

Electron Microscopy Resources and Education at the Institute of Materials Science, University of Connecticut

Virgil C. Solomon,* Roger A. Ristau* and Mark Aindow* **

* Institute of Materials Science, University of Connecticut, Storrs, CT 06269-3136

** Department of Chemical, Materials & Biomolecular Engineering, School of Engineering, University of Connecticut, Storrs, CT 06269-3222

Electron Microscopy Laboratory (EM Lab) at the Institute of Materials Science (IMS) is a multi-user facility created to serve researchers from several University of Connecticut (UConn) departments, such as: Chemical, Materials and Biomolecular Engineering, Physics, Chemical Engineering, Chemistry, Mechanical Engineering, Electrical and Computer Engineering, Geology and Geophysics, Civil and Environmental Engineering, Pharmacy and UConn Health Center. Within the IMS building the EM Lab is located in a dedicated facility, designed especially for the electron microscopy. The central pieces of the equipment available in EM Lab include two TEM's, two SEM's and one FIB [1]. The high resolution TEM JEOL 2010 FasTEM is equipped with a Gatan Imaging Filter (GIF 2000), that enables electron energy loss spectroscopy and energy filtered imaging, a XEDS EDAX Phoenix detector with super-ultrathin polymer window, four high-resolution CCD cameras, and a FasTEM interface that allows the TEM to be controlled remotely from any location with Internet access. A FEI Tecnai G² Spirit STEM equipped with XEDS detector was installed in June 2008, replacing the old Philips EM 420 STEM. The two SEM's are a field emission high-resolution JEOL JSM 6335F and an FEI Environmental SEM ElectroScan 2020. Both microscopes have XEDS detectors and a Peltier stage is available for ESEM. Finally, the dual beam FIB FEI Strata 400 STEM equipped with EDAX Genesis XEDS system and 3D reconstruction software was installed in February 2009. Two sample preparation rooms, one equipped with ion milling apparatus, dimplers, twin-jet electropolisher, and the other one equipped with ultramicrotomy instruments, plus a computer suite and an optical microscopy laboratory are also available for the EM lab patrons. The management, maintenance and development of the laboratory, as well as the microscopy education, it is provided by a team that has Mark Aindow as EM Lab director and Roger Ristau and Virgil Solomon as EM Lab specialists.

Microscopy training has a long tradition at IMS. Courses and training session in optical and electron microscopy has been taught since the IMS creation in 1965 [2]. Currently, EM Lab offers several options for learning optical, scanning and transmission electron microscopy. For the graduates students that need TEM capabilities for their research a 3-credit course is taught by Mark Aindow during spring semester. The lectures are design to teach students fundamental electron microscopy topics such as: electron beam-specimen interactions, basics of electron microscopes, electron diffraction theory, types of patterns and interpretation, imaging, x-ray microanalysis and electron energy-loss spectrometry. The course also includes a weekly 4-hours laboratory session held on Tecnai G² Spirit STEM. In order to provide an effective practical training and to allow each student to operate the TEM the laboratory groups comprise maximum of 5 students. The students that successfully fulfill the course requirements automatically receive a user license at the end of the class and they are allowed to operate the microscope independently. During the autumn semester the researchers in need for TEM training have the opportunity to join a small class, of maximum six students, that will teach the TEM theory and practice in eight to ten weekly 5-hours sessions. At the end of the class students should demonstrate an acceptable competency in operating the microscope, in order to get the user license.

Since almost every month there are several new students interested in utilizing scanning electron microscopes the training program for these instruments is more flexible. Once a group of five to six individuals interested in a certain SEM is formed a two hours training class is provided for the whole group. After a short introduction in the SEM theory, the training covers the basic instrument operation procedure. This class is followed by four to eight hours of one-on-one training that focus on improving the practical skills of SEM operation. Emphasis is placed on preparing the sample, loading and unloading the sample, microscope alignment, obtaining good SE and BSE micrographs and basic analytical work using XEDS detector. EM Lab specialists provide the laboratory instruction.

References

- [1] Electron Microscopy Laboratory Home Page: <http://www.ims.uconn.edu/~micro/>.
 [2] IMS Annual Reports: <http://www.ims.uconn.edu/about/annual.html>.

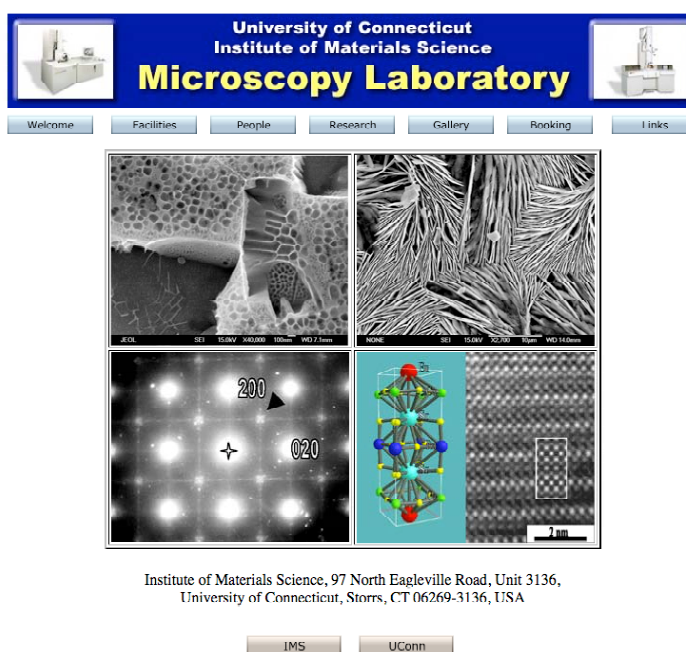


Fig. 1 Home page of the Electron Microscopy Laboratory, IMS, UConn [1].



Fig.2 SEM and TEM laboratory sessions, left and right image, respectively.