



HF ETCHING, BOE/GLASS/BOROFLOAT/TITANIUM



LOCATION: Aisle 1+2 Drop Deck and Aisle 1 Wet Deck

PRIMARY TRAINER: Stephanie Bozic (2-6724, sbozic@ualberta.ca)

SECONDARY TRAINER: Jolene Chorzempa (2-4823, jolenec@ualberta.ca)

1. OVERVIEW

This document outlines the general process for etching with etchants containing hydrofluoric Acid. These etchants are Buffered Oxide Etch (BOE), Glass Etch, Borofloat Etch and Titanium Etch. BOE is a commercial product with 10:1 ratio of hydrofluoric acid and ammonium bifluoride. Glass, Borofloat and Titanium etchants are solutions made by the NanoFab staff. This document will also outline the process for neutralizing and disposing of any HF containing solution.

2. SAFETY PRECAUTIONS

HF is extremely hazardous and is dangerous to the skin and eyes. The burns may be delayed and not readily visible. Use extreme caution while handling this chemical. Please consult the MSDS for further information.

Should HF come in contact with the body call for help, wash the area for 1 minute with water, and immediately apply calcium gluconate gel with one gloved hand. Leave calcium gluconate gel on the affected area for 15 minutes and wash away. Repeat if necessary. Have a NanoFab staff member help escort you to the hospital to ensure all safety protocols have been followed and that all HF has been removed.



Should you use calcium gluconate gel, a safety report must be filled out to ensure our lab is following safety guidelines responsibly.

HF etches glass so only Teflon or plastic containers can be used within the wet deck.

Acid gear must be worn while handling Buffered Oxide Etch:

- **Chemical Apron**
- **Chemical Resistant Gloves**
- **Face Shield**

HF cannot be disposed of down the drain. It must be neutralized by a 3:1 ratio of calcium chloride:HF and aspirated immediately. Any surfaces must be washed with calcium chloride prior to washing with water.

NO CHEMICALS ARE TO BE REMOVED FROM WET DECK IN OPEN CONTAINERS.

If you are bringing any new materials into the NanoFab for use in your process, it is necessary to fill out a chemical import form (available on our website, <http://www.nanofab.ualberta.ca>) and supply an MSDS data sheet to Stephanie Bozic.

3. OPERATING INSTRUCTIONS

The etch rates are approximately 55nm/min for BOE; 1.4 μ m/min for Borofloat; and 1.3 μ m/min for Glass. These are only approximate. Determine your own accurate etch rate as these may vary.

- 3.1 Transfer your substrates to a carrier.
- 3.2 Label a Teflon or plastic container with the chemical name, your name and the date. DO NOT use glass containers as HF will etch the glass. *If working in a drop deck prepare a DI water bath. It is useful for quenching the etching and transporting the substrates for rinsing.*
- 3.3 Set up the container and the carrier of substrates as well as any other needed equipment (stir plate, etc.) on the deck.
- 3.4 Put on all the acid gear which includes the apron, face shield and chemical resistant gloves.
 - 3.4.1 Check the condition of the gloves by filling them with nitrogen using the nitrogen gun. This ensures that there are no leaks. Also inspect for any dark spots or spills.
 - 3.4.2 New gloves may be obtained from the bottom drawer in Aisle 1. Label with the size and date.
- 3.5 Obtain a bottle of the etchant. Use either fresh stock or your own solution. Obtain a bottle of Calcium Chloride. Set the calcium chloride aside for use later.
- 3.6 Pour the etchant into the container. Ensure the container is far back enough on the deck as to not introduce vapors into the air.
- 3.7 Place carrier of substrates into the container and start the timer for 5 minutes. It is recommended to etch for 5 minutes to obtain an accurate etch rate. If the etch rate has already been calculated, calculate time required and set the timer for the calculated time (depth/rate=time). *Titanium etching is extremely fast. The endpoint is determined by visual*



inspection; however the color change is difficult to see. It is highly recommended that a test piece is etched first and the time recorded. Proceed to next step.

- 3.8 Just prior to the end of the time, lift the container and allow excess etchant to drip into the container.
- 3.9 Quench the etching by submersing in a DI water bath or transferring to the dump rinser. The substrates must be rinsed in the dump rinser for 5 cycles before handling.
- 3.10 Wash and dry gloves, wipe acid apron, remove acid gear and replace in original spot.
- 3.11 Using the contact Profilometer (Alphastep) measure the depth and calculate the etch rate (depth/time=rate). Using the etch rate, determine the remaining time required to etch to the correct depth. *Inspect with the microscope if doing titanium etching to determine if the etch was complete*
- 3.12 Re-dress in the acid gear and re-inspect the chemical resistant gloves. Repeat steps 3.7 – 3.11 for the calculated duration or until etching is completed.
- 3.13 Re-dress in the acid gear and re-inspect the chemical resistant gloves. Transfer the etchant to a storage bottle labeled with the chemical name, the date, and your name.
- 3.14 If the etchant is going to be disposed, calcium chloride is added to the etchant in a 3:1 ratio to precipitate the fluoride. The aspirator and plenum rinse is turned on and the solution is aspirated. Rinse three times with water and aspirate the rinses as well.
- 3.15 Wash the outside of the bottle(s) with calcium chloride followed by water. Dry the bottle(s) and store in the cabinet for later use.
- 3.16 Rinse the used container with calcium chloride. If a DI water bath was used, add calcium chloride in a 1:1 ratio to precipitate the fluoride. Turn on the aspirator and plenum rinse to aspirate the neutralized DI water bath.
- 3.17 Transfer all containers to the dump rinser and rinse for 5 cycles.
- 3.18 Rinse the deck with calcium chloride and wash with water. Rinse the calcium chloride bottle and return to cabinet if solution remains. If empty place in chemical pass-thru.
- 3.19 Wash and dry all of the acid gear and return to original spot.

4. TROUBLESHOOTING

If you encounter an unexpected error or require assistance please contact the primary or secondary trainer listed above. Should they not be available, please contact any staff member for assistance.

6. APPROVAL

QUALIFIED TRAINER: Jolene Chorzempa
TRAINING COORDINATOR: Stephanie Bozic