

# MatNet Facilities

---

## 1. Photoelectric Emission Microscope *Bowling Green State University*

This instrument is used in surface morphological characterization and can be used to monitor the progress of surface reactions at real time video rates. Lateral resolution can approach 20 nm. Staib PM150 PEEM with detector and controls.

Contact: Dr. Michael V. Mundschau  
(419) 372-2890  
e-mail: mmundsc@bgnet.bgsu.edu

---

## 2. Optical Properties Characterization *Bowling Green State University*

Optical characterization of devices at the femtosecond time scale from room temperature down to liquid nitrogen temperatures. Coherent MIRA 900 Femtosecond mode-locked laser.

Contact: Dr. Yujie Ding  
(419) 372-8785  
e-mail: yding@bgnet.bgsu.edu

---

## 3. Ion Beam Accelerator *Case Western Reserve University*

This system consists of a 1.7 MV tandem pelletron accelerator for the production of 3.4 MeV protons, 5.1 MeV alpha particles, and N ions with energies in excess of 7.0 MeV. Can provide thin film depth profile analysis using Rutherford Back Scattering (RBS); hydrogen and stable isotopic depth profile analysis using Nuclear Reaction Analysis (NRA); and chemical analysis using Proton-induced X-ray Emission (PIXE). In most instances the analysis is non-destructive. NEC 5SDH.

Contact: Dr. Arthur H. Heuer  
(216) 368-3868  
e-mail: ahh@po.cwru.edu

---

**4. High Resolution Field Emission Scanning Electron Microscope**  
**Case Western Reserve University**

This instrument has two secondary electron detectors, a back scatter detector, and an infrared chamber scope. In addition, it has a Noran energy dispersive x-ray detection system and an EBSP detector capable of producing Kikuchi patterns suitable for crystallographic analysis. The microscope is capable of operating at a spatial resolution of less than 1.5nm at an energy of 15kV.  
Hitachi S-4500 FE SEM.

**Contact:** Dr. Arthur H. Heuer  
(216) 368-3868  
**e-mail:** [ahh@po.cwru.edu](mailto:ahh@po.cwru.edu)

---

**5. Scanning Transmission Electron Microscope**  
**Case Western Reserve University**

This 200kV STEM is equipped with a Noran x-ray detector (HPGe UTW) sensitive to a broad range of energies and is capable of detecting light elements including boron, as well as heavier elements. The system also has a Gatan PEELS (Parallel-acquisition Electron Energy Loss Spectrometer) for light element detection and analysis. This configuration enables microchemical and microcrystallographic analysis at spatial resolution down to about 10 nm.  
Philips CM20.

**Contact:** Dr. Arthur H. Heuer  
(216) 368-3868  
**e-mail:** [ahh@po.cwru.edu](mailto:ahh@po.cwru.edu)

---

**6. High Resolution Transmission Electron Microscope**  
**Case Western Reserve University**

Working at an accelerating voltage of 400kV, this high resolution microscope operates with a point to point resolution of better than 0.19 nm.  
JEOL 4000 EX

**Contact:** Dr. Arthur H. Heuer  
(216) 368-3868  
**e-mail:** [ahh@po.cwru.edu](mailto:ahh@po.cwru.edu)

---

**7. Scanning Auger Microprobe & Secondary Ion Mass Spectrometer**  
**Case Western Reserve University**

This system is composed of a conventional scanning electron microscope with a lanthanum hexaboride (LaB6) cathode, a secondary electron detector, and an axial cylindrical mirror analyzer to detect Auger electrons produced during electron imaging. Very small spot sizes are available down to 20nm for imaging, and several hundred nm for rapid Auger data acquisition using high beam currents. Inert gas sputtering is used to clean the surface. In situ fracture stage for inducing intergranular fracture to study grain boundary segregation. The Secondary Ion Mass Spectrometer is capable of a mass range up to 512 amu, and is particularly useful for isotopic

studies of surface chemistry and trace element analysis.  
PHI 660 Auger  
PHI 3600 SIMS  
PHI 04-303.

Contact: Dr. Gary M. Michal  
(216) 368-5070  
e-mail: [gmm3@po.cwru.edu](mailto:gmm3@po.cwru.edu)

---

#### 8. Electron Spectroscopy for Chemical Analysis (XPS) Case Western Reserve University

System includes a conventional dual anode x-ray source (Mg & Al), a 200 hemispherical electron energy analyzer, a XYZT sample stage with 8 sample storage, and an inert gas sputtering source (PHI 04-303.) Includes a monochromated aluminum anode x-ray source, a multi-channel detector, a sample stage cooling attachment, and a small spot (30  $\mu$ m) electron lens with sample imaging and mapping capability.  
PHI5600 ESCA.

Contact: Dr. Gary M. Michal  
(216) 368-5070  
e-mail: [gmm3@po.cwru.edu](mailto:gmm3@po.cwru.edu)

---

#### 9. X-ray Diffractometer with High Temperature Capabilities Case Western Reserve University

4kW ultrastable x-ray diffraction system, including  $\theta/\theta$  wide angle goniometer with independently controlled stepper motors. Can also be used in  $\theta/2\theta$  mode. Accessories include high temperature (2000°C) vacuum furnace, thin film grazing angle collimation attachment, third axis stress measurement attachment and Peltier-cooled detector for high count rate.  
Scintag 6-S-4R XRD System

Contact: Dr. Gary M. Michal  
(216) 368-5070  
e-mail: [gmm3@po.cwru.edu](mailto:gmm3@po.cwru.edu)

---

#### 10. Mechanical Testing Facility Case Western Reserve University

This facility enables testing under static, dynamic, and cyclic conditions, over temperatures ranging from -196 C to 1400 C. High alignment grips and hydraulic grips are available for testing brittle and semi-brittle materials, while crack growth can be measured via optical, compliance, or D.C. potential drop techniques. Creep testing frames are available, as is a novel high gas, high temperature pressure testing device which enables tension testing with superposed hydrostatic pressures of up to 100 kpsi at temperatures up to 1200 C. A unique 550,000 lb. capacity Manufacturing Process Simulator, which will enable sheet metal forming experiments and forging simulations, is currently under construction.  
Screw Driven Test Frames  
2 Instron 1100

1 Instron 1361 (Electro-Mechanical)  
Servo Hydraulic Test Frames  
1 MTS (50,000 lbs., w/±3 in travel)  
1 MTS (20,000 lbs., w/±3 in travel)  
1 MTS (3,000 lbs., w/±2 in travel)  
Impact Machine  
1 Wiedeman Baldwin with Dynatop Instrumentation

Contact: Dr. John Lewandowski  
(216) 368-4234  
e-mail: [jjl3@po.cwru.edu](mailto:jjl3@po.cwru.edu)

---

**11. Molecular Beam Epitaxy Facility**  
*University of Cincinnati*

The facility provides investigators with state-of-the-art capabilities to fabricate semiconductor thin films with closely controlled properties.

Contact: Dr. Andrew Steckl  
(513) 556-4777  
e-mail: [asteckl@uceng.uc.edu](mailto:asteckl@uceng.uc.edu)

---

**12. Analytical Transmission Electron Microscope**  
*The Ohio State University*

This electron microscope offers a resolution down to 0.18 nm and can be operated up to 300kV accelerating voltage. There are single tilt, double tilt, and heating sample holders.  
Hitachi H-9000 NAR

Contact: Dr. Hendrik Colijn or Dr. Cameron Begg  
(614) 292-0674 (614) 292-4429  
e-mail: [colijn.1@osu.edu](mailto:colijn.1@osu.edu) [begg.4@osu.edu](mailto:begg.4@osu.edu)

---

**13. Analytical Transmission Electron Microscope**  
*The Ohio State University*

This 200kV instrument with LaB6 electron source is optimized for crystallographic work. It has fine probe and CBED capabilities and offers a resolution down to 0.27 nm. A light element x-ray detector and serial electron energy-loss spectrometer are attached.  
Philips CM-200 TEM

Contact: Dr. Hendrik Colijn or Dr. Cameron Begg  
(614) 292-0674 (614) 292-4429  
e-mail: [colijn.1@osu.edu](mailto:colijn.1@osu.edu) [begg.4@osu.edu](mailto:begg.4@osu.edu)

---

**14. Analytical Transmission Electron Microscope**  
*The Ohio State University*

This 200kV instrument has a field emission electron gun (FEG) for high source brightness. This allows very high electron currents in small probes. Attachments include a light-element x-ray detector and Gatan imaging filter electron energy-loss spectrometer for PEELS and energy filtered imaging. The microscope has fine probe and CBED capabilities and offers down to a 0.24 nm resolution. Philips CM-200FEG TEM

Contact: Dr.Hendrik Colijn or Dr.Cameron Begg  
(614) 292-0674 (614) 292-4429  
e-mail: colijn.1@osu.edu begg.4@osu.edu

---

**15. Teaching Transmission Electron Microscope**  
*The Ohio State University*

This instrument operates up to a 200kV accelerating voltage and utilizes a Be window EDS detector.  
Philips EM-400T

Contact: Dr.Hendrik Colijn or Dr.Cameron Begg  
(614) 292-0674 (614) 292-4429  
e-mail: colijn.1@osu.edu begg.4@osu.edu

---

**16. Scanning Electron Microscope**  
*The Ohio State University*

This instrument has a field emission gun for high brightness for both low voltage and high resolution imaging down to 1.5 nm. Operates at a 200V-30kV accelerating voltage and has a light element x-ray detector, along with SE, SC, BSE, EBSP, and EBIC detectors  
Philips XL-30

Contact: Dr.Hendrik Colijn or Dr.Cameron Begg  
(614) 292-0674 (614) 292-4429  
e-mail: colijn.1@osu.edu begg.4@osu.edu

---

**17. Scanning Electron Microscope**  
*The Ohio State University*

This general purpose SEM operates at 10-25kV accelerating voltage with W source and has a resolution of 6.0 nm. It has secondary electron and back scattered electron detectors with digital imaging and mapping using a Be window EDS system.  
Hitachi S-510

Contact: Dr.Hendrik Colijn or Dr.Cameron Begg  
(614) 292-0674 (614) 292-4429  
e-mail: colijn.1@osu.edu begg.4@osu.edu

---

**18. X-Ray Diffractometer**  
*The Ohio State University*

This instrument has a Cu anode, 2kW sealed tube x-ray source and a 3 circle goniometer with pole-figure attachment with integrated computer control.  
Scintag PAD-V

Contact: Dr.Hendrik Colijn or Dr.Cameron Begg  
(614) 292-0674 (614) 292-4429  
e-mail: colijn.1@osu.edu begg.4@osu.edu

---

**19. Hot Stage X-Ray Diffractometer**  
*The Ohio State University*

This instrument has a Cu anode, 2kW sealed tube x-ray source with a q-q goniometer and offers controlled atmosphere heating to 1400°C with integrated computer control.  
Scintag XDS-2000

Contact: Dr.Hendrik Colijn or Dr.Cameron Begg  
(614) 292-0674 (614) 292-4429  
e-mail: colijn.1@osu.edu begg.4@osu.edu

---

**20. X-Ray Camera System**  
*The Ohio State University*

This system utilizes a Cu Anode, 2kW sealed tube x-ray source and provides Laue, Debye-Scherrer, and other cameras.  
Philips XRG-3000

Contact: Dr.Hendrik Colijn or Dr.Cameron Begg  
(614) 292-0674 (614) 292-4429  
e-mail: colijn.1@osu.edu begg.4@osu.edu

---

**21. Surface Analysis Laboratory**  
*The Ohio State University*

Laboratory contains: -Vacuum generator dual chamber -ESCA (XPS) chamber -Al monochromatic x-ray, Al/Mg twin x-ray -Auger (AES) focus electron gun -UPS/HeI& HeII UV source - hemispherical analyser. SIMS chamber -duoplasmatron -MIG metal ion gun -SIMS & RGA detector. Prep Chamber: AG21 sputter gun, fracture attachment, vacuum transport vessel. Vacuum leak detector.

Contact: Joel Haynes  
(614) 292-2760  
e-mail: jahaynes@mps.ohio-state.edu

---

**22. High Frequency Conductivity Facility**  
*The Ohio State University*

This high frequency dielectric response lab allows measurement of high frequency, 75-100 GHz (W band), microwave complex dielectric response. Measurement ability ranges from insulating materials ( $\epsilon \sim 1 - 10$ ,  $\sigma < 10^{-6}$  S/cm) to highly conducting materials ( $\epsilon \sim 10^3$ ,  $\sigma \sim 10^2$  S/cm).

Wilton 360B Vector Network Analyzer  
WR 10-2 Waveguide fixture

Contact: Dr. Wonpil Lee  
(614) 292-6859  
e-mail: wplee@mps.ohio-state.edu

---

**23. Time-Resolved Optical Response Facility**  
*The Ohio State University*

The facility consists of a 100 femtosecond Titanium -Sapphire kilohertz laser system. This system provides femtosecond resolution and timescales from femtoseconds to nanoseconds.

Spectra Physics 2080 Argon Ion Laser  
Spectra Physics Tsunami Ti:S Laser  
Positive Light Spitfire kilohertz amplifier  
Photometrics CCD camera and Chromex spectrographs

Contact: Dr. Linn Van Woerkom  
(614) 292-9626  
e-mail: lvw@mps.ohio-state.edu

---

**24. Mechanical Behavior Laboratory**  
*The Ohio State University*

This facility provides for the mechanical testing of materials and components. Equipment available includes: Screw-driven Test Frames, Servo-Hydraulic Test Frames, and Hydraulic Forming Simulator.

Screw-Driven Test Frames

Instron 1362 (22,000 pounds capacity w/± 2 in travel)

Monsanto Benchtop (5,000 pounds tension only w/8 in travel)

Servo-Hydraulic Test Frames

Instron 1331 ( 22,000 pounds capacity w/±2 in travel)

Instron 1322 (55,000 pounds capacity w/±5 in travel and furnaces for temperatures up to 1500°C)

MTS (110,000 pounds capacity w/±3in travel)

Contact: Dr. Lloyd Barnhart  
(614) 292-5456  
e-mail: Barnhart.44@osu.edu

---

**25. Plasma Transferred-Arc Materials Processing System**  
*The Ohio State University*

This system allows the preparation of reliable, pure and reproducible samples of metallic, intermetallic, alloy, some ceramic, and composite, materials for aerospace and automotive structural materials. Samples produced on a prototype industrial scale. Under construction.

Contact: Dr. Hamish Fraser  
(614) 292-2708  
e-mail: [fraser@kcqll.eng.ohio-state.edu](mailto:fraser@kcqll.eng.ohio-state.edu)  
or  
Dr. Mike Mills  
(614) 292-7514  
e-mail: [millsmj@kcqll.eng.ohio-state.edu](mailto:millsmj@kcqll.eng.ohio-state.edu)  
or  
Dr. Carroll Mobley  
(614) 292-5770  
e-mail: [mobley.1@osu.edu](mailto:mobley.1@osu.edu)

---

**26. Solid-State Nuclear Magnetic Resonance (NMR) Spectroscopy Facility**  
*The Ohio State University*

This facility will be used for the study of structural and electronic properties of ceramics, glasses, catalysts, high temperature superconductors, and organic/inorganic polymers. Facility will house a 9.4 Tesla (400MHz-1H) spectrometer with a double resonance variable temperature high speed magic-angle spinning probe and a double resonance variable temperature static sample probe. Operational Spring, 1996.

Contact: Dr. Charles Cottrell or Dr. Philip Grandinetti  
(614) 292-0489 (614) 292-6818  
e-mail: [cottrell.2@osu.edu](mailto:cottrell.2@osu.edu) [grandinetti.1@osu.edu](mailto:grandinetti.1@osu.edu)

---

**27. X-Ray Materials Analysis Center**  
*University of Akron*

A state-of-the-art analysis center for the characterization of polymeric material of all types. An innovative plate imaging system will allow very fast collection of wide angle diffraction data using a 18kW rotating anode source. Samples may also be probed with small angle scattering. Under construction.

Contact: Dr. Stephen Cheng or Dr. Mark Foster  
(216) 972-6931 (216) 972-5323  
e-mail: [foster@charles.polymer.uakron.edu](mailto:foster@charles.polymer.uakron.edu)

---

**28. Electron Emission Spectrometer (ESCA)**  
*Case Western Reserve University*

This instrument allows exploration of surfaces to a depth of 0.4 to 8.0 nm. Sputtering can be used to remove surface contaminants in very thin layers (1.5 to 2.5 nm). A high intensity x-ray source has been installed that provides high sensitivity.  
Varian VIEE-15

Contact: Dr. Gheorghe D. Mateescu  
(216) 368.2589  
e-mail: gdm2@po.cwru.edu

---

**29. Ion Scattering Spectrometer (ISS)**  
*Case Western Reserve University*

This instrument can be used for the elemental analysis of the first atomic layer with a sensitivity limit of approximately 10<sup>-3</sup> monolayer. Very low primary ion current densities ensure minimal damage to sample.  
Ultrahigh Vacuum ISS

Contact: Dr. Gheorghe D. Mateescu  
(216) 368.2589  
e-mail: gdm2@po.cwru.e

---

**30. Secondary Ion Mass Spectrometer (SIMS)**  
*Case Western Reserve University*

This instrument makes it possible to measure mass spectra of virtually any kind of sample since there are no limits set by the specimen's vapor pressure. Detection limits are as low as 10<sup>-9</sup>g. This instrument allows element mapping in the x-y plane that can be combined with depth profiling in order to obtain 3D elemental analysis.

Contact: Dr. Gheorghe D. Mateescu  
(216) 368.2589  
e-mail: gdm2@po.cwru.e

---

**31. Laser Raman Spectrometer**  
*Case Western Reserve University*

This instrument is equipped with a double-pass monochromator and a CR-8 (8W) argon laser. Features include: a large sample compartment, variable temperature capability, sample spinning, slit widths down to 1mm. and photon counting or DC level multiplier detector.  
SPEX Ramalog-5

Contact: Dr. Gheorghe D. Mateescu  
(216) 368.2589  
e-mail: gdm2@po.cwru.e

---

**32. Superconductive Fourier Transform NMR**  
*Case Western Reserve University*

This system offers highly-enhanced sensitivity associated with a wide variety of double and triple resonance capabilities. In addition to protons, deuterons, and fluorine nuclei, the system provides access to other nuclei including lithium-7, boron-11, carbon-12, nitrogen-15, oxygen-17, sodium-23, silicon-29, phosphorus-31, sulfur-33 and selenium-77. System operates at 4.7 Tesla (200 MHz).  
Varian XL-200M

**Contact:** Dr. Gheorghe D. Mateescu  
(216) 368.2589  
**e-mail:** gdm2@po.cwru.e

---

**33. Superconductive Fourier Transform NMR (FTNMR)**  
*Case Western Reserve University*

This system offers highly-enhanced sensitivity associated with a wide variety of double and triple resonance capabilities. The system is used primarily for routine proton measurements. System operates at 4.7 Tesla (200 MHz).  
Varian XL 200H

**Contact:** Dr. Gheorghe D. Mateescu  
(216) 368.2589  
**e-mail:** gdm2@po.cwru.e

---

**34. Nuclear Magnetic Resonance (NMR) Spectroscopy**  
*Case Western Reserve University*

This 400 MHz (9.4 Tesla) system provides excellent sensitivity, dynamic range and resolution. High resolution solid state multinuclear measurements can be done via CP-MAS (crosspolarization-magic angle spinning). Wide line spectroscopy can also be performed. Probes are available with inserts from 5 to 20 mm diameter that will ensure multinuclear measurements from 13.9 MHz (109Ag) to 400.13 MHz (1H).  
Bruker MSL-400

**Contact:** Dr. Gheorghe D. Mateescu  
(216) 368.2589  
**e-mail:** gdm2@po.cwru.e

---

**35. Nuclear Magnetic Resonance (NMR) Microscopy**  
*Case Western Reserve University*

This microscope, which is installed on the MSL-400, offers extremely high resolution by intrinsic sensitivity of the high field spectrometer and by the outstanding strength of the x, y, z, field gradients which can be set at values exceeding 100 Gauss/cm.

Contact: Dr. Gheorghe D. Mateescu  
(216) 368.2589  
e-mail: gdm2@po.cwru.e  
email: gdm2@po.cwru.edu

---

**36. Electron Paramagnetic Resonance (EPR) Spectrometer**  
*Case Western Reserve University*

This instrument provides detection of paramagnetic centers in organic and inorganic molecules (e.g. free radicals) in solution and solid state at various temperatures. Resonance frequency: 8.8-9.6 GHz (X-band).  
Varian E-line Century Series

Contact: Dr. Gheorghe D. Mateescu  
(216) 368.2589  
e-mail: gdm2@po.cwru.e

---

**37. Cryogenic GC-FTIR**  
*Case Western Reserve University*

This instrument offers the unique capability of isolating on a gold disk at 8 $\frac{1}{4}$ K, in a single operation, minute chromatographic fractions into an argon matrix. Elimination of rotational broadening combined with the possibility of accumulating many scans, increases the sensitivity of this technique by a factor of 100. The spectrometer can be used separately in transmission and reflectance modes such as ATR (Attenuated Total Reflectance) and diffuse reflectance.  
Mattson Sirius-100

Contact: Dr. Gheorghe D. Mateescu  
(216) 368.2589  
e-mail: gdm2@po.cwru.e

---

**38. GC Mass Spectrometer**  
*Case Western Reserve University*

This instrument is a dual-sector mass spectrometer which, in addition to the conventional EI (electron impact) source, has CI (chemical ionization) and FAB (fast atom bombardment) capabilities. The resolution attainable in EI and CI modes is 7000 amu. At low resolution, FAB and GC/MS measurements can be made. The practical mass limit in FAB is 3000 amu; it can be expanded to 7000 amu with an added postacceleration detector.  
Kratos MS25RFA

Contact: Dr. Gheorghe D. Mateescu  
(216) 368.2589  
e-mail: gdm2@po.cwru.e

---

**39. Single Crystal X-ray Crystallographic System**  
**Case Western Reserve University**

This system consists of a P3 diffractometer with a low temperature setup, Tektronix 4207, a Nicolet crystallographic work station and other equipment. The ShellXTL programs, written by George Sheldrick are used for rapid structure solution and presentation of graphics.  
Nicolet R3 M/V

**Contact:** Dr. Gheorghe D. Mateescu  
(216) 368.2589  
**e-mail:** gdm2@po.cwru.e

---

**40. Scanning Electron Microscope**  
**Bowling Green State University**

An SEM utilizing a lanthanum hexaboride source with an accelerating voltage range of 0.2 to 30 kilovolts. Ultimate resolution is 3.5 nm. Accessories include a backscattered electron detector and energy dispersive X-ray analysis system with windowless capabilities (detection down to boron).

**Contact:** Dr. Carol Heckman  
(419) 372-8218  
**e-mail:** heckman@bqnet.bgsu.edu

---

**41. Transmission Electron Microscope**  
**Bowling Green State University**

A conventional tungsten source TEM with attached CCD camera interfaced to a Sun workstation to provide comprehensive image collection and analysis capability.

**Contact:** Dr. Carol Heckman  
(419) 372-8218  
**e-mail:** heckman@bqnet.bgsu.edu

---