University of Delaware Core Facilities

NMR Center

The Center provides an array of NMR spectroscopic services to the overall research community at the University of Delaware and to industrial users in the State of Delaware. It supports world-class research in various NIH-funded, NSF-funded, and DOE-funded projects, as well as projects funded by private foundations and companies. The NMR Center currently houses eight superconducting NMR spectrometers ranging from 9.4 to 20 T in magnetic field strength (proton frequencies ranging from 400 MHz to 850 MHz) for a wide variety of solution and solid-state NMR experiments.

In our solution NMR facility, we have two 600 MHz and three 400 MHz NMR spectrometers, primarily providing structural characterization of synthetic chemical and biomolecular materials. These instruments feature auto sampling and cyro-probes. The solid-state NMR facility consists of a three Bruker spectrometers (500, 600, and 850 MHx), all of which are equipped with multiple magic-angle-spinning probes and other equipment to allow a variety of experiments on solid and semi-solid materials, from simple ^{13}C MAS-NMR analyses to NMR experiments on unusual and rare nuclear species like ^{207}Pb, ^{199}Hg, ^{195}Pt, ^{67}Zn.

Mass Spectrometry

The mass spectrometry research needs of the UD community and some external companies and universities. The facility houses state-of-the art mass spectrometers, LCs and UPLCs providing a range of capabilities: a) single quad with UPLC for quick mass confirmation; b) GCMS for volatile compounds; c) high resolution analysis (Q-exactive orbitrap and Xevo q-tof, including peptide and protein analysis; d) MALDI for macromolecules and polymers; e) UPLCs, LCs, and mass directed purifications; f) inorganic compound determinations (GCT q-tof, GC/MS with EI or CI); g) Proteomics via Q-exactive orbitrap and UPLC systems.

Advanced Materials Characterization Lab

The Advanced Materials Characterization Lab, which is open to researchers within the UD community, other academics institutions, and to industry, fosters an atmosphere of collaborative interdisciplinary research and industrial partnership opportunities. The lab is staffed by expert personnel who maintain the facilities and train users. The facility has more than 25 different analytical instruments available for use. Short courses are held regularly in the AMCL lab and are free to attend with prior registration required.

Nanofabrication Facility

The Nanofabrication Facility has a complete suite of equipment for lithography, deposition, etch, metrology, thermal processing, and packaging. Its four-person staff has over 80 years of combined experience. While the Nanofab is primarily a user facility (staff provides user training and advice), it will consider performing simple fabrication tasks on behalf of others. We have users from UD, other universities, corporations, and national labs.

Materials Growth Facility

The Materials Growth Facility (MGF) is a user-facility offering molecular beam epitaxy (MBE) growth of both topological insulators and III-V semiconductors and sputtering of magnetic and precious metals. The facility consists of three growth systems, all connected under ultra high vacuum: a) Artemis is a state-of-the-art Veeco GENxplor MBE system for growth of chacogenide materials such as Bi2Se3, Bi2Te3, In2Se3, and related materials. Additionally, this system now has an e-beam source, permitting the growth of transitional metal dichalcogenides and other novel 2D materials; b) Apollo is a state-of-the-art Veeco GENxplor MBE system for the growth of III-V semiconductors (GaAs, InAs, GaSb, etc). Unusual capabilities include the inclusion of bismuth, rare earth elements (currently, erbium and terbium), a high-flux filiament source for silicon-doped materials, and an atomic hydrogen source to permit improved growth on patterned and unconventional substrates; c) Hephaestus is an AJA ATC Series 2200 ultrahigh vacuum sputtering system for magnetic and previous metal sources. Capabilities include an off-axis magnetron for 'gentle' sputtering of materials and a high-temperature substrate heater. All systems can be used independently, or samples can be obtained by non-experts with growth by a professional epitaxy engineer.

Keck Center for Advanced Microscopy and Microanalysis

The Center houses two field emission transmission electron microscopes (FEG-TEMs), Talos F200C and JEM-2010F, two thermionic transmission electron microscopes, JEM-3010 and Tecnai G2 12 Twin, two field emission scanning electron microscopes, JSM-7400F and AurigaTM 60 CrossBeamTM with the AurigaTM 60 being a FIB-SEM dual beam instrument, and two scanning probe microscopes, Multimode NanoScope V and Dimension 3100 V. The laboratory staff and associated faculty members are knowledgeable in SEM, TEM and SPM and are experts in advanced microscopy of a wide range of materials, and work with university and external users in many areas including research, research training, and consultation.

X-ray Crystallography Laboratory

Single crystal X-ray crystallography is considered as the "gold standard" in molecular structure determination. Small-molecule (i.e. not proteins or polymeric carbohydrates) structural studies may be performed on a dual wavelength Bruker AXS Duo (Mo & Cu) diffractometer or a D8 Venture diffractometer equipped with ImuS Diamond, a high-brilliance Cu-source. Typical turn-around times under average conditions, from start of data-collection to completely refined small-molecule structure, may range from a few hours to a few days.

Surface Analysis Facility

The Facility exists primarily to support the federally funded research projects of University of Delaware faculty members and also welcomes collaborative interactions with other universities and colleges, as well as local, regional and national for-profit companies. The facility currently houses three main instruments, with one of them undergoing major upgrade in 2022: 1) Thermo Fisher K-Alpha+ XPS; 2) Horiba LabRAM HR Evolution Atomic Force Microscopy (AFM) – Raman Microscope; 3) Time-of-flight secondary ion mass spectroscopy, with current instrument (TOF-SIMS IV) to be replaced with state-of-the-art TOF.SIMS 5 in 2022.