**Facility managers:**
Emma Bullock: 202 478 8986
Suzy Vitale: 202 478 8918

Emma Bullock: 202 361 5649 (cell)
Suzy Vitale:
Gary Bors: 202-510-8577
All other emergencies: 911

**Secondary Contacts:**
**Emergency Information:**

**Purpose:**
Multiuse facility for mounting, polishing, and carbon-or metal-coating specimens for SEM and electron microprobe analysis. While in this laboratory, personnel must be aware of the specific hazards associated with the handling of vacuum apparatus, carbon and metal evaporative and sputter coating, polishing materials, and plastic impregnation.

*All laboratories and facilities on the Broad Branch Rd. campus are controlled areas. Specific training must be completed and documented before working in this laboratory / facility.*

(**Laboratory-specific information**)

- Chemicals: Small quantities of ethyl alcohol and acetone are stored in the sample preparation laboratory for sample cleaning. Both acetone and ethyl alcohol are flammable and will burn in the event of a fire. An MSDS for ethyl alcohol may be found at http://www.sciencelab.com/msds.php?msdsId=9923955, and one for acetone at http://www.sciencelab.com/msds.php?msdsId=9927062.
- . However, commercial polishing compounds, plastic resins, and vacuum pump oil are maintained in A-G25. MSDS sheets for the Buehler polishing and mounting materials are available at the following website: http://www.buehler.com/safety-data-sheets.php. MSDS Safety Data Sheets for products from PACE Technologies are available at https://www.metallographic.com/MSDS/MSDS.htm. Any user of these materials should study the appropriate MSDS sheets beforehand. The polishing suspensions and pastes are considered non-toxic and non-combustible and meet US Dept. of Transportation standards for nonflammable shipping. Inhalation of dry powders of any polishing compounds should be avoided. All polishing should be done in water or oil suspension. Dust masks (available in the laboratory) should be worn while handling dry polishing powders. Overexposure to fumes from the plastic resin or vacuum pump oil should be avoided. There is an eye wash facility in A-G25. Care should be taken to keep the top of the eyewash clean and to operate it for at least a minute every month.
- Carbon Evaporator and Metal Sputter Coater: The bell jars of the carbon evaporator and the metal sputter coater are under high vacuum during operation and thus bear a risk of implosion. No one is to use either instrument who has not received personal instruction in their safe operation. The plastic guard around the carbon evaporator must never be removed while the bell jar is under vacuum. The bell jar of the sputter coater is of sufficient thickness and small volume to minimize the possibility of implosion; however care should be taken to avoid any handling of the jar or vibration of the sputtering unit during operation. A wise precaution is to wear safety goggles while the sputter coater is under vacuum. Before any operation of either the carbon or metal sputter coater, the bell jar should be visually

examined for any chips or cracks. If any are observed, the coater must not be used. A sign stating it is out of order should be placed on it, and the facility manager should be contacted.

- Carbon Evaporation: The intensity of light emitted by the carbon electrodes during evaporation can cause severe retinal damage if looked upon directly. If the bell jar has been recently cleaned and is not covered with a thick carbon layer, the operator should wear welder's goggles or a similar level of eye protection during the period of evaporation. Dark glasses with highly darkened lenses are acceptable protective wear during evaporation when the bell jar has a carbon layer that is thick enough to be opaque at room-light conditions. In any case, the operator should hold a hand in front of the electrodes during evaporation to avoid staring directly at them and look for light and sparks emitted away from the electrodes to determine that the evaporation is proceeding. Before beginning an evaporation, the user should notify anyone in the room or passing by the door to avert their eyes. Upon venting the bell jar after carbon evaporation is completed, care should be taken not to touch the electrodes or the metal posts to which they are connected or a serious burn can result. Users should wear gloves when preparing the carbon electrodes, placing in the sample and removing it (for cleanliness as well as safety). Normally one's sample, even if metallic, will not be hot enough to cause a burn immediately after evaporation is completed, but the user should initially handle the sample with caution while removing it.
- Sputter Coating: The light emitted during sputter coating is not intense enough to cause eye damage and the user needs to observe the color of the discharge glow to insure that there is not air or moisture contamination. Dark glasses can be worn if the user is light sensitive. The sample after a sputter coating should not be hot to the touch, but the user should take care not to touch the sputter target or its holder. Gloves should be worn in placing and removing samples for cleanliness. The sputter coaters are attached to high pressure Ar gas cylinders (see below). The cylinders must be attached to the wall with safety straps and care should be taken not to bump into the gas regulator.
- Vacuum Impregnation: A small plastic bell jar is attached to a vacuum roughing pump for vacuum impregnation of plastic resins around and in pore spaces of samples. As with any vacuum system, there is the possibility of implosion during operation. The bell jar should be inspected before it is pumped down, and if any chips or cracks are observed, it is not to be used – a sign stating it is out of order should be placed on it and the facility manager should be notified. Eye goggles should be worn if one is closely examining the status of an impregnation while it is under vacuum.
- Gas Cylinders: A cylinder of argon gas is contained in the laboratory. Argon is nonflammable and non-toxic. However, the tanks are under high pressure and can explode if subject to severe shock. Compressed gas tanks should not be handled or moved by anyone not already trained in gas cylinder safety. Tanks must be strapped to their holding frames at all times, capped when not in use (i.e., when a gas regulator is not attached), and moved using a transport cart. The facility manager is responsible for changing tanks when needed. The gas regulators are set for the proper gas flow and should not be adjusted by anyone except the facility manager or someone trained and designated by the facility manager.
- Vacuum Pump Performance and Fumes: Vacuum pumps in A-G25 are lubricated with oils whose fumes are mildly irritating. They have an ACGIH time weighted average exposure standard over an 8 hour period of 5 mg /$m^3$ (which is a level at which the odor would be very strong). Moderate levels of exposure to pump fumes result in no adverse effects listed by OSHA or ACGIH. If a user notices an unusually strong odor of pump oil or sees smoking

of oil from any of the pumps, he/she should leave the room and notify the facility manager at once. The carbon evaporator uses an oil diffusion pump whose surface is hot enough to cause severe burns if touched. The vacuum pumps in A-G25 are "dry" pumps that produce no significant oil vapor. Both the carbon evaporator and sputter coater employ turbomolecular pumps that have a small risk of explosion under catastrophic failure. If the pumps are making unusual squealing or chattering noises, power should be turned off and the laboratory manager notified.

- After Hours Restrictions: Carbon evaporation or sputter coating must only be done by people who have been checked out on the equipment and are authorized to use them unattended. If given permission to use during off hours, the operator must have a back-up person who knows that the equipment is in use. Otherwise, there are no restrictions for polishing and related sample preparation in A-G25.
- Manuals: Manuals for operating the polishing wheels, polishing heads, carbon coater and sputter coater are available for viewing upon request. These should not be removed from the sample preparation laboratory.
- Reordering of supplies: If any of the laboratory supplies are running low, the laboratory managers should be notified, and they will reorder the necessary items.
- Fire extinguisher: A fire extinguisher is located next to the entrance/exit door in A-G25. An additional fire extinguisher is located outside of the lab, towards A-G28A.

Laboratory User

*I agree that I have thoroughly read and understood this laboratory safety document. I have access to this safety information at all times when I am working. I have been trained to be able to identify the hazards to which I may be exposed and to follow the work practices and procedures discussed in this document. I certify that I will conduct my research work safely and that I will be responsible for following stated safety policies.*

| _____ | _____ | _____ |
|---|---|---|
| User Name (Print) | User Signature | Date |

Principal Investigator

*I certify that the information presented in this safety document is accurate and complete. I agree to comply with all safety procedures and to fully train and supervise all researchers under my direction.*

| _____ | _____ |
|---|---|
| PI Signature | Date |