

**Facility Name:** Nano-Engineering Research Core Facility (NERCF)

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**Facility URL:** <http://engineering.unl.edu/nercf/>

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**Facility Description:** The Nano-Engineering Research Core Facility (NERCF) in the College of Engineering at the University of Nebraska-Lincoln (UNL) was completed in Spring 2016. The goal of the NERCF is to create a centralized, shared-user core facility that houses the state-of-the-science research instrumentation necessary to position the UNL researchers at the forefront of global research efforts focused on advanced manufacturing of materials, nanostructures and nanodevices.

The NERCF enhances research capacity and quality by providing in-house nanofabrication and nanocharacterization facilities open to use by faculty across the University of Nebraska system. Further, it is the intent of this facility to become a regional hub for nano-engineering. The equipment and operations are funded in part by the Nebraska Research Initiative and the UNL Office of Research and Economic Development. The mission of the NERCF is to advance materials manufacturing efforts within the university and the state of Nebraska.

**Facility Location:**

N213-N223, Voelte-Keegan Nanoscience Research Center  
855 N 16th Street  
University of Nebraska-Lincoln, City Campus  
Lincoln, NE 68588-0297

**Equipment:**

1) 3D printer

Make: Stratasys, Ltd.

Model: Objet 500 Connex3

Function: The Objet 500 Connex3 is an advanced multi-material 3D printing system. It is able to jet multiple resin types simultaneously based on the three model-material jetting systems.

- Print in brilliant, vivid colors that apply a wide range of material properties in a single build;
- Produce precise, smooth and highly detailed models;
- Reduce post-processing time (reduce or eliminate painting and bonding);
- Industry-widest range of modeling applications for all prototyping needs;

2) Atomic Force Microscope

Make: Anasys Instruments

Model: afm+

Function: The afm+ is a full featured Atomic Force Microscope with powerful analytical capabilities that make it much more than just an imaging tool. The afm+ is easy to set up and operate, there is decades of AFM expertise distilled into instrument design which means faster time to results. Powerful localized nanoscale analytical techniques include:

- Thermal-nanoscale thermal analysis with our patented ThermaLever probes;
- Mechanical-wideband nanomechanical analysis with our Lorentz Contact Resonance mode

### 3) Bio Atomic Force Microscope

Make: Asylum Research

Model: MFP-3D™

Function: The MFP-3D-BIO provides the highest sensitivity and most accurate images and measurements possible on an inverted optical platform. The NPS™ closed loop nanopositioning sensors on all three axes ensure distortion-free images on samples as small as proteins and as large as cells - in both air and liquid. The MFP-3D measures the cantilever deflection to better than 20pm (8pm typical) without artifacts, making the MFP-3D ideal for force measurements such as unfolding single molecules or probing cell mechanics.

### 4) Cell Culture Lab

Function: Equipped with CO<sub>2</sub> incubator, bio-safety cabinet, plant growth incubator, centrifuge, refrigerator/freezer, pH meter, microbalance, which enables the investigation of normal physiology and biochemistry of cells (e.g., metabolic studies, aging), the effects of drugs and toxic compounds on the cells, and etc.

### 5) Confocal laser scanning microscope

Make: Keyence Corporation

Model: VK-X200K

Function: The VK-X200K Series combines features of an optical microscope, roughness gauge, laser profilometer, and scanning electron microscope, our laser scanning confocal microscope performs non-contact surface profile, surface roughness, and thickness measurements without the need for sample preparation.

### 6) Cryogenic Probe Station

Make: Lake Shore Cryotronics Inc

Model: TTP4

Function: Lake Shore's cryogenic probe station is a six-probe system which is capable of reaching low temperature of 67K using liquid nitrogen cryogen, capable of providing high vacuum ( $1 \times 10^{-7}$  torr) base pressure and gas (N<sub>2</sub>) control. The system provide precisely controlled environments for non-destructive measurement of the electrical properties, including IV characterization, four-point probe resistance.

### 7) Dual Beam FIB/SEM

Make: FEI Company

Model: Helios 660

Function: The Helios NanoLab™ 660 features FEI's most recent advances in field emission SEM (FESEM) and focused ion beam (FIB) technologies and their combined use. As FEI's 11th DualBeam™ platform, it is designed to access a new world of extreme high resolution (XHR) 2D and 3D characterization, nanoprototyping, and highest quality sample preparation. Point resolution: 0.6nm at 20kV.

#### 8) Environmental SEM

Make: FEI Company

Model: Quanta 200

Function: The FEI Quanta Environmental SEM is capable of running at low vacuum, thus reducing charging on insulating samples and allowing imaging without applying a conductive coating. In addition, ESEM mode allows imaging of specimens that contain water, including biological samples.

#### 9) Femtosecond Laser System

Make: Coherent Inc.

Model: Astrella

Function: The Astrella laser is a femtosecond laser system from Coherent that produces 35 fs pulses and is designed to be very stable (0.5% rms power stability), with a high beam quality ( $M2 < 1.25$ ). There are three available beam lines with specifications included in the table above. To complement the Astrella laser, a large range of sample translation stages, beam manipulation optics, and spectroscopy equipment are available upon request.

#### 10) nanoIR2-s

Make: Anasys Instruments

Model: nanoIR2-s

Function: The Anasys nanoIR2-s system is capable of providing high resolution localized infrared (IR) spectroscopy and imaging, along with AFM imaging and metrology. The system will support research associated with organics materials, polymers and materials in life sciences. In addition, this instrument has the extension ability for scattering scanning near-field optical microscopy (SNOM).

#### 11) Spark Plasma Sintering System

Make: Thermal Technology LLC

Model: 10-4 spark plasma sintering

Function: The model 10-4 spark plasma sintering (SPS) system from Thermal Technology LLC introduces a revolutionary high-speed powder consolidation process. SPS utilizes high-amperage pulsed DC current to activate the consolidation and reaction-sintering of materials. The SPS process is able to prepare conductive, non-conductive and composite materials to any level of density.

## 12) Sputtering Coating System RF/DC

Make: AJA International

Model: Flagship ATC 2200

Function: ATC Flagship Series magnetron sputtering systems provide research scale physical vapor deposition which can be configured in either con-focal, normal incidence, off-axis, glancing angle, or combination of target to substrate orientations. It is equipped with a vacuum load-lock which gives two major advantages of higher throughput and better film quality.

## 13) Triboindenter

Make: Hysitron LLC

Model: TI 950

Function: The Hysitron TI 950 TriboIndenter is an automated, high throughput instrument to support the numerous nanomechanical and nanotribological characterization techniques. The system incorporates the newly developed *performech™* advanced control module, which greatly improves the precision of feedback-controlled nanomechanical testing, provides dual head testing capability for nano–micro scale connectivity, and offers unprecedented noise-floor performance.

## 14) Vibrating Sample Magnetometer

Make: Quantum Design Inc

Model: VersaLab™

Function: VersaLab is specifically designed for magnetic characterization up to 3 tesla and over a wide temperature range (50 K-1000 K) without the need of liquid cryogenes. VersaLab utilizes technology developed for Quantum Design's popular Physical Property Measurement System (PPMS®).

- Free time while instrument performs the automated measurements;
- Free space in the lab because of its compact size and portability;
- Freedom from cooling water and high power requirements;
- Freedom from liquid cryogenes;
- A single hardware configuration for a wide range of temperatures, fields, and magnetic moments