Micro/Nano Fabrication Laboratory

Safety Orientation

The Thomas J. Watson Sr.,
Laboratory of Applied Physics
California Institute of Technology

Little Mistakes Can Have Big Consequence

Material Safety Data Sheets (MSDS)
http://safety.caltech.edu/msds

1. Safety Philosophy

The number one priority dealing with hazardous materials is to understand the combination of common sense and specific knowledge of the potential hazards, proper use of chemicals and instruments.
It is very important you should know about the danger of chemicals and instruments that you use.

1.1 Staff Responsibility

1. To train and educate users about the potential safety hazards and proper response procedures in the lab.
2. Training safe operation and operating procedures for each instruments.

1.2 Users Responsibility

1. This laboratory supports various members from different discipline, therefore it is very important for each member to become familiar with cross contamination issues related for fabrication and processing.
2. Each user is responsible for safety of other; any one with irresponsible behavior related to safety may be denied access to the lab.

2. Laboratory Safety

1. Absolutely No eating, No gum chewing and No drinking in the lab including Clean rooms, Soft Lithography, AFM and FESEM.
2. Due to cross contamination do not use cell phone, pager and headset while you are in the lab.
3. Use shoes that fully enclose the feet (No sandals and open toe shoes).
4. Wear slacks to protect your legs, No bare legs such as wearing shorts and dresses.
5. Clean room lab coat must be button all the way from neck to bottom.
6. Wear face shield in addition to safety glasses when handling chemicals or working at chemical wet benches (fume hoods).
7. Always work in very confined area rather than spreading your personal belonging all over the bench. Clean up after yourself and label all personal belongings with your name and Professor.
8. During night, weekend and long holiday weekend make sure do not work alone in the lab; always plan to work with another member in the lab.

3. Chemical Safety

1. All chemicals used in the lab are toxic and hazardous; therefore you must read and understand the Material Safety Data Sheets (MSDS) before handling them. This helps to understand the hazards and appropriate precautionary safety measures. MSDS documents for chemicals can be found on the shelf in each lab; also it can be obtained from www.hazard.com.
2. To bring in any new chemicals to use in the lab, you must provide the MSDS.
3. Use bottle safety carrier for transporting of chemical bottles.
4. Make sure when you storing the chemical bottle after use is caped and cleaned.
5. Always use chemicals inside exhausted working wet benches (fume hoods).
6. Waste chemicals must be stored in the chemical waste bottles with appropriated chemicals.

4. Instruments Safety

1. Use the instruments that you have been trained and qualified.
2. It is essential that you are always aware of potential hazards related to High Voltage sources and Vacuum, Laser and UV exposure from metal deposition systems, mask aligner, plasma etch, sputter system, ellipsometer and AFM.

5. Chemical Safety Information

1- The Materials Safety Data Sheet (MSDS) provides information about chemical identification, composition and hazard data, and first aid measures, fire fighting measures, storage and handling precautions. The MSDS of all chemicals used in the lab are located on the shelf.

2- To bring new chemicals to use in the lab, you must provide the MSDS.

Hydrofluoric Acid

Hydrofluoric acid (HF) is an extremely corrosive acid used for many purposes including mineral digestion, surface cleaning, etching, biological staining, and in the manufacture of semiconductors. HF has a number of chemical, physical and toxicological properties, which make handling this material especially hazardous. This Safety Bulletin discusses how to protect you against the dangers of HF.

Safety Precautions for HF Use

- *User Training*

MSDS (Material Safety Data Sheets) on HF should be available to anyone working with this material; online versions can be obtained from www.hazard.com.

- *Personal Protective Equipment*

Eye protection in the form of safety goggles and a face shield should be used.

Gloves including heavyweight Viton, Neoprene or Nitrile are to be worn when working with HF. Always consult the manufacturer's glove selection guide when selecting a chemically resistant glove.

Body Protection in the form of a lab coat and acid resistant apron should be used.

- *Safe Work Practices*

Chemical Fume Hoods should be used when working with HF.

Storage of HF and HF waste should be in a closed, labeled, chemically compatible container (e.g. polyethylene or Teflon), and should have a polyethylene secondary containment tray.

- *EH&S Can Help*

Contact us at x6727 if you need assistance training lab members on hazards, proper storage, handling and emergency procedures, or if you have any questions regarding HF use.

(http://www.safety.caltech.edu/services/chemsafety)

Emergency Procedures for Hydrofluoric Acid (HF) Exposure

Please post these procedures in areas where HF is used. All exposures to HF should receive immediate first aid and medical evaluation even if the injury appears minor or no pain is felt. HF can produce delayed effects and serious tissue damage without necessarily producing pain.
In the event of HF exposure, immediately start the first-aid procedures described below to avoid HF burns or other permanent damage. Once first aid has been started, **call ext 5000**.

First Aid for Skin Contact

- Immediately (within seconds) proceed to the nearest eyewash or shower and wash affected area for 15 minutes.
- Remove all contaminated clothing while in the shower.
- Apply Calcium Gluconate Gel* to the affected area. Re-apply Gel every 15 minutes until emergency medical assistance arrives.

First Aid for Eye Contact

- Immediately proceed to the nearest eyewash station
- Thoroughly wash eyes with water for 15 minutes while holding eyelids open
- **Do *not*** apply calcium gluconate gel to eyes.
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First Aid for Ingestion

- **Do *not*** induce vomiting
- If conscious give large quantities of milk or water

First Aid for Inhalation

- Remove to fresh air
- Get medical assistance immediately

All exposures to HF require medical attention, if exposure is suspected, contact ext. 5000.

** Calcium Gluconate Gel is available for purchase through the EH&S Office, contact ext. 6727 for more information.*

http://www.safety.caltech.edu/services/chemsafety

6. Hazard Classes of Chemicals

It is your responsibility as an experience user to read and understand the MSDS of chemicals such as:

1- F**lammable:** All organic solvents including acetone, methanol, ethyl alcohol, isopropanol, all negative or positive photoresists and developers.
2- **Corrosive** (hydrofluoric acid, buffered oxide etchants for example BOE, any pre mixed ammonium fluoride and hydrofluoric acid, sulfuric acid, nitric acid and acetic acid.
3- **Reactive** (strong sulfuric acid, nitric acid and acetic acid**)**
4- **Poison** (Zinc arsenide, gallium arsenide, indium phosphide and any other compound materials with arsenic or phosphide).
5- **Oxidizer** (sulfuric acid, nitric acid and acetic acid).

7. Chemical Storage

1- When storing the chemical bottle, make sure bottle is caped properly to prevent the vapor escape from bottle. Absolutely No Lose Cap Bottle stored.
2- Chemicals must be stored in proper and dedicated storage. Acids in acids cabinets, bases in bases cabinet and solvents in solvents cabinet.
3- Personal chemical storage must be labeled with (chemicals name not formula, ratio, professor's name, your name and phone number) on the bottle.

8. Using the Wet Benches (Fume Hood)

All the chemicals must be used inside the designated wet bench.

1- Make every effort to understand the chemical processes you use and how to manage it properly.
2- Always keep the open face chemicals with six inch from grove toward inside the wet bench.
3- Do not remove hot chemicals from hot plate, let it cool, then remove or dispose it.
4- Do not change the hot plate temperature when other people dishes are on the hot plate.

5- If your cleaning process inside the fume hood is taking longer time in your absence, make sure use small clean room paper to write your name, phone number with starting and finishing time.
6- Do not leave chemicals un-attendant inside the hood.
7- Open beakers with chemicals must remain inside the fume hood. Do not remove out of the fume hood.
8- No personal chemical storage on the wet benches

- Reference: Environment Health & Safety at Caltech

http://www.safety.caltech.edu

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