

FEI XL30-SFEG

High-resolution Scanning Electron Microscope

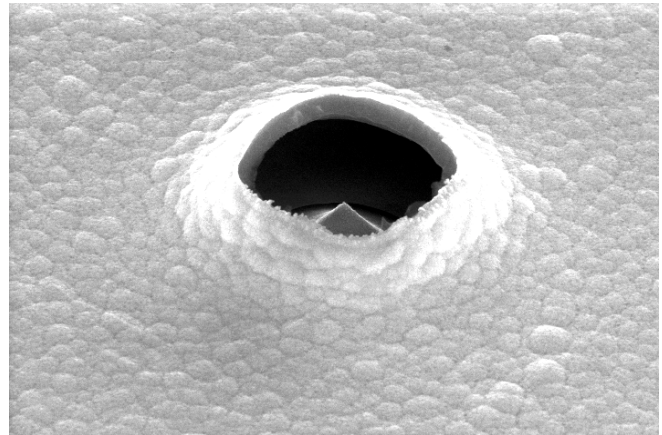
The XL30-SFEG is a high-resolution scanning electron microscope capable of resolutions better than 2 nm, magnifications over 600 kX, and operating voltages from 200 volts up to 30 kV with 1 kV and 2 kV being routine. At the lower beam potentials one can obtain excellent topographic detail and minimum charging while at the higher potentials one can get the optimum resolution and perform efficient EDS analyses. It also offers three imaging modes, each of which can be used simultaneously and blended to provide the desired image. This instrument is also fully computer controlled, making this a very easy to use system.

This instrument includes an EDAX Phoenix EDS system and a TexSEM Laboratories EBSD system. The EDS (energy dispersive x-ray spectroscopy) system can be used for elemental analyses and is capable of detecting carbon, nitrogen and oxygen. The EBSD (electron backscatter diffraction) system provides crystallographic information about regions of a specimen down to 20 nm (very best case). EBSD analyses determine crystal structure and orientation and are used to measure such things as crystallographic texture and determine the number and types of twins and grain boundaries. When combined with data from the EDS system and by searching databases, such as the JCPDS database, it can be used for phase identification. The combination of advanced, high-resolution imaging, elemental analysis and crystallographic mapping makes this a very powerful research tool.

Offline processing of images, EDS spectra and EBSD data can be done using any of the computers in the Image Processing Laboratory which is located right around the corner.



The FEI XL30-SFEG in Materials Science Central Facilities. The stage door, EDS detector and camera for the EBSD system can be seen on the column (right). The display on the right is used for microscope control while the display on the left is used for EDS and EBSD analyses. One keyboard and mouse control both computers.



Field emitter tip, a single element in what will probably be the next generation of flat panel display devices.

Specifications

XL30-SFEG

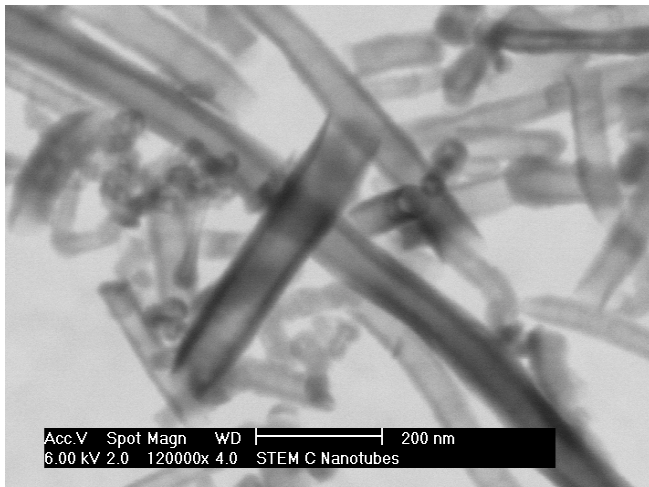
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| Source | Schottky-emitter, automatic gun configuration control, optimized for the whole voltage range, 0.10 to 30 kV accelerating potential (focus compensated) and 1pA to 25 nA beam current, stable to better than 0.2% per hour. |
| Resolution | 1.5 nm at 10 kV or higher, 2.5 nm at 1 kV |
| Detectors | SEI, BSE, in-lens, STEM |
| Images | Images can be captured at resolutions up to 4k x 3k and saved as tiff files. |
| Stage | 50 mm x 50 mm X-Y travel, 360° rotation, -15° to 75° tilt (-15° to 45° for large specimens), compucentric rotation, 1 to 60 mm working distance, all five axes are under computer control |
| Software | Windows NT-based software with a multi-user shell. The XL NT Docu software provides image database management features. |

EDAX Phoenix EDS

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| Detector | Ultra-thin windows Si-Li detector, 139 eV resolution, 5 mm working distance. |
| Software | Windows NT-based, beam and stage control, auto-ZAF, spectral mapping, x-ray mapping, image analysis |

TexSEM Laboratories EBSD

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| Hardware | Retractable SIT camera, 10 pts/sec pattern acquisition |
| Software | Windows NT-based, Delphi system for EBSD and OIM analyses. |



STEM-mode image of carbon nanotubes

Specimen Preparation Facilities

Materials Science Central Facilities also maintains a specimen preparation laboratory for metallographic and electron microscopy specimen preparation. We can advise users on the best specimen preparation technique and can teach them how to use the equipment. We can also provide most of the consumable supplies. The equipment available are:

Buehler Isomet Plus, 1000 and 2000 – precision sectioning and wafering saws.

Buehler Simplimet – automatic mounting presses (two) with an assortment of standard and conductive mounting media. These presses can be set up for 1", 1¼" and 1½" diameter specimens.

Buehler Ecomet 3 – polisher/grinder with Automet 2 head for semiautomatic preparation of up to six 1", 1¼" and 1½" mounted specimens at a time.

Buehler Electromet – electro-polisher/etcher for polishing and etching of metallic specimens.

Buehler Minimet – for convenient grinding and polishing of single specimens.

Buehler Vibromet 2 – vibratory polisher for final polishing of up to six standard sized specimens or large and irregularly shaped specimens. Vibratory polishing is practically a requirement for EBSD analyses.

MC MT6000-XL Ultramicrotome with CR2000 Cryostage – capable of automated sectioning and dial-in thickness from 5 to 99 nm and temperature-controlled cryo-sectioning down to -160°C.

Denton DV502 Vacuum Evaporator – used for carbon and thermal deposition. Tungsten wire metal evaporation and molybdenum boats are available for specimen cleaning.

Labconco Freeze Drier 8 – generally used for SEM sample preparation of biological and water born particulate samples.

Critical Point Drier – replaces a dehydration fluid such as ethanol using liquid CO₂ which is then brought to the critical point. Samples come out dry and wrinkle free.

BioRad Microscience Division SEM Coating System 5000 – used to produce cool, thin (10 Å to 1000 Å) and even coatings of gold or palladium.

Materials Science Central Facilities

Materials Science Central Facilities is a set of laboratories in the department of Chemical Engineering and Materials Science which supports the materials characterization needs of students and researchers at UC Davis as well as our friends and colleagues at other institutions and in industry.

Access – All major and minor instruments are available to all on a first-come first-served basis but advance reservations may be required for the major instruments (SEM, TEM, XRD).

Training– We can provide basic and advanced training on the operation of all of our major instruments. Training covers both theory of operation of the instrument and hands-on training and is conducted on a one-on-one basis.

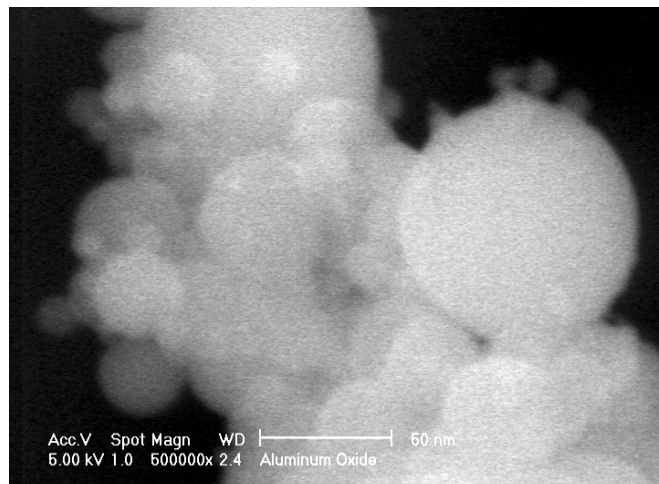
Support and Services – We provide training and technical support for users of all equipment, including specimen preparation equipment. If you prefer, our staff can also prepare the specimens and perform the analysis for you. This service allows you to take advantage of our expertise and experience and to get quick turn-around. In some cases this is also the most economical option.

Recharges – Like all of the major instruments in Central Facilities the XL30-SFEG is operated on a recharge basis. The current recharge rates are:

- User – \$30/hour
- Service – \$60/hour
- Commercial – \$200/hour

Contacting Us

Drop by room 108 in Engineering II anytime Monday thru Thursday between 8 AM and 7 PM or call us at (530) 752-0284. We can also be reached by email at mrdunlap@ucdavis.edu (microscopist) or mlmeier@ucdavis.edu (director). Additional information on the equipment and services available in Materials Science Central Facilities can also be found on the web at www.matsci.ucdavis.edu.



High-resolution image of Nanotek's 32 nm aluminum oxide powder.