

Imaging Materials for a Brighter World

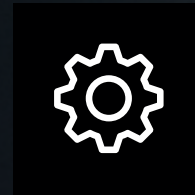
**BREAKTHROUGH
MATERIALS
RESEARCH**



**LEADING IN
EDUCATION AND
TRAINING**



**PROVIDING
SPECIALIZED
SERVICES**



Canadian Centre for
Electron Microscopy





Canadian Centre for Electron Microscopy provides world-class microscopy capabilities and expertise. We are the go-to provider of electron, ion, and X-ray microscopy services and consultation to Canadian industry and researchers working in a broad range of fields. Located at McMaster University, CCEM features state-of-the-art instrumentation and experienced, dedicated staff who are happy to work with you to find solutions to your research and development questions.

Industry Partners CCEM provides imaging and analysis services to a wide range of Canadian industries. We have long-standing, productive relationships with companies in the areas of nuclear materials, semi-conductor technology, automotive materials, and many others. Our experienced staff can advise on the best techniques to obtain the data required to solve problems of materials performance, optimize materials production methods or design new materials.

Instruments

CCEM has the most unique instrument suite in all of Canada. We have, on site, transmission electron microscopes, scanning electron microscopes, focused ion beam instruments, atom probe tomography, and 3D X-ray microscopes. We also have sample preparation facilities for a wide variety of materials.

Transmission Electron Microscopy (TEM)



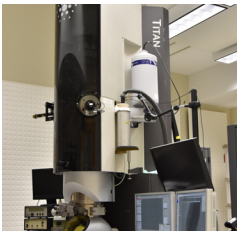
Thermo Fisher Scientific Spectra Ultra

The TFS Spectra Ultra is an ultra-high-resolution, double-corrected HRTEM/STEM that operates at 30, 60, 200, and 300 kV. A X-FEG source and an ultimono monochromator (10 meV at 60 kV) and Ultra-X energy dispersive X-ray spectroscopy (EDS) detector makes this instrument well suited for high-energy-resolution analytical work down to single atoms.



Nion HERMES 100

The Nion HERMES 100 is a STEM instrument equipped with a probe corrector, monochromator and spectrometer that allows imaging and spectroscopy with both high spatial and ultra-high energy resolution. This microscope will image specimens at atomic resolution, identify features by imaging, diffraction, and spectroscopy, obtain spatially resolved electron energy loss spectroscopy (EELS) maps, and perform many other nanoscale characterization activities.



Thermo Fisher Scientific Titan 80-300 LB

The Titan 80-300 LB is a high-resolution, image-corrected high resolution TEM (HRTEM)/scanning transmission electron microscopy (STEM) that operates at 80 and 300 kV. A high-brightness source and a monochromator make this TEM well suited for high-energy-resolution analytical work including energy-filtered imaging. A cryogenic capability and the option to acquire and analyze electron tomography data are also available.



Thermo Fisher Scientific Talos 200X

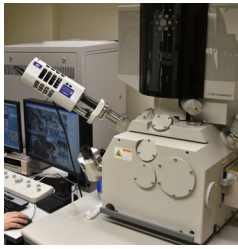
The TFS Talos 200X is an analytical TEM and STEM equipped with an X-field emission gun (X-FEG) source and an adjustable high tension between 80 and 200 kV. A four in-column silicon drift detectors (SDD) Super-X detectors for EDS allowing for the fastest and the most precise EDS analysis in 2D and 3D. In-situ liquid and gas holders are available for experimentation with Protochips Axon system for ultra-stable imaging.



Thermo Fisher Scientific Talos L120C and JEOL 1200EX TEMSCAN

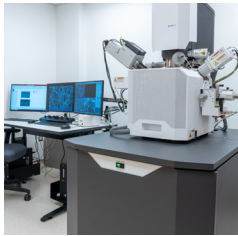
The TFS L120C is a general purpose analytical TEM equipped with a LaB6 filament and an adjustable high tension between 20-120kV. The JEOL 1200EX is a very user friendly TEM equipped with a tungsten filament and an adjustable high tension between 60-120kV. Both microscopes excel at imaging beam sensitive materials, and are very user friendly.

Scanning Electron Microscopes (SEM)



Thermo Fisher Scientific FEI Magellan 400

The TFS Magellan 400 is an SEM with nanometer resolution. An in-situ plasma cleaner and a liquid nitrogen cold finger allow the analysis of sensitive materials. SEM analysis at low beam energies enables characterization of nanometer-scale surface structures, even of non-conductive materials. The Magellan's dual EDS detectors allow high-sensitivity compositional analysis, particularly from rough surfaces. The concentric back-scattered electron detector provides flexibility in imaging compositional contrast, so the image can be 'tuned' to clearly show selected features of interest.



Thermo Fisher Scientific Quattro ESEM

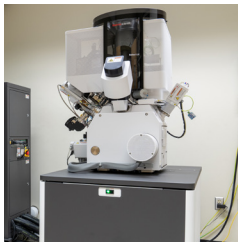
The TFS Quattro ESEM, environmental SEM allows for the study of materials in a range of conditions, such as natural state materials, hot, wet/humid, or reactive. It supports cooling and heating experiments both in high vacuum and low vacuum to accommodate the widest range of environments. Elemental information can be obtained with TFS ChemiSEM Technology, which provides live, quantitative, elemental mapping with SEM software.



Thermo Fisher Scientific Apreo 2S LoVac

The TFS Apreo 2 S LoVac is a high-performance FEG-SEM designed to deliver exceptional imaging and analytical versatility across a wide range of materials. Operating seamlessly in both high and low vacuum modes, it allows for precise analysis of even the most delicate samples. Equipped with advanced capabilities, including Energy Dispersive Spectroscopy (EDS) for detailed elemental analysis and Electron Backscatter Diffraction (EBSD) for comprehensive crystallographic mapping, the Apreo 2 S LoVac provides unmatched clarity and adaptability in imaging. These powerful tools enable in-depth compositional and structural insights, revealing the finest details of sample morphology and internal structure. Ideal for both academic and industrial applications, the Apreo 2 S LoVac empowers researchers to unlock new levels of insight and detail in their materials.

Focused Ion Beam (FIB)



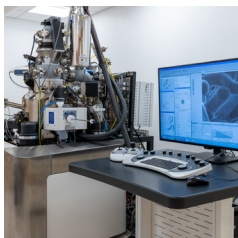
Thermo Fisher Scientific Helios 5 UC

The Helios 5 is a modern workhorse FIB that CCEM has targeted to be used by both CCEM staff and users for efficiently performing typical FIB tasks such as cross-section analysis and sample preparation for TEM and atom probe tomography (APT). It is equipped with an assortment of detectors; Everhart-Thornley detector (ETD), through-the-lens detector (TLD), ion conversion and electron (ICE) detector, mirror detector (MD), and in-column detector (ICD); many with backscattered electron modes.



Thermo Fisher Scientific Helios 5 UXe DualBeam Plasma-FIB

The Helios 5 PFIB provides the capacity to perform large area (up to 1 mm²) cross-sectioning, large 3D volume (up to 200 μm × 200 μm × 200 μm) characterization, and Ga⁺ free sample preparation by using an inductively coupled Xe⁺ plasma source with an ion current that can reach as high as 2.5 μA. This instrument is capable of imaging beam-sensitive (e.g. biological, polymer, graphene-based, etc.) samples at sub-nanometer resolution.



Zeiss Orion NanoFab

The Zeiss Orion NanoFab is a dual beam instrument with two different FIB columns. The primary is a gas field ion source column which uses either He or Ne, and the second is a liquid metal ion source Ga⁺ column. The Orion is also capable of imaging many non-conductive, charging samples, without requiring additional sample preparation steps (e.g. metal coating).



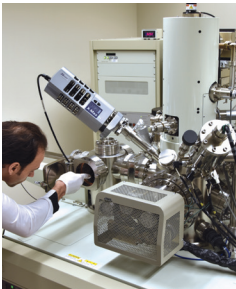
Zeiss Crossbeam 350 with Laser

The Crossbeam 350 at CCEM is a fully-equipped Ga⁺ FIB-SEM with a femtosecond laser that enables massive volumes of material ablation. Add-ons for the Crossbeam 350 include a Leica cryo system with cold vacuum transfer capability, Fibics scan generator with Atlas 5 software, correlation with 3D X-ray micro compute tomography (μCT) data, Kleindiek MM3 micromanipulator with rotation enabling in-situ micromanipulation, an in-column EBSD and, a retractable 4-quadrant annular backscattered electron detector.



Cameca LEAP 5000 XS

The Local Electrode Atom Probe (LEAP) allows for 3D analysis of materials at the sub-nanometer scale. Materials are examined by successive field-evaporation of ions. The collected data is then reconstructed to yield a 3D computer model of the material, offering an unparalleled combination of spatial and compositional accuracy. In addition to the traditional method of high-voltage pulsing to induce field evaporation, the LEAP 5000 XS also uses an ultraviolet laser. The capability for laser pulsing expands the range of potential materials for analysis from metals, alloys, semiconductors to ceramics, minerals and bio-materials.



JEOL JAMP-9500F FE-Auger

The field emission Auger microprobe is a high-sensitivity instrument for surface analysis. Elements can be detected with concentrations as low as 0.2 atomic%, although higher concentrations are required for accurate quantification. An incorporated SEM provides images of the sample and an EDS detector provides a quick preview allowing precise selection of the location for analysis. The surface can be milled away with the in-situ ion gun, allowing depth profiling to a depth of a few hundred nanometres.

X-Ray Microscopes (XRM)



Nikon M2 225 KV CT

The Nikon M2 225 KV CT is a high-performance X-ray computed tomography scanner with a tungsten target X-ray source. With its advanced technology, this scanner provides fast and accurate 3D imaging of a wide range of materials, including metals, plastics, composites, and more, allowing for non-destructive testing, quality control, and materials research. It features a large field of view and a high-resolution detector, enabling users to examine the internal structure of objects with unprecedented detail and accuracy.



Zeiss Xradia 630 Versa

The Zeiss Xradia 630 Versa is a high-resolution 3D X-ray microscope for non-destructive imaging of wide variety of sample types and length scales, from the sub-micron to millimeter range. This system can deliver exceptional resolution performance (450 nm with the maximum achievable voxel size of 40 nm). This X-ray Microscope comes with a dual-stage magnification feature that uses advanced synchrotron-caliber optics and ground-breaking Resolution at a Distance technology to provide high resolution even at large working distances. The combination of the detector designs enables the efficient and accurate study of a broad spectrum of sample sizes and types. This instruments also supports the investigation of 3D crystallographic data.

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