

# Stanford University - Shared Facilities for Nanoscale Science and Engineering

About this document .....	2
Shared Facilities .....	3
Cell Sciences Imaging Facility (CSIF) .....	3
Chemistry NMR Facility .....	3
Chemistry Optical Spectroscopy Facility .....	3
Environmental Measurement I: Gas-Solution Analytical Center .....	4
Stable Isotope Biogeochemistry Laboratory .....	4
Stanford ICPMS/TIMS Facility .....	5
Stanford/USGS Micro Analysis Center .....	5
Stanford Magnetic Resonance Laboratory .....	5
Stanford Mass Spectrometry Laboratory .....	6
Stanford Nanofabrication Facility (SNF) .....	6
Stanford Nanocharacterization Facility (SNL) .....	8
Stanford Nano Center (SNC) .....	8
Stanford NNIN Computing Facility (SNCF) .....	9
Semi-shared facilities and labs .....	10
Nanomagnetics Facility .....	10
Microsystems Laboratory Cleanshop .....	10
Stanford Microfluidics Foundry .....	11

## About this document

This document seeks to provide an overview of instrumentation and capabilities that exist at Stanford to support nanoscale science and research in shared or semi-shared facilities and labs.

- Shared facilities
  - Usually open to Stanford community; usually fees paid for instrument or service usage
- Semi-shared facilities and labs
  - Access more restricted; usually fees pad for instrument or service usage
- Individual labs

The listings might be incorrect and partially outdated. For up-to-date information, please check with the lab or facility. If you have any corrections or additions, please email them to [tobi@stanford.edu](mailto:tobi@stanford.edu).

In addition to the facilities, we are also collecting information about individual labs' instrumentation and capabilities. Access is usually restricted and might not allow/support other users that are not part of the research team. We intend to just list this information for possible collaborations or discussions. If you would like to list your lab, please let us know.

## Shared Facilities

### Cell Sciences Imaging Facility (CSIF)

Website: <http://taltos.stanford.edu/>

Contact: Jon Mulholland ([jwm@stanford.edu](mailto:jwm@stanford.edu))

Location: Beckman Center

CSIF provides high-resolution imaging for the study of molecular and structural organization of cells and tissue including confocal, multi-photon, deconvolution, and ratio imaging fluorescence light microscopy.

Available instruments:

- Leica SP5 2-photon/confocal upright microscope system with a Mai Tai DeepSee ultrafast pulsed laser for 2-photon excitation and enclosed environmental control.
- Zeiss LSM 510 with Ti:Sapphire laser for 2-photon excitation
- Leica SP2 AOBS Confocal
- Applied Precision DeltaVision wide-field deconvolution system
- Biotech's DeltaTC3 heated stage system
- Leica DM1000 and DM2000 light microscopes with color cameras
- Jeol TEM1230
- Hitachi S-3400N VP-SEM

### Chemistry NMR Facility

Website: <http://www.stanford.edu/group/chem-NMR>

Contact: Dr. Stephen Lynch ([srlynch@stanford.edu](mailto:srlynch@stanford.edu))

The NMR Facility for the Stanford University Chemistry Department houses 5 Varian NMR Spectrometers.

Available instruments:

- NMR: Inova 300
- NMR: Varian 400
- NMR: Mercury 400
- NMR: Inova 500
- NMR: Inova 600

### Chemistry Optical Spectroscopy Facility

Website: <http://www.stanford.edu/group/chem-optics>

Contact: Dr. Stephen Lynch ([srlynch@stanford.edu](mailto:srlynch@stanford.edu))

The Optics Facility for the Stanford University Chemistry Department houses 4 Optical Spectroscopy Instruments.

Available instruments:

- Fluorolog 3 Fluorimeter (2 instruments)
- Vertex 70 FTIR with RAM II Raman accessory
- Cary 6000i UV/Vis/NIR Spectrometer

## Environmental Measurement I: Gas-Solution Analytical Center

Website: <http://em-1.stanford.edu/>

Contact: Scott Fendorf ([fendorf@stanford.edu](mailto:fendorf@stanford.edu))

Location:

The EM-1: Gas-Solution Analytical Center provides quantitative analysis and technical expertise to members of the Stanford community needing to conduct soil, gas, and water measurements.

Available instruments:

- Inductively Coupled Plasma (ICP) Spectrometer TJA IRIS Advantage/1000
- ICP-MS
- Elemental Analyzer Carlo Erba NA1500
- Discrete Analyzer WestCo SmartChem 200
- Gas Chromatograph Shimadzu GC-2014
- Total Organic Carbon Analyzer Shimadzu TOC-5000A
- Ion Chromatograph Dionex DX-500
- Freeze Dryer Labconco FreeZone 4.5
- Mercury Analyzer Tekran® Series 2600
- CEM MarsXpress Microwave Digester

## Stable Isotope Biogeochemistry Laboratory

Website: <http://pangea.stanford.edu/research/sibl/user.php>

Contact: David Mucciarone ([dam1@stanford.edu](mailto:dam1@stanford.edu)), Peter Blisniuk ([blisniuk@stanford.edu](mailto:blisniuk@stanford.edu))

Location: Mitchell Building and Green Earth Sciences Building

The Stable Isotope Biogeochemistry Laboratory (SIBL) at Stanford University's School of Earth Sciences provides analytical facilities and technical expertise to members of the Stanford community who need to determine stable isotope ratios of a variety of organic and inorganic materials from both terrestrial and marine environments.

Available instruments:

- Thermo Finnigan Delta
- Thermo Finnigan Delta
- Thermo Finnigan MAT 252

- Thermo Finnigan MAT 252

### **Stanford ICPMS/TIMS Facility**

Website: <http://plasmalab.stanford.edu/>

Contact: Prof. Kate Maher ([kmaher@stanford.edu](mailto:kmaher@stanford.edu))

Location: Green Earth Sciences Building

The Plasma Lab is a shared analytical facility in the School of Earth Sciences that includes key capabilities in the areas of radiogenic isotope geochemistry, non-traditional stable isotope geochemistry, and high-sensitivity geochemical analyses.

Available instruments:

- Nu Plasma HR Multi-collector ICP-MS
- Nu Attom High-resolution ICP-MS
- Finnigan MAT 262 TIMS
- Picotrace Clean Lab Environment

### **Stanford/USGS Micro Analysis Center**

Website: <http://shrimprg.stanford.edu/SUMAC%20INSTRUMENTS.htm>

Contact: Joe Wooden ([jwooden@stanford.edu](mailto:jwooden@stanford.edu))

Location: Green Earth Sciences Building,

Available instruments:

- Sensitive High Resolution Ion Micro Probe Reverse Geometry ion probe
- Finnigan MAT 262 Thermal Ionization Mass Spectrometer and geochemistry lab.
- Jeol 5600 LV Scanning Electron Microscope with cathodoluminescence imaging and EDAX with EDS system.
- Jeol 8900 Electron Microprobe
- LEO 982 Scanning Electron Microscope with cathodoluminescence imaging and EDS system.
- Mounting and polishing facilities

### **Stanford Magnetic Resonance Laboratory**

Website: <http://smrl.stanford.edu/>

Contact: Dr. Corey Liu ([liuc@stanford.edu](mailto:liuc@stanford.edu))

The Stanford Magnetic Resonance Laboratory is a research facility within the Stanford University School of Medicine. The goal of this facility is to provide research instrumentation and expertise in the area of solution-phase, high resolution Nuclear Magnetic Resonance (NMR) spectroscopy. The research focus of the facility is primarily in the study of biological macromolecules. Collaborating researchers also use the facility to study properties of polymers, minerals, soils, and for NMR imaging experiments.

Available instruments:

- 800 MHz Varian Inova
- 600 MHz Varian Inova

- 500 MHz Bruker Avance

## Stanford Mass Spectrometry Laboratory

Website: <http://mass-spec.stanford.edu>

Contact: Dr. Allis Chien ([allis@stanford.edu](mailto:allis@stanford.edu))

Location: Seely G. Mudd Building

The Vincent Coates Foundation Mass Spectrometry Laboratory supports the mass spec & proteomics facility as a shared core resource.

Available instruments:

- Thermo LTQ-Orbitrap Velos nanoUPLC-MS
- Thermo LTQ XL ion trap HPLC-MS
- Thermo LCQ Deca XP+ ion trap DESI-MS
- Thermo Exactive benchtop Orbitrap UPLC-MS
- Micromass Q-ToF hybrid quadrupole-time of flight LC-MS
- Thermo Vantage triple quadrupole UPLC-MS
- Micromass Quattro Premier triple quadrupole HPLC-MS
- Micromass ZQ single quadrupole HPLC-MS (open access)
- Agilent (HP) 7890/5975 GC-MS (open access)
- Agilent (HP) 7890/5975 GC-MS
- Agilent (HP) 6890/5973 GC-MS
- Advion NanoMate Triversa nano-electrospray robot
- Waters Acquity UPLC, nanoUPLC
- Eksigent NanoLC-2D capillary HPLC

## Stanford Nanofabrication Facility (SNF)

Website: <http://snf.stanford.edu>

Contact: General Access ([access@snf.stanford.edu](mailto:access@snf.stanford.edu))

The Stanford Nanofabrication Facility (SNF) is a shared resource serving academic, industrial, and governmental researchers across the country and around the globe. More than a lab, it's a vibrant community of researchers. We are supported by NSF through the National Nanotechnology Infrastructure Network. We welcome researchers from any discipline who wish to explore uses of micro- and nano- fabrication.

Available instruments:

- Electron Beam Group
  - Hitachi HL-700 EBeam Writer, Raith 150 Ebeam Writer, Hummer V Sputter Coater, Hitachi S4160 SEM, Hitachi S-800 SEM
- Optical Lithography Group
  - Resist Coat
    - Headway Manual Resist Spinner, Laurell Manual Resist Spinner, SVG Resist Coat Tracks 1&2, EVG 101 Resist Spray Coater
  - Exposure
    - ASML PAS 5500/60 i-line Stepper, EV Group Contact Aligner, EV Group Nanoimprint System, Karl Suss MA-6 Contact Aligner 1&2

- Develop
  - SVG Resist Develop tracks 1&2
- Ovens
  - Blue M Programmable Oven, Fusion UV Cure System, 110 C Oven, 90 C Oven, Mahnaz's Oven, Singe Oven, Ultraviolet Photoresist Cure, YES Prime Oven
- Chemical Vapor Deposition Group
  - Low pressure
    - teos2, Thermo LPCVD Nitride, Thermco LPCVD Poly (clean), Thermco LPCVD Poly (gold), LPCVD BPSG, LPCVD Nitride, LPCVD Polysilicon, LPCVD silicon Germanium Poly
  - Plasma Enhanced
    - STS Plasma Enhanced CVD, TEL Trias SPA Plasma Processing System, PlasmaTherm Versaline HDP VCD System, PlasmaTherm Shuttlecock PECVD System
  - Atomic Layer
    - Atomic Layer Deposition System (clean), Savannah Atomic Layer Deposition System (semi-clean), Fiji Atomic Layer Deposition - Left and Right
  - Epitaxial
    - Applied Materials Centurion Epitaxial System
- Metallization and Sputtering
  - Gryphon, Innotec ES26C E-Gun Evaporator, Metallica Sputter System, IntlVac Nanochrome II Physical Vapor Deposition System, IntlVac Nanochrome II Evaporator
- Dry Etching
  - AMT Oxide Plasma Etcher, Drytek 100 Plasma Etcher, Drytek 100 Plasma Etcher, Drytek 100 Plasma Etcher, Gasonics Aura Asher, Lam Research TCP 9400 Poly Etcher, Matrix Plasma Resist Strip, MRC Reactive Ion Etcher, Applied Materials P5000 Etcher, Plasma Quest ECR Etcher, STS Deep RIE Etcher, STS HRM Deep RIE Etcher, Xactix Xenon Difluoride Etcher
- Annealing, Oxidation, and Doping
  - Forming Gas Anneal, Thermco Oxidation Furnace #1, Tylan #1 Oxidation Furnace, Tylan #3 Oxidation Furnace, Tylan #4 Oxidation Furnace, Boron Predep Furnace (BBr3), Phos Predep Furnace (POCl3), H2 Anneal Furnace
- Rapid Thermal Annealing
  - AG4100 Rapid Thermal Annealer, AG4108 Rapid Thermal Annealer, AllWin 610 Rapid Thermal Annealer, AllWin 610 Rapid Thermal Annealer
- Wetbenches
  - Critical Point Dryer, Lithography Solvent Bench, Mask Scrubber, Diffusion Wetbench, Ebeam Process Wetbench, GaAs Acid Wetbench, General Wetbench, General Wetbench 2, Metal Wetbench, Miscellaneous Photoresist Wetbench, Nitride and Tweezer Cleaning Wetbench, Non-Metal Wetbench, Silicide Wetbench, Solvent Wetbench
- Wafer Bonding and Sawing
  - Electronics Visions Wafer Bonder, Karl Suss Wafer Bonder, K&S Wafer Saw
- Characterization and Testing

- Digital Instruments Nanoscope 3000 AFM, Alphastep 500 Profilometer, Rudolph Ellipsometer, Nanospec Film Thickness Measurement System, Prometrix Resistivity Mapping System, Tencor P2 Profilometer, Flexus 2320, Tencor 4500 Surfscan Particle Monitor, J.A. Woollam M2000 Spectroscopic Ellipsometer, Zygo 3D Surface Profiler

## Stanford Nanocharacterization Facility (SNL)

Website: <http://snl.stanford.edu>

Contact: Richard Chin ([rwchin@stanford.edu](mailto:rwchin@stanford.edu))

The Stanford Nanocharacterization Laboratory (SNL), housed within the Geballe Laboratory for Advanced Materials, provides modern facilities for the characterization of materials. It is a sister facility to the Stanford Nanofabrication Facility (SNF) in Stanford's National Nanotechnology Infrastructure Network (NNIN) program. The instruments are available for all qualified users in the Stanford community, and for Stanford collaborators both locally and globally. Our mission is to provide high quality, useful data and insight for as wide a range of users as possible. We have several types of high resolution microscopes, X-ray diffractometers, and surface science analytical instruments.

Available instruments:

- Focused Ion Beam Laboratory
  - FEI Strata 235DB dual-beam FIB/SEM
- Transmission Electron Microscope Laboratory
  - FEI Titan 80-300 TEM with Environmental Cell (located in SNC)
  - FEI Tecnai G2 F20 X-TWIN with EDS
- Scanning Electron Microscope Laboratory
  - FEI XL30 Sirion SEM with FEG source, EDX detector
  - FEI Magellan 400 XHR Scanning Electron Microscope with FEG source, EDAX Pegasus integrated EDS and EBSD system (located in SNC)
- Electron Microprobe Analysis (EMPA) Laboratory
  - JEOL JXA-733A Superprobe
- Scanning Auger Spectroscopy Laboratory
  - PHI 700 Scanning Auger Nanoprobe
- X-Ray Photoemission Spectroscopy (XPS/ESCA) Laboratory
  - SSI S-Probe XPS Spectrometer
  - PHI VersaProbe Scanning XPS Microprobe
- X-ray Diffraction Laboratory
  - PANalytical X'Pert 1 Diffractometer
  - PANalytical X'Pert 2 Diffractometer
  - Multiwire Laue Diffractometer
- Scanning Probe Microscope (SPM) Laboratory
  - Veeco Multimode scanning probe microscope
  - Park Systems XE-70

## Stanford Nano Center (SNC)

Website: <http://snc.stanford.edu>

Contact: Richard Chin ([rwchin@stanford.edu](mailto:rwchin@stanford.edu))

The SNC shared facilities include some of the most advanced nanoscale patterning and characterization equipment available, complementing the nearby Stanford Nanocharacterization Lab (SNL) and Stanford Nanofabrication Facility (SNF). The new facilities have been built to meet cutting-edge requirements on the control of vibration, acoustics, electromagnetic interference, light, and cleanliness that are essential for the nanoscale instrumentation.

Available instruments:

- FEI Titan 80-300 TEM with Environmental Cell
- Scanning Electron Microscopy
  - FEI Nova NanoSEM
  - FEI Magellan 400 XHR Scanning Electron Microscope with FEG source, EDAX Pegasus integrated EDS and EBSD system
- JEOL 6300 Electron Beam Lithography System
- Agilent 5500 Scanning Probe Microscope (AFM, MFM, STM, EFM, KFM, CSAFM)
- Intlvac Ion Beam Mill Etcher
- Flexible Clean Room
  - 2000 square foot class 100 cleanroom facility
  - photolithography, wet etching, chemical processing, rapid thermal annealing, plasma cleaning, sample preparation, liftoff, chemical etching, thickness measurement, characterization, probing, testing, precision cleaning, optical assembling, delicate assembly work, etc.
  - work with many odd materials which are generally banned in a rigid CMOS type of facility
- Microfab Shop
  - thin film deposition by evaporation and sputtering
  - design and fabrication of special mounting fixtures
  - prototype device fabrication
  - mold-making, casting, bonding, precision cleaning, etc.
- Soft Materials facility - Jeff Tok

### **Stanford NNIN Computing Facility (SNCF)**

Website: <http://www.stanford.edu/group/nnin-computing/>

Contact: Zhiyong Zhang ([zyzhang@stanford.edu](mailto:zyzhang@stanford.edu))

Stanford NNIN Computing Facility (SNCF) is part of the National Nanotechnology Infrastructure Network (NNIN), funded by the National Science Foundation (NSF). The mission of SNCF is to provide computing capability to researchers in academia and industry to model nanoscale processes.

Available instrumentation:

- PC cluster with 64 nodes, each with 2 quad core processors

## Semi-shared facilities and labs

### Nanomagnetics Facility

Website: [http://www.stanford.edu/group/nanomag\\_center/facility.htm](http://www.stanford.edu/group/nanomag_center/facility.htm)

Contact: Shan Wang ([sxwang@stanford.edu](mailto:sxwang@stanford.edu))

The Nanomagnetics Facility in the Stanford Center for Magnetic Nanotechnology provides processing and characterization capabilities for magnetic and other novel materials.

Available instruments:

- UHV system for in situ vacuum deposition of a variety of films from targets
- Ion milling with 7" RF Source
- Obducat nanoimprint system
- Alternating Gradient Magnetometer
- M-H Loop Tracer
- Vibrating Sample Magnetometer
- High frequency permeameter
- Kerr microscope for magnetic domain imaging
- AFM & MFM
- Perkin Elmer 4400 Deposition System
- Ion Tech Deposition System
- UHV chamber with 4 ion beam targets and 3 DC magnetron targets

### Microsystems Laboratory Cleanshop

Website: [http://microsystems.stanford.edu/wiki/MERL\\_Clean\\_Shop](http://microsystems.stanford.edu/wiki/MERL_Clean_Shop)

Contact: Beth Pruitt ([Pruitt@stanford.edu](mailto:Pruitt@stanford.edu))

The MERL Cleanshop houses a class 10000 cleanroom soft lithography facility that is owned and maintained by the Pruitt Microsystems Lab. We offer access to our equipment as a courtesy to other MERL research groups on a limited basis. Only students in research labs housed in MERL or affiliates while directly collaborating with those labs are eligible to use the soft lithography facility in the MERL Cleanshop. Note that any MERL PI may discuss placement of other equipment requiring cleanliness control in the cleanshop with the ME/MEMS faculty users (Pruitt, Kenny, Goodson, Santiago, Zheng, Cutkosky, etc).

Instruments available:

- O2 Plasma Asher
- Brewer SU-8 Spin Coater
- Hot Plates
- Laurell PDMS Spinner
- Laurell SU-8 Spinner
- PDMS

- Solvent Station
- UV Light Source

### **Stanford Microfluidics Foundry**

Website: <http://www.stanford.edu/group/foundry/>

Contact: Stephen Quake ([quake@stanford.edu](mailto:quake@stanford.edu))

Location: Clark Center

Our mission is to be the main service provider of integrated microfluidic devices on Stanford campus servicing universities and academic institutions. We aim to make our services and designs readily accessible and promote use in a wide variety of applications. The Stanford Microfluidics Foundry is a newly built Class 10,000 cleanroom facility.

Available instruments: