

SEM Users Guide

The SEM users guide that follows provides information concerning the following:

- 1- Knowledge and skills required of the level-1 SEM user.**
- 2- Policy for scheduling SEM use time.**
- 3- Costs associated with SEM use.**
- 4- Training policy for becoming an SEM user.**

1- SKILLS REQUIRED OF A LEVEL-1 SEM USER

A level-1 SEM 982 self-user has sufficient skills to independently operate the microscope during typical business hours when higher-level help is accessible if needed. A level-1 self-user is authorized to use the instrument on his/her own when minimal control must be exercised over the electron gun. A level-1 user can load/unload specimens; control a majority of basic instrument operational parameters; and record and manipulate digital images. A level-1 self-user must demonstrate that he/she understands and adheres to the following guidelines.

1. Vacuum system

- basic understanding of the pumping sequence is mandatory.
- there is a problem if the specimen chamber requires more than 8 minutes to pumped down after specimen insertion.
- the max gun pressure during operation must not exceed 5×10^{-9} .

2. Specimen Exchange

- cleanliness is truly next to godliness (gloves at all times, oil-free specimens, minimize time specimen chamber is open)
- understand/check N₂ gas supply (1.2 psi inlet pressure).
- improper closure of specimen exchange drawer can cause a \$5000 repair to the X-ray detector for which the user is responsible
- there are restrictions on specimen size and height so the objective lens is not damaged during specimen insertion or during tilting/translating operations.
- Z must be set to 0000 prior to specimen removal to avoid damage to objective lens.
- the steel set screws involved in specimen exchange can easily damage the aluminum fittings into which they thread.

3. Session Documentation

- session history required in the log notebook and invoice slip.

- the user must record the: emission current; extraction voltage; heating current; and gun vacuum status.

4. Basic Instrument Operating Parameters

- how to set the working distance
- difference between in-lens, ET, and BS detectors
- difference between TV and slow-scan modes
- criteria for choosing an accelerating voltage
- criteria for choosing an aperture size and aperture alignment
- stigmatism and focus

5. File Storage

- users must provide their own ZIP disks and store their image data directly on these.

6. X-Ray Spectroscopy system

- ISIS computer is dedicated strictly to X-ray analysis.
- the ISIS application program must be on constantly. It monitors the temperature and conditions of the X-ray detector.
- data collected and stored on the hard drive must be downloaded by the user to some other medium. The ISIS computer drive will be periodically purged of user data.

1A – Level 2 users

Only level 2 users can access the 982 outside of normal business hours (i.e. on weekends or during the evening).

A level 2 user is sufficiently knowledgeable about the microscope that he/she could in principle train new users to achieve Level I user status.

Level 2 user status will typically be awarded to only those users who:

- (1) use the microscope approximately 3-4 times monthly and have done so for at least 6 months;
- (2) can clearly demonstrate how to check and maintain the levels of liquid nitrogen and nitrogen gas;
- (3) can describe the most likely error conditions of the microscope and how specifically to respond to each;
- (4) can generate: (a) a secondary electron image from a nonconductive test specimen at 200 kx or more; and (b) either a backscattered image or an EDS spectrum from a two-phase conductive specimen.

2 - SCHEDULING MICROSCOPE (SEM) USE TIME

- * An instrument reservation calendar is accessible in the SEM Room (B-012).
- * Users may reserve up to two sessions per week. Additional sessions may be reserved subject to instrument availability. Additional sessions beyond the first two can only be reserved less than one day in advance of the desired session.
- * Users who need operator assistance must make arrangements for this themselves. Contact Dr. Berton Greenberg at X5258 bgreenbe@stevens.edu to make such arrangements.
- * Users who cancel reserved sessions with less than 24 hours notice may be subject to a one-hour use charge of \$50.
- * Use priority must be given to occasional undergraduate and graduate teaching laboratories and to Corporate Affiliates.

3-COSTS ASSOCIATED WITH SEM USE

Stevens Academic Users

- * \$50.00 per hour for instrument maintenance with a 1 hour \$50.00 minimum charge.
- * \$45.00 per hour charge for operator cost when instrument is operated by a staff member for an academic user. Benefits and overhead charges are added by the sponsored project office as appropriate. There will be a minimum 1 hour charge.
- * Users are expected to bear the costs of consumables including storage media (Zip disks are the recommended medium).)
- * Charges for non-Stevens academic users will follow a similar cost structure but will be considered on a case-by-case basis by the Facility Director (M. Libera).

Non-Academic Users

- * non-academic users must pay rates comparable to those of commercial analytical service companies.
- * If needed, consumables will be provided at cost.
- * Non-academic users with substantial need for characterization may elect to become a Facility Corporate Affiliate where alternate cost and use structures are available.

4- TRAINING POLICY FOR BECOMING A LEVEL-1 SEM USER

Every effort will be made to encourage individual researchers and students to achieve self-user status and train them in how to operate the 982 FEG SEM. **This training demands a non-trivial amount of time and effort. Prospective self users will be required to outline their anticipated needs in order to justify self-user training.** A training fee of \$200 is charged for training.

The training will involve the following general steps that may be tailored to the number and experience of user trainees.

1) **Instrument Overview and Video:** ~ 2 hours preferably to a group audience as large as 5-6 individuals. Overview includes general vacuum system; basic electron-optical features; functions of various hard and soft controls; digital storage/file manipulation; and specimen exchange. Each student should also watch a 2 part training video on the SEM LEO982 FEG before step 2).

2) **Assisted Practice I:** Each trainee will use the instrument under direct supervision of an authorized level II user (e.g. Facility Staff) to experience directly the various elements of a session with the instrument. (~1 - 1.5 hours)

3) **Assisted Practice II:** Each trainee will use the instrument again under supervision. (~1 - 1.5 hours).

**** The assisted practices MUST use test specimens provided by the Microscopy Facility. They CAN NOT involve research specimens.**

4) **Optional Practice:** After the assisted practice, a user trainee may elect to spend time practicing with his/her own specimens. This must be done with another level I or level II present for all operations involving specimen exchange and Z adjustment. The trainee is responsible for the instrument hourly maintenance fee for any such practice sessions.

5) **Level I Self-User Test:** The trainee must demonstrate a clear understanding and physical acumen associated with the Level-1 self-user skill list by independently executing all elements associated with a typical user session (~1-1.5 hours).

Having successfully passed the test, the user will be authorized to independently sign up for and use the 982 FEG SEM during normal business hours when other experienced users are generally around in the event of a technical problem. Evening and limited weekend use is available only to qualified level-2 users.

Students and staff with sufficient SEM experience may be qualified for a very abbreviated version of training for no charge.