathode and duoplasmatron sputter ion gun.
(3) Perkin-Elmer Lambda 900 UV/VIS/NIR spectrometer for variable angle optical transmission and reflection measurements and integrated temperature dependent photoconductivity measurement features.
(4) A variable angle single wavelength ellipsometry system.
(5) Dynamic light scattering instrument for particle size determination.

Other Resources: WSU provides sufficient resources to support the project including secretarial, machine shop, electronics shop, and C\&IT support.