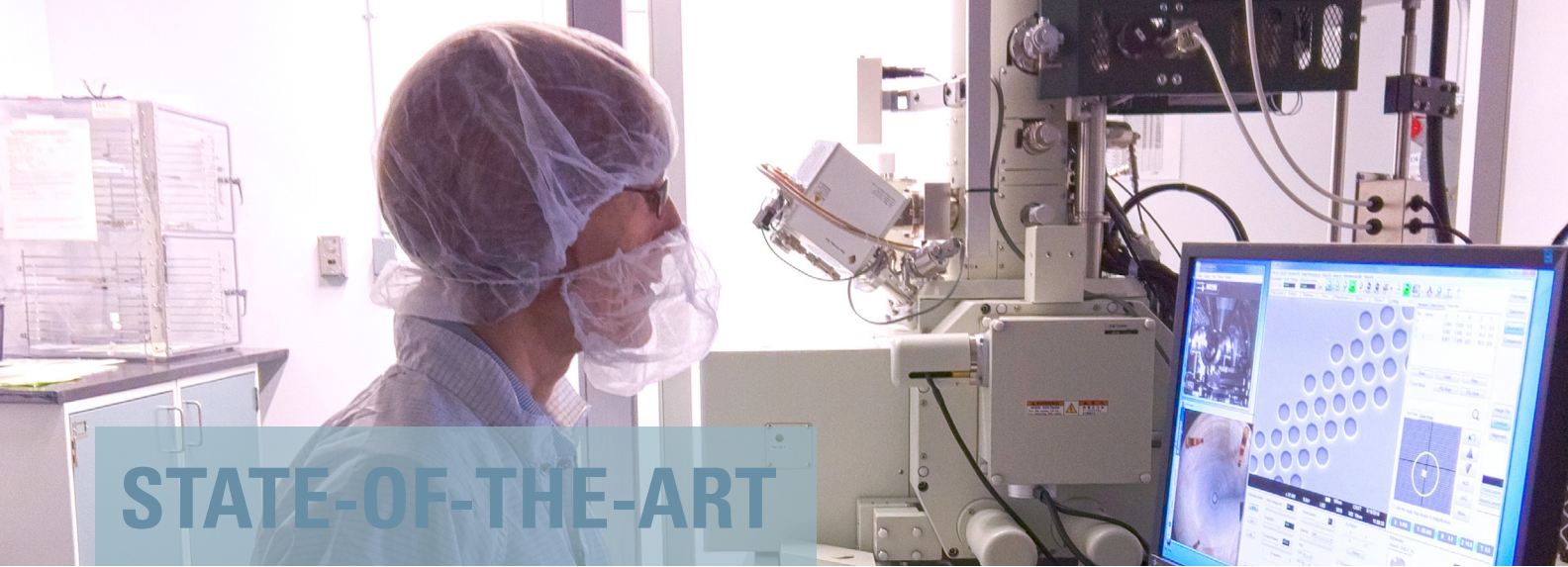




**NIST**  
National Institute of  
Standards and Technology  
U.S. Department of Commerce

**CNST**  
**NANOFAB**  
USER FACILITY



## STATE-OF-THE-ART

The Center for Nanoscale Science and Technology (CNST) NanoFab provides researchers with rapid access to state-of-the-art, commercial nanoscale measurement and fabrication tools and methods, along with technical expertise, at economical hourly rates. It is well-equipped to process and characterize a wide range of nanoscale materials, structures, and devices. The CNST is part of NIST's Physical Measurement Laboratory and promotes collaboration in nanotechnology both across NIST's laboratories and among researchers nationwide.

**To get started, contact the NanoFab Manager, [nanofab@nist.gov](mailto:nanofab@nist.gov)**

Over 100 commercial tools are available within the NanoFab's 5,600 m<sup>2</sup> (60,000 ft<sup>2</sup>) of advanced laboratory space, which includes 1,900 m<sup>2</sup> (20,000 ft<sup>2</sup>) of cleanroom. Most tools are located in the 780 m<sup>2</sup> (8,400 ft<sup>2</sup>) class 100 cleanroom. **Visit [nist.gov/cnst](http://nist.gov/cnst) for a complete list of capabilities, tools, processes, and user rates.**

- **RAPID ACCESS** – Applications are accepted continuously, with a streamlined application process designed to get projects started in just a few weeks.
- **SHARED-USE OPERATION** – Economical hourly rates, based on operating costs, with tools reserved through an online system accessible from mobile devices.
- **RESEARCHERS MAY APPLY FOR REDUCED RATES** – If a nonproprietary project advances the NIST mission, reduced rates may be available.
- **FLEXIBLE HOURS** – The NanoFab is open and staffed weekdays from 7 a.m. to midnight, with access possible 24 hours a day, 7 days a week.
- **TRAINING** – The NanoFab can train researchers in how to use tools.
- **EXPERT STAFF DEDICATED TO TECHNICAL SUPPORT AND PROCESS DEVELOPMENT** – The NanoFab is operated by a dedicated support staff of process engineers and technicians who train and assist users, operate and maintain the tools, and develop and control the processes. The support staff is available for expert consultation for all tools and processes.
- **REMOTE JOBS** – Researchers can specify the work they need done and have it performed by the NanoFab staff.
- **INTELLECTUAL PROPERTY RIGHTS ARE PROTECTED** – NIST does not claim any rights to intellectual property used or developed in the NanoFab unless a NIST federal employee is a co-inventor.



# TOOLS & PROCESSES

**LITHOGRAPHY** – Patterning of features from less than 10 nm to micrometers in size on wafers up to 200 mm in diameter.

- Two Direct Write Electron Beam Lithography Systems (JEOL JBX 6300-FS)
- Laser Pattern Generator (Heidelberg DWL 2000)
- Nanoimprint Lithography Tool (Nanonex NX-2000)
- Maskless Aligner (Heidelberg MLA-150)
- i-Line 5x Reduction Stepper (ASML PAS 5500/275)
- Contact Aligners (Suss Microtec MA8)
- Automated Resist Spin/Spray Coater (Suss Microtec ASC200 Gen 3)

**SOFT LITHOGRAPHY** – A soft lithography lab allows replication of master molds by spin and drop casting elastomeric polymers.

- PDMS Casting Station with a Spinner (Smart Coater 100) and Assembly Hood (Enviroco)
- PDMS mixing tool (FlackTek DAC 250.1 FVZ-K) and PDMS Port Creator (CorSolutions)
- Plasma bonder (Harrick PDC-32) and forced convection curing oven (Jeio Tech OF-12G)
- Soft Lithography cleanroom features a hood (Supreme Air), Microfluidic test station (CorSolutions), and Salinization/Bonding Chamber (Yield Engineering Systems) to facilitate device manufacture and testing

**DRY ETCH** – Etching for processing silicon, oxides, nitrides, polymers, metals, III-V compounds, alloys, ceramics, and multilayer structures.

- Four ICP Etchers (2 Oxford Plasmalab 100s) with sample heating and cryogenic cooling
- 2 Unaxis Shuttleline ICP Etch Systems, including “Bosch” process deep silicon etching
- Two Reactive Ion Etch Systems (Unaxis 790)
- XeF<sub>2</sub> Etch System (Xactix Xetch E1 series)
- Ion Milling System (4Wave IBE-20B) with end point detection
- Downstream Plasma Asher (ULVAC Solutions ENVIRO-1Xa) for resist stripping
- Deep Silicon Etcher (SPTS Omega c2L Rapier)

**METROLOGY AND CHARACTERIZATION** – Nanoscale imaging, structural, and chemical characterization using a wide range of electron, X-Ray, and optical techniques.

- Two Dual Beam SEM/FIB systems (FEI Helios NanoLab 660) for imaging, patterned material ablation, chemical analysis using X-Ray energy dispersive spectroscopy (EDS), and crystallographic studies using an electron backscatter diffraction (EBSD) system
- Scanning/Transmission Electron Microscope (FEI Titan) with a 16-Megapixel Camera (Gatan Oneview), cryotransfer holder and EDS and electron energy-loss analytical capabilities for chemical analysis
- Two Field Emission Scanning Electron Microscopes - FESEM (JEOL 7800F) and a FESEM (Zeiss Ultra-60) with EDS for chemical analysis
- Two Atomic Force Microscopes (AFM) - Wafer-scale AFM (Bruker Fast Scan) and a research-grade AFM (Asylum Research Cypher) with high-resolution fast scanning capability
- X-Ray Diffraction System (Rigaku SmartLab) with 9 kW rotating anode X-Ray generator for fast data collection
- Dynamic Light Scattering with Field Flow Fractionation (Wyatt Technologies Dawn Heleos II)
- Tools for ellipsometry, profilometry, reflectometry, and film stress measurements

**THIN-FILM DEPOSITION AND PROCESSING** –

Depositing and annealing a wide variety of materials with sub-nanometer precision.

- Cluster Sputter Deposition System (4Wave) with biased target chamber to produce atomically sharp interfaces
- Two Dual Gun Electron Beam Evaporator Systems (Denton Infinity 22)
- Two Sputter Deposition Systems (Denton Discovery 550)
- Furnaces for low-pressure chemical vapor deposition, thermal oxidation and diffusion processes
- Rapid Thermal Annealer (AnnealSys AS-Master 2000 HT)
- Plasma-Enhanced Chemical Vapor Deposition System (Plasma-Therm Versaline)
- Atomic Layer Deposition System (Oxford FlexALRPT)
- Parylene Deposition System (Specialty Coating Systems PDS-2010)



## NIST

Founded in 1901, the National Institute of Standards and Technology (NIST) is a non-regulatory federal agency within the U.S. Department of Commerce. NIST's mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life. The agency operates primarily in two locations: Gaithersburg, Maryland (headquarters) and Boulder, Colorado. NIST employs about 3,400 scientists, engineers, technicians, and support and administrative personnel, and hosts about 2,500 associates from academia, industry, and other government agencies, who collaborate with NIST staff and access user facilities.

## CNST NANOFAB

The Center for Nanoscale Science and Technology (CNST), part of the Physical Measurement Laboratory at the National Institute of Standards and Technology (NIST), is the Department of Commerce's nanotechnology user facility. The CNST enables innovation by providing rapid access to the tools needed to make and measure nanostructures. These tools are available to all researchers, both inside and outside NIST, with a particular emphasis on supporting industry.

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