Hydrofluoric acid (HF) is an essential tool for semiconductor processing and glass etching. Buffered HF also known as buffered oxide etch (BOE), is primary use in etching thin films of silicon dioxide. Diluted hydrofluoric acid can be used to remove native silicon dioxide form wafers.

1.0 Material Requirements

1.1 Equipment/Tools needed for process

- The HF solutions must be always handled inside chemical fume hood aimed to work with acid and corrosive substances (Acid Hood)
- Only use polypropylene, polyethylene, polymethylpente or Teflon graduated cylinders, containers, wafer holders, baskets, and/or tweezers.
  - Never use glass containers and metal tweezers.

1.2 Chemicals

- 49 % Hydrofluoric Acid (solution straight out of the bottle from the chemical supplier)

1.2.1 Hazards associated with chemicals:

- Fatal if swallowed, in contact with skin, if inhaled.
- Causes severe skin burns and eye damage.
- Causes damage to organs
Hydrofluoric acid poses severe health risks upon exposure. Exposure to concentrated (greater than 50 %) hydrofluoric acid solutions will cause severe, penetrating burns to the skin (skin discoloration, blisters), eyes, and lungs. Exposure to less concentrated solutions will also cause severe burns but the appearance of symptoms may be delayed for up to 24 hours. The fluoride anion will readily absorb through the skin and perform its damage on the inside, penetrating deep into body tissues, causing a systemic injury. If you are exposed to hydrofluoric acid seek medical attention immediately, even if you do not feel pain.

1.3 Administrative controls:

- Always handle HF solutions inside the fume hood.
- Implement the buddy system. In the PRISM Cleanroom, SMP and Packaging laboratories, those who transport liquid chemicals to/from chemical cabinets or perform wet chemistry operations at the fume hoods cannot be alone and must have an in-person Safety Buddy present: at least one Staff or other authorized Labmember in the same laboratory level (line of sight or within hearing distance) at all times.
- Know the location of calcium gluconate gel, the emergency shower and eyewash station.
- Review safety data sheet (SDS) for HF.
- Use only enough material needed to complete an experiment.

1.4 Protective equipment needed:

- Face shield on top of safety glasses or safety goggles
- Acid-resistant apron
- MAPA Trionic Orange gloves (made of nitrile, neoprene, and natural rubber); Wear two pairs of disposable nitrile gloves under the MAPA gloves
- Closed toe shoes and long pants

2.0 Procedure

NEVER USE A GLASS CONTAINER with HF since HF attacks glass. Process HF only using containers, graduated cylinders, wafer holders, baskets, and/or tweezers made of compatible with HF plastics such as polypropylene, polyethylene, polymethylpente or Teflon. When diluting HF, remember to add acid to water. When etch is complete, transfer the sample carefully to the rinse container. Rinse sample, tools (beakers, holders, and tweezers) thoroughly with water and wipe up any spills.

3.0 Waste Products

HF solution must be put in waste carboy located in WET-ACIDS hood and labeled: “CARBOY 1: Fluorine containing solutions”. HF contaminated solid waste (wipes, gloves) need to be placed in a white container with a lid and “Hazardous Waste, Acid Contaminated Objects” label.
4.0 Accident Procedures

4.1 Exposure

Remember that symptoms of diluted HF exposure are delayed for several hours but the fluoride ion readily penetrates the skin causing destruction of deep tissue layers and bones. Therefore, if you suspect you may have been exposed to HF, apply first aid immediately.

4.1.1 Skin:
- Go under the emergency shower for 5 minutes and in a meantime remove contaminated clothing. Yell for help! After 5 minutes, apply calcium gluconate gel to exposed areas on skin. Reapply calcium gluconate gel every 10 minutes. To avoid cross contamination, wear gloves when applying calcium gluconate gel.
- Buddy must contact Public Safety so you can get immediate medical attention.
- Give SDS to medical personnel.

4.1.2 Eyes:
- Using an eyewash station, rinse with copious amounts of water for a minimum of 15 minutes while holding the lids open. Yell for help!
- Buddy must contact Public Safety so you can get immediate medical attention.
- Give SDS for HF to medical personnel.

4.1.3 Inhalation:
- Remove to fresh air. Seek medical attention immediately. Give SDS to medical personnel.

4.1.4 Ingestion: Get immediate medical attention.

4.2 Spill: How do you deal with a spill inside and outside the fume hood?

4.2.1 For small spills that occur inside of a fume hood (a few drops)
- A few drops of HF inside the fume hood can be cleaned by using Texwipes. The contaminated area must be rinsed with water after the spilled chemical is absorbed. Texwipes used in the clean-up process need to be placed in a container for hazardous acid/base-contaminated objects.
4.2.2. For bigger spills that occur inside of a fume hood

- Post a restriction on the hood and contact cleanroom staff

4.2.3 For spills that occur outside of a fume hood

- Evacuate the cleanroom! Use cleanroom phone paging system (PS) to alert other labmembers about the spill (press paging system button (PS) on the phone, lift the handset, send a message and hang up the handset). Immediately notify cleanroom staff (or Public Safety if the spill occurs outside of business hours).

5.0 Related Documents