Materials Characterization Facility

Welcome to the Advanced Materials Processing and Analysis Center (AMPAC) at the University of Central Florida (UCF). The overall mission of AMPAC is to achieve excellence in materials research and education at UCF and promote the high-technology economic growth of the central Florida region. AMPAC strives to excel in the design, processing and characterization of advanced materials to achieve national prominence in targeted research areas that include energy, biotechnology, microelectronics and nanotechnology.

AMPAC was founded in 1998. Today, AMPAC has 9 faculty members, 3 technical personnel, and 4 administrative staff members. Materials Characterization Facility (MCF, multi-user facility), which is operated by AMPAC, provides state-of-the-art equipment not only to UCF researchers, but also to researchers from industry, university, and government organizations around the country.

Past 20 years, AMPAC has successfully met its mission by creating a well-educated workforce through the MS and Ph.D. programs in materials science and engineering at UCF, forming multiple synergistic research partnerships with industries and government organizations, and building a reputation of research excellence.

Our success is attributed to our creative engineers, faculty members, talented graduate students, postdoctoral fellows, visiting scientists, administrative staffs, and outstanding research facilities. Material research experts at home and abroad are welcome to visit and collaborate with AMPAC.

MCF is dedicated to providing researchers and industrial partners a place to perform characterization and analysis to advance research. Utilizing state-of-the-art characterization equipment for hands-on training and classroom education. User friendly support service with expert advice and data interpretation from Engineers. We aim to enhance competitiveness of industrial partners and boost economic development of the Central Florida region.

Director Jiyu Fang

MCF STAFF

Sandra Griggs

Facility Scheduler

Mikhail Klimov

Engineer

Kirk Scammon

Engineer

How to use MCF for your research needs

All work performed at MCF requires a work order form.

UCF users will need to submit a completed work order form signed by their advisor.

Other University or industry or government users will need to provide a Purchase Order made to UCF/AMPAC

Completed work order forms and Purchase Orders may be submitted via email to ampacmcf@ucf.edu, or in person at the address below:

UCF, RESEARCH 1
4353 SCORPIUS ST STE 102
Orlando, FL 32816

To schedule equipment time, users may contact MCF via email to **ampacmcf@ucf.edu** or by calling (407) 882-1500.

Please include the equipment to be scheduled, date, time block needed and user name.

Also check us out on Facebook

Equipment List

State of the art characterization equipment

FEI Tecnai F30 TEM

JEOL TEM-1011

FIB FEI 200 TEM

FIB ZEISS Crossbeam with SEM

JEOL SEM JSM 6480

ZEISS ULTRA 55 SEM

OMANO Optical Microscopes

Physical Electronics 600 AES/SAM (Auger Electron Spectroscopy-Scanning Auger Microprobe)

Cameca IMS-3F SIMS Ion Microscope

PHI Adept 1010 Dynamic SIMS

LEICA EM UC7/FC7 Ultramicrotomy

Renishaw RM 1000B Micro-Raman Spectrometer

XPS Escalab 250Xi - X-Ray Photoelectron Spectroscopy

XRD #1 Basic Diffraction

XRD #2 Environmental Diffraction

XRD #3 Thin Film Diffraction

XRF - X-Ray Fluorescence Spectrometer

FEI TECNAI F30 TEM

Transmission Electron Microscope

The FEI Tecnai F30 is an analytical electron microscope (AEM), which can function as a conventional transmission electron microscope (TEM) or a scanning transmission electron microscope (STEM).

It has a field emission gun (FEG) and it can operate up to an accelerating voltage of 300KV. It includes both an energy dispersive x-ray detector (XEDS) and an electron energy loss spectrometer for elemental analysis.

The probe size can be reduced to <0.2 nm for chemical analysis and nano-diffraction studies.

Contact Engineer Mikhail Klimov

JEOL TEM-1011

Transmission Electron Microscope

JEM-1011 is a simple, dependable imaging instrument for high throughput of images with excellent contrast and definition. With an acceleration voltage flexibility of 40 to 100kV, it is suitable for all biological, polymer and thin materials science specimens.

Its high contrast objective lens pole piece combines the highest possible contrast and brightness with optimum resolution. The JEOL patented cool beam gun allows high-brightness, high coherence illumination conditions with filament-saving low emission current.

JEM-1011 has a unique feature of 2-specimen holder where two specimens are introduced into the column at the same time in the "Quick Change" holder, facilitating fast imaging throughput and instant comparison under the same operating conditions. Other features include user friendly controls, file storage, and automatic filament heating.

Contact Engineer Mikhail Klimov

FIB FEI 200

Focused Ion Beam

The FEI FIB 200 removes material by sputtering using gallium at lateral resolution of approximately 5 nm. Platinum metal can also be deposited by ion beam assisted chemical vapor deposition. Gas assisted etching and selective carbon milling may also be performed. FIB has a wide range of applications:

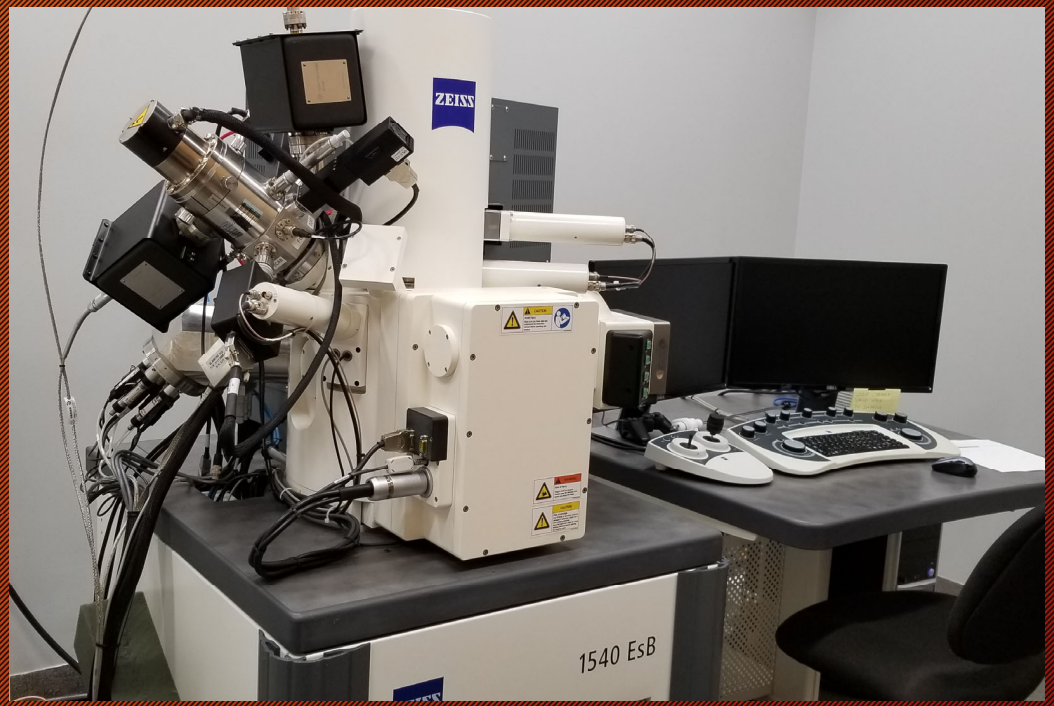
•Specimen preparation for SEM and TEM. TEM cross-section specimens can be prepared within two hours.
•Ion channeling contrast imaging
•Device modification – mainly semi-conductor industry

Contact Engineer Mikhail Klimov

FIB ZEISS CROSSBEAM with SEM

Focused Ion Beam

The Zeiss 1540 CrossBeam is configured to rapidly produce high-quality TEM samples. The addition of the field emission SEM column adds high-resolution observation and analysis of samples as they are being prepared. The on-line evaluation of samples as they are being thinned enables routine preparation of site specific samples that are less than 50 nm thick. In addition to the preparation for TEM samples, other uses include nano-machining and serial cross-sectioning of bulk samples for tomographic reconstruction.



Contact Engineer

JEOL SEM JSM 6480

Scanning Electron Microscope

The JEOL JSM-6480 SEM provides a variable pressure mode of operation that allows microscopy of damp, oily and non-conductive samples. It has a unique differential pumping system with a real-time vacuum feedback (RVF) for VP mode. This SEM has automated functions for filament saturation, gun alignment, brightness, contract and stigmatism.

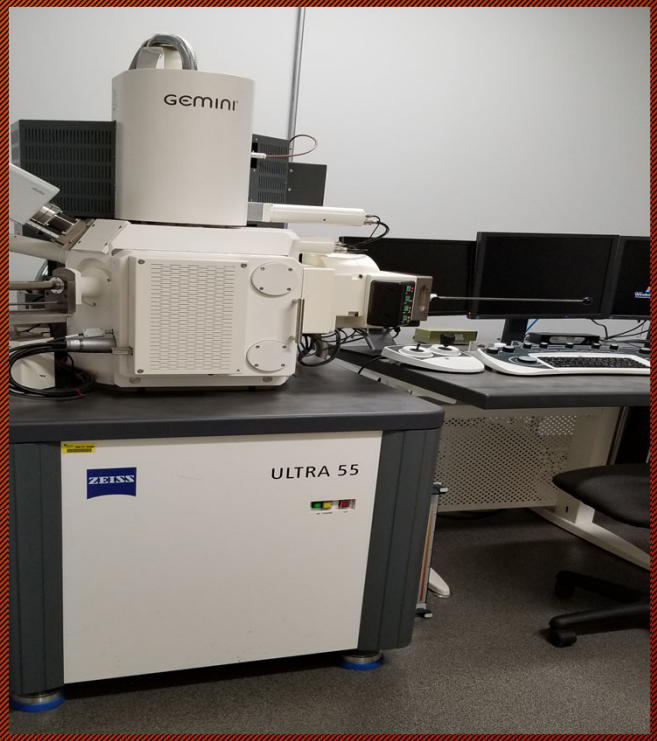
Contact Engineer

ZEISS ULTRA 55 SEM

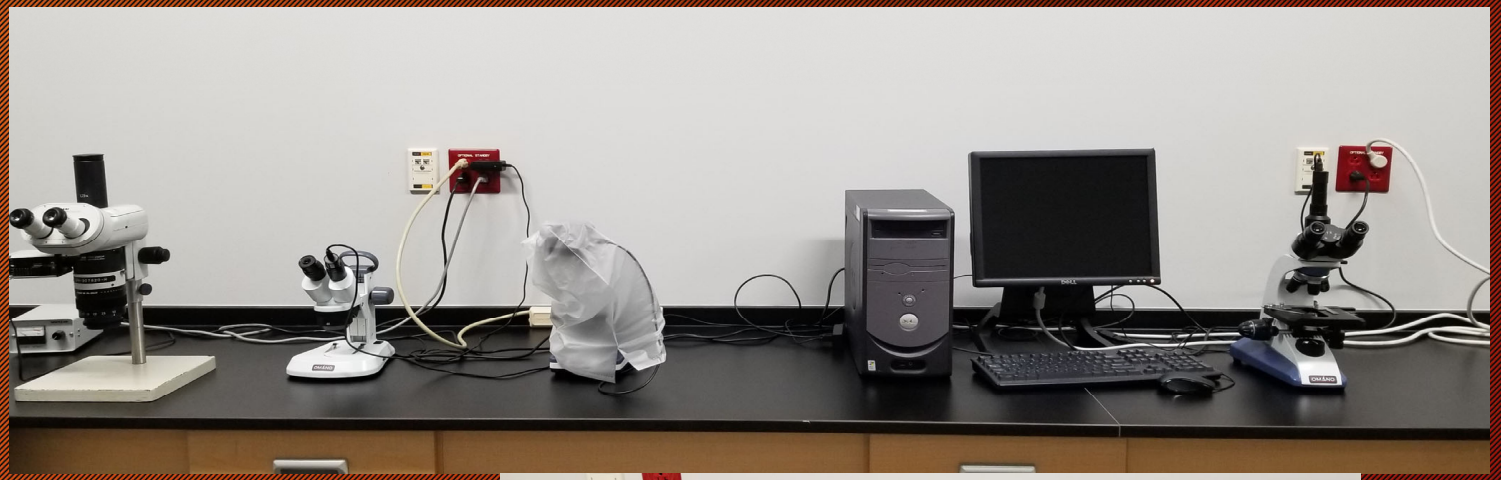
Scanning Electron Microscope

The Zeiss Ultra-55 SEM has a unique design to the final lens; it is electrostatic instead of electromagnetic. This feature allows the microscope to image magnetic materials without distortion from created by a magnetic field. This microscope is also capable of delivering very high lateral resolution at low voltages. The Nabity Electron Beam Lithography system allows researchers to create nanometer scale patterns using the pattern generator in conjunction with the electron beam. The Noran System 7 EDS system with Silicon Drift Detector can acquire the EDS spectrum much faster that a conventional SiLi detector and can detect elements as light as Boron.

Contact Engineer Kirk Scammon



OMANO & Optical Microscope Room



Multiple OMANO microscopes

Reichert microscope

Physical Electronics 600 AES/SAM

Auger Electron Spectroscopy - Scanning Auger Microprobe

AES uses an electron beam to excite a sample, and then measures the energies of secondary electrons emitted. Elemental composition information (and some chemical information) is obtained from the top few atomic layers. AES detects all elements except H and He and is most effective on electrically conductive surfaces. Elemental maps can be constructed from the sample to reveal the spatial distribution of elements on the surface. An attached ion gun allows one to obtain elemental depth profiles from the sample.

Contact Engineer Kirk Scammon

Cameca IMS-3F SIMS Ion Microscope

Secondary Ion Mass Spectrometry

SIMS (Secondary Ion Mass Spectrometry) is an analytical technique that is used to characterize the surface and near surface (~30 um) region of materials. It is capable of detecting practically all elements, including hydrogen (only the noble gases are difficult to measure) with detection limits in ppm range for most elements and ppb range for some. There are several modes of SIMS instrument operation:

Static SIMS - allows molecular as well as elemental characterization of the first top monolayer.

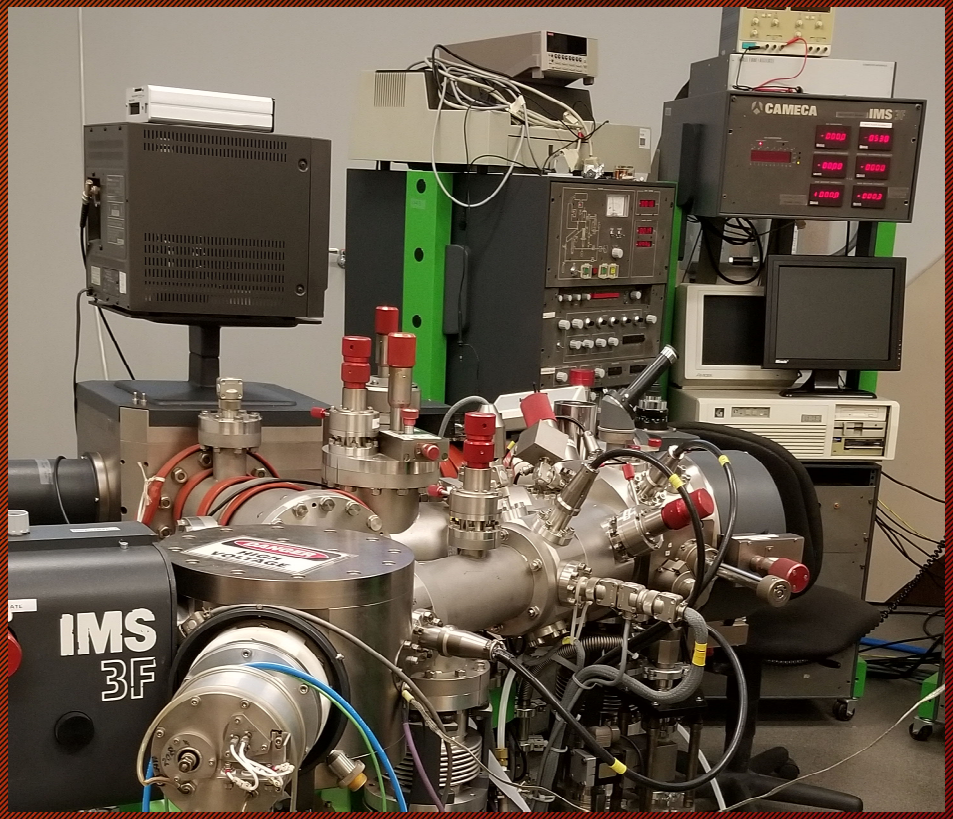
Dynamic SIMS - provides for the investigation of bulk composition or the depth distribution of the trace elements.

Ion imaging - allows lateral imaging and, if combined with depth profiling, ~3D compositional reconstruction for heterogeneous samples.

Isotope ratio measurement - another unique technique of SIMS making it possible to measure isotope ratio with precision of 0.1% and better.

SIMS can be applied to any type of material (insulators, semiconductors, metals, and organic molecules) that can stay under vacuum.

Contact Engineer Mikhail Klimov



PHI Adept 1010 Dynamic SIMS

Secondary Ion Mass Spectrometry

Depth resolution: ~ 1nm

Lateral resolution: ~ 1um

Mass resolution: ~100

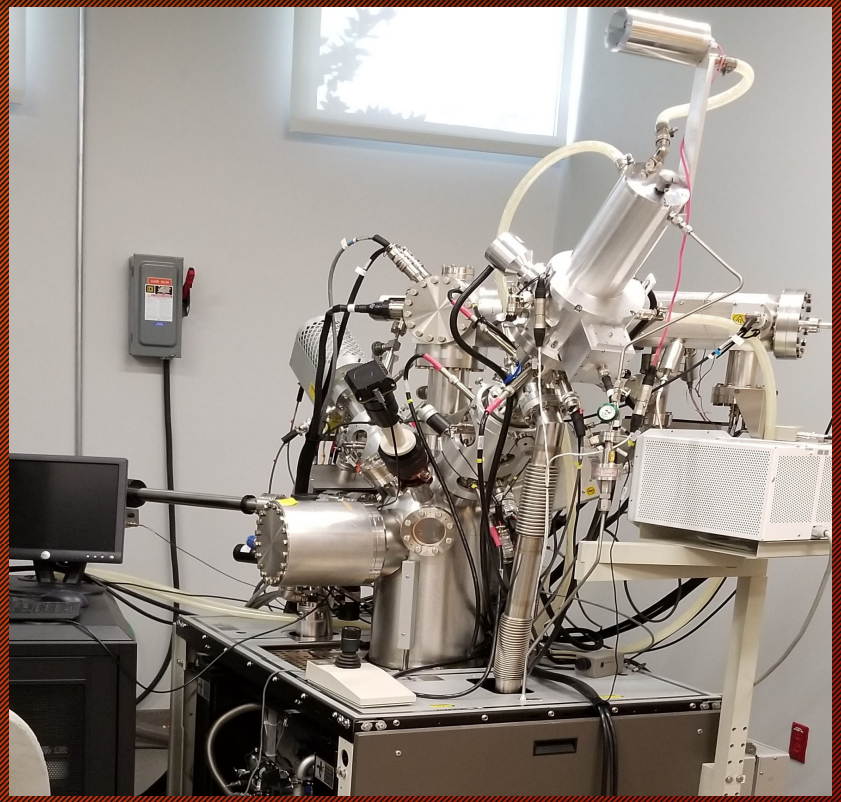
Mass range: 0-340 amu

Primary ions: O2+, Ar+, Xe+, Cs+ from 250eV to 10kV

Scanning electron gun allows for bulk insulators analysis

Mass analyzer type: quadrupole

Contact Engineer Mikhail Klimov



LEICA EM UC7/FC7 Ultramicrotome

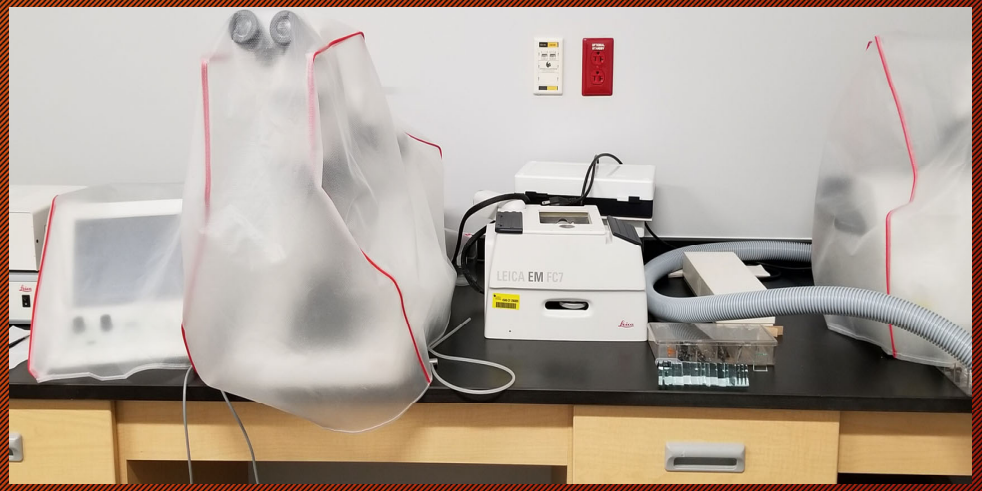
Specimen Preparation

The high quality microtome for precise room temperature and cryo sectioning.

The Leica EM UC7 prepares excellent quality semi- and ultra-thin sections, as well as the perfectly smooth surfaces required for LM, TEM, SEM, and AFM examination for biological samples, polymer samples, soft materials and composites. The precision mechanics, ergonomic design, and intuitive layout of the touch screen control unit make the Leica EM UC7 ideal for the highest quality specimen preparation by getting tens nanometers thickness.

The Leica EM FC7 provides three different cryo-modes: Standard; High gas flow – increased LN2 gas flow reduces ice contamination below -140°C and Wet sectioning—to set a temperature difference of up to 130°C between knife (-40°C) and specimen (-170°C), which is useful for, e.g., DMSO applications.

Contact Engineer



Renshaw RM 1000B Micro Raman Spectrometer

Raman spectroscopy is a spectroscopic technique to study vibrational, rotational, and other low-frequency modes. It relies on inelastic scattering, or Raman scattering of monochromatic light, usually from a laser in the visible, near infrared, or near ultraviolet range. The laser light interacts with phonons or other excitations in the system, resulting in the energy of the laser photons being shifted up or down. The shift in energy gives information about the phonon modes in the system. Raman spectroscopy offers several advantages for microscopic analysis. Since it is a scattering technique, specimens do not need to be fixed or sectioned. Raman spectra can be collected from a very small volume (< 1 μm in diameter); these spectra allow the identification of species present in that volume. Water does not interfere very strongly. Thus, Raman spectroscopy is suitable for the microscopic examination of minerals, materials such as polymers and ceramics, cells and proteins.

Contact Engineer Mikhail Klimov

XPS Escalab 250 Xi

X-ray Photoelectron Spectroscopy

ESCALAB 250Xi is equipped with a micro-focusing X-ray monochromator to deliver optimum XPS performance. Its market leading sensitivity ensures maximum sample throughput. Parallel XPS imaging is the method of choice for the best lateral resolution, ESCALAB 250Xi provides images having a resolution of <3µm.

The newly developed imaging detector provides "signature-free", quantitative data. The multi-technique capability and the availability of a range of preparation chambers and devices ensures that the instrument will provide the solution to any surface analytical problem.

Key features:

High sensitivity spectroscopy

X-ray monochromator as standard

Small area XPS

Image resolution <3µm

Quantitative imaging

Depth profiling capability

XRD #1 #2 #3

X-Ray Diffraction

XRD #1 Basic

XRD #2 Environmental

XRD #3 Thin Film

Each XRD has its own capabilities. Examples include : determine the crystal structure and lattice parameters of crystalline materials; transmission X-ray powder diffraction on small samples; provide maximum flexibility over sample positioning to provide high quality data of thin films and textured materials.

Contact Engineer Kirk Scammon

XRF

X-Ray Fluorescence Spectrometer

This system can be used to determine the composition of a sample in atmosphere with minimal sample preparation and time. In addition, the data from the XRF can be imported with XRD data to enhance analysis.

Elemental composition for elements from Sodium and above.

50 KV Silver Anode

Minimal specimen preparation necessary.

Both Solids and Liquids can be analyzed.

Small Equipment

Sample Prep Equipment

Gatan PECS - Coating System

Sputtering coat material on to a surface, mechanical cleaning/etching the surface with Ar ions.

Sputter Coater-Quoram

Sputter coating is the standard method for preparing non-conducting or poorly conducting specimens prior to observation in a scanning electron microscope (SEM). For depositing non-oxidizing metals - such as gold (Au)- and turbomolecular-pumped coaters, suitable for both oxidizing and non-oxidizing metals, such as chromium (Cr).

Plasma Cleaner

Plasma cleaning involves the removal of impurities and contaminants from surfaces through the use of an energetic plasma or Dielectric barrier discharge (DBD) plasma created from gaseous species. Gases such as argon and oxygen, as well as mixtures such as air and hydrogen/nitrogen are used.

Computer Lab

Tours and STEM days