

Nanoscale Science and Technology Laboratory

The Nanoscale Science and Technology Laboratory (NSTL) clean room facility offers the scientific and research communities a wide array of semiconductor-based device fabrication equipment. This premier research facility, which opened in June 2003, is located at the Oak Ridge National Laboratory (ORNL), a world leader in materials science, electronic device research, and nanofabrication.

The ORNL NSTL facility was constructed to support a wide variety of thin-film and solid-state electronic research projects and provides hands-on training and consultation in semiconductor-based device fabrication. The facility's available processes include photolithography, thin-film deposition and etching, metrology and imaging, and wet chemical processing. The NSTL wafer-scale fabrication facility is currently involved in nanotechnology-fueled genome research, nanomaterials

functionalization, and nanoscale electron optics research.

Features

- Wide range of processes and microfabrication/nanofabrication techniques.
- Photolithography and etching.
- Thin-film deposition.
- Semiconductor-based device fabrication.
- State-of-the-art SEM, AFM, and optical microscopy.
- Contains 1,200 sq. ft. of class 100 and 1000 clean room space.

Capabilities

Lithography

GCA AutoStep 200 step-and-repeat i-line photolithography system—capable of 0.5 μm resolution. The system is capable of fully exposing round substrates from 10 millimeters to 200 millimeters in diameter.



Nanoscale Devices and Systems

Purpose: NSTL offers a wide array of semiconductor-based device fabrication equipment to the scientific and research communities.

Sponsors: Various Work for Others sponsors.

- Features:**
- Semiconductor processing.
 - 1200 ft² of class 100 and 1000 clean room space.
 - Hitachi S4700 scanning electron microscope.

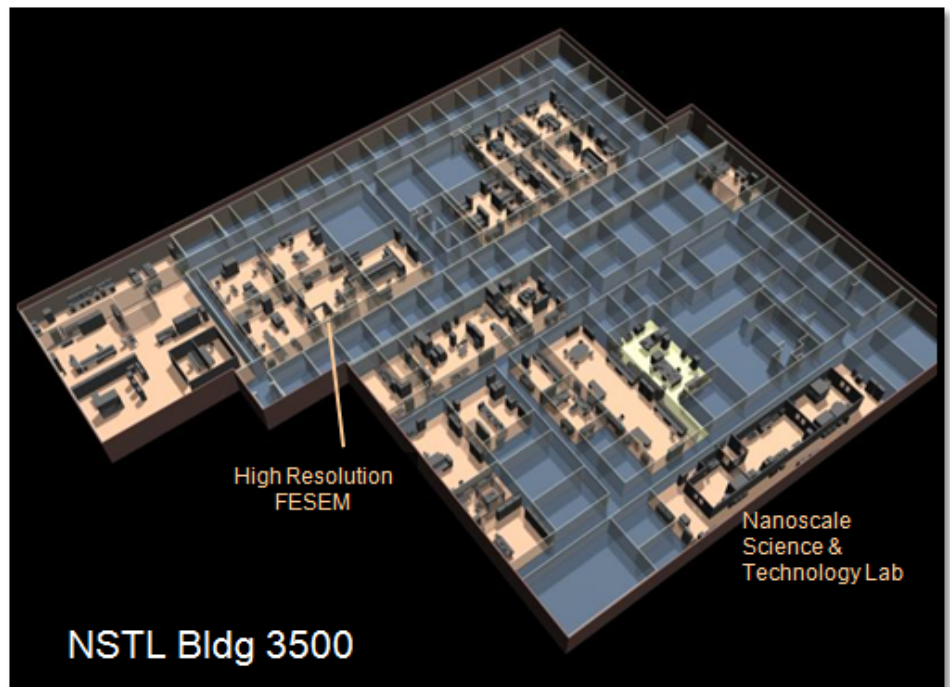
Users: Scientists and engineers from ORNL, universities, industries, and other government laboratories.

Complementary ORNL Facilities:

- Center for Nanophase Materials Sciences.
- High Temperature Materials Laboratory.

Contact Information:

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NSTL Bldg 3500

Karl Suss MA-6 mask aligner—system with the ability to print submicron features on substrates from 50 millimeter to 150 millimeter in diameter. The system is equipped with both front and back alignment capability.

Thin Film Deposition

Trion Technologies ORION PECVD System—plasma-enhanced CVD system capable of depositing SiO₂, Si₃N₄, and amorphous Si. Substrate handling capability from small pieces up to 200-millimeter diameter wafer rounds.



Tytan Tystar LPCVD System—low-pressure CVD system capable of handling substrates in batches of 25 wafers per run. Maximum substrate size is 150 millimeters. Amorphous silicon, polysilicon, and n-phos. polysilicon capabilities.

Electron-beam evaporator—a 10 keV, 4-crucible electron beam evaporation system capable of depositing metal, dielectric, and semiconductor materials. Substrate handling capability from small pieces up to and including 3-100-millimeter wafer rounds.



DC Magnetron Sputtering System—single 2-inch magnetron sputtering gun system capable of depositing metals such as Cu, Ti, and W. Substrate handling capability from small pieces to 100-millimeter wafer rounds.

Etching Processes

Trion Technologies ORACLE RIE System—cluster reactive ion etching system equipped with a dedicated ICP F₂-based etch chamber and RIE Cl₂-based etch chamber.



Automated substrate handling capability from small pieces up to 200-millimeter diameter rounds.

Reynolds Tech acid/caustic etch bench—a laminar flow bench dedicated for wet chemical etching processes.

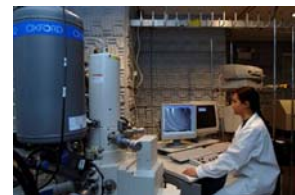
Metrology & Inspection

Filmetrics F-40 thin film measurement system—reflectometer for measuring thickness and refractive index of optically transparent materials.

Tencor Alphastep profilometer—stylus profilometer system used for measuring step heights of a variety of materials.

Leitz optical microscope—brightfield/darkfield optical microscope with 1500× magnification capability. CCD camera for digital image capture.

Hitachi S-4700 scanning electron microscope—cold field emission SEM. Resolution of 2.5 μm at 1 kV at the microanalysis and specimen exchange position. Energy X-ray energy dispersive spectroscopy for rapid elemental analysis.



Related Nearby Facilities

- The Center for Nanophase Materials Sciences is a collaborative nanoscience user research facility for the synthesis, characterization, theory/modeling/simulation, and design of nanoscale materials.
- The High Temperature Materials Laboratory is a Department of Energy User Facility dedicated to solving materials problems that limit the efficiency and reliability of systems for power generation and energy conversion, distribution, and use.

Contact Information

For more information on accessing NSTL and related facilities, please contact Gary Alley (alleygt@ornl.gov) at 865-574-5725.