

Gold Etch TFA

Standard Operating Procedure

Faculty Supervisor: Prof. Robert White, Mechanical Engineering (x72210)

Safety Office: Peter Nowak x73246 (Just dial this directly on any campus phone.)

(617)627-3246 (From off-campus or from a cell phone)

Tufts Emergency Medical Services are at x66911.

Revised: March 19, 2015

Warning: Avoid contact with skin and eyes. Do not ingest. Do not breathe the vapors. Vapors are highly irritant to the mucous membranes and respiratory track and can cause excessive tearing. Work carefully in the hood with goggles, face shield and trionic gloves.

1. Material Requirements:

1.1 Equipment: One glass Petri dish, two glass beakers (for rinse), stainless steel tweezers, PTFE (Teflon) wafer holders or sample holders.

1.2 Chemicals: Gold Etchant TFA (contains 8 wt% Iodine, 21 wt% Potassium Iodide, 71 wt% water)

1.2.1 Hazards associated with chemicals:

1.2.1.1 Vapors irritate severely irritate the eyes, mucous membranes and respiratory track.

1.2.1.2 Do not concentrate the etchant by evaporating off the water. Iodine and Potassium Iodide in concentrated forms can cause severe skin irritation in concentrated solutions or crystalline form.

1.2.1.3 Do not mix with strong reducing agents, ammonia, ammonium hydroxide, powdered metals or alkali metals. Toxic byproducts include oxides of iodine and iodine fumes.

1.3 Engineering Controls: Conduct procedure in ventilated fume hood. Store bottles of chemicals (sealed tightly) in cabinets with secondary containment. Work area should contain an eye wash and safety shower.

1.4 Personal Protective Equipment: Trionic gloves on top of nitrile gloves, apron, goggles, and face-shield.

2.0 Procedure:

Complete all processes in the fume hood.

2.1 Gold Etch

2.1.1 Get a water rinse beaker which will fit your samples (A 1000 mL beaker works for a single 4" wafer.) **Do this first.** If something goes wrong, you want the water available to quench the reaction.

2.1.2 Stand the rinse beaker on a few fab wipes in the hood, and fill it with deionized water such that the water level will cover the entire wafer.

2.1.3 Place a couple fab wipes in a pile in the hood. Get a glass Petri dish that will fit your samples for processing (you should find one labeled "Gold Etchant TFA" on the shelves). Put it on the fab wipes in the hood.

2.1.4 Carefully pour some of the Gold Etchant TFA into the glass Petri dish such that the dish is a little over half full.

2.1.5 Calculate the etch time for your sample. You will need to know the thickness of your gold layer. At 25°C, the gold will etch at a rate of approximately **28Å/sec**. For other temperatures, refer to figure 1.

2.1.6 Put your wafer into the etchant and soak for the appropriate amount of time calculated in the previous step. Careful swirling of the Petri dish will accelerate the etch.

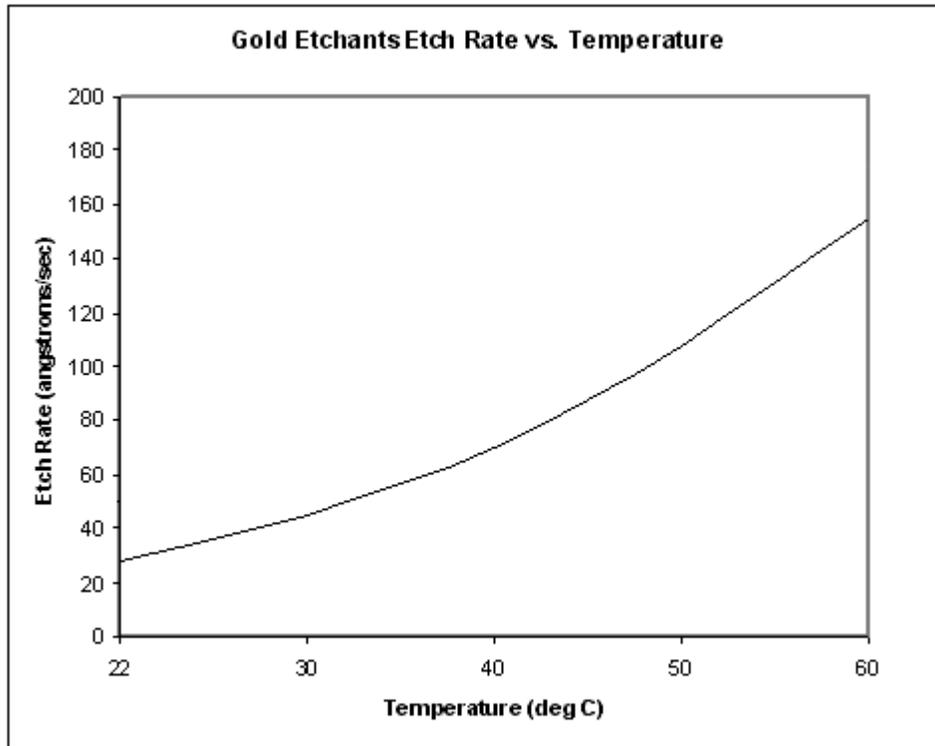


Figure 1. Gold Etchant TFA rate change with temperature.

2.2 DI Water rinse: 15 min:

- 2.2.1 When the etch is complete, transfer the sample carefully to the first DI water rinse beaker.
- 2.2.2 If you used tweezers to move the sample, make sure you leave them in the rinse beaker to rinse as well.
- 2.2.3 Let the sample and tools soak in DI water for 5 mins.
- 2.2.4 Fill the second glass rinse beaker with DI water. Transfer the sample to this second rinse and soak for another 5 mins.

2.3 Sample dry:

- 2.3.1 After the water rinse is finished, remove your samples and blow them dry with the N₂ gun.
- 2.3.2 After getting most of the water off, you can dry the samples more in an oven at 120 °C or on a hotplate at 150 °C.
- 2.3.3 Inspect wafer for traces un-etched gold. If features are small, use an optical microscope. If more etch time is required, place wafer back into the Petri dish with the etchant for another 30 seconds while swirling. Repeat rinse and drying procedure.

2.4 Cleanup

- 2.4.1 The etchant may be used for multiple etches. For temporary storage (< 1 day), place the top of the Petri dish over the etchant and store on fab wipes in the back of the hood. Make sure the dish is clearly labeled "Gold Etchant TFA"
- 2.4.2 Dump the etchant waste into a clearly labeled bottle for gold etchant waste. The label should note "contains Iodine".
- 2.4.3 Rinse the Petri dish once with DI water, and dump it into the etchant waste bottle (can be either an HDPE or glass bottle).
- 2.4.4 Dump the first rinse water beaker into the gold etchant waste bottle.

- 2.4.5 Dump the second rinse water beaker into the 5 gallon HDPE dilute acid waste water container.
- 2.4.6 Rinse all three containers again with DI water. This time, dump them into the 5 gallon HDPE dilute acid waste water container.
- 2.4.7 Return all labware to its proper location. The Petri dish and the beaker can drip dry on fab wipes in the hood or on the bottom shelf of the storage shelving.
- 2.4.8 Wipe up any drips in the area with chemical wipes and dispose in the acid trash.

2.5 Storage

- 2.5.1 Store gold etchant in the acid cabinet.

3.0 Waste Disposal:

3.1 Gold Etchant TFA waste:

- 3.1.1 Solid waste should go in the acid/base waste bin.
- 3.1.2 Liquid waste should go in the gold etch waste container. This container can be HDPE, polypropylene or glass. HDPE and polypropylene containers should not be used for more than 3 years.

4.0 Accident Procedures:

4.1 Contact: Read MSDS prior to working with any chemical to familiarize yourself with the symptoms of exposure and recommendations for treatment.

4.1.1 Gold Etchant TFA:

- 4.1.1.1 Skin contact: Remove contaminated clothing, rinse affected area with water for 15 minutes. Wash skin with soap and water. **If there is any irritation, get immediate medical attention. Don't be shy. Tufts Emergency Medical Services are at x66911.**
- 4.1.1.2 Eye contact: Immediately flush with water for 15 minutes while lifting upper and lower eyelids occasionally. **Get immediate medical attention. Call Tufts Emergency Medical Services are at x66911.**
- 4.1.1.3 Ingestion: Drink water or milk unless victim is unconscious. Induce vomiting if medical help is not immediately available. **Get immediate medical attention. Call Tufts Emergency Medical Services are at x66911.**
- 4.1.1.4 Inhalation: Remove to fresh air. Resuscitate if necessary. Take care not to inhale any fumes released from the victim's lungs. **Get immediate medical attention. Call Tufts Emergency Medical Services are at x66911.**

4.2 Spill:

- 4.2.1 If a small, contained spill occurs, such as inside the hood, wipe it up with chemical wipes and dispose of in the solvent trash container.
- 4.2.2 If a large spill occurs that you are not comfortable cleaning up:
 - 4.2.2.1 Evacuate the lab and notify the Tufts emergency services (x66911) immediately. Clean up should only be performed by authorized personnel according to MSDS guidelines. Notify the faculty advisor.

If at any time you feel a situation is dangerous, do not hesitate to call the safety office (x73246, Peter Nowak) or the faculty supervisor (x72210, Robert White).

Report all accidents (injuries, major spills, fires) to the safety office at x73246 (Peter Nowak) and the faculty supervisor at x72210 (Robert White). For emergencies, call Tufts Emergency Services at x66911.