

## **Procedure: Substrate Etching Procedures**

**Purpose:** To safely use standard etchants for the Silicon (Si), Glass (SiO<sub>2</sub>), Chromium (Cr), and Gold (Au).

**Location:** Spedding Hall Room 54

**Project Leader:** Marc Porter

**Objectives:**

1. To ensure that procedures are consistently and properly executed.
2. To ensure that the experimenter is cognizant of the hazards associated with these etchants.
3. To teach the experimenter the proper method of using etchants and substrates.

**Authorization Process:** Read this document and material safety data sheets (MSDSs) for all chemicals. For the glass etch the experimenter must take the Hydrofluoric Acid Safety class.

**Minimum Personal Protective Equipment:** Gloves that are resistant to the materials that are used, safety glasses, chemical apron, lab coat and fume hood.

**Potential Hazards:**

1. Highly corrosive materials including hydrofluoric acid.
2. Carcinogenic materials such as chromium and chromium oxides.

**In Case of Emergency:** Follow standard evacuation procedure.

## Caution:

- Hydrofluoric acid can leach calcium from the body causing harmful deposits.
- The strong acids and bases used in this procedure are highly corrosive. If contact with skin occurs, the affected area should be rinsed with copious amounts of water immediately.

## A. Procedure:

	Si	SiO <sub>2</sub>	Cr	Au
Solution	44 g KOH	28 mL HF	30 g	4 g KI
Recipe	56 g H <sub>2</sub> O	170 mL H <sub>2</sub> O 113 g NH <sub>4</sub> F	CeNH <sub>3</sub> (NO <sub>3</sub> ) <sub>5</sub> 1 L H <sub>2</sub> O 100 ml HClO <sub>4</sub>	1 g I <sub>2</sub> 40 mL H <sub>2</sub> O

### Si etching:

#### A. Preparation and Use

1. Prepare the Si etchant solution in a Teflon container.
2. Heat the etchant in a water bath to 80 °C in a fume hood, with the container opening covered properly to prevent solvent evaporation.
3. Place the sample in etchant solution and start timing the reaction.
4. After the required profile is obtained, take the sample out of the etchant solution using Teflon tweezers and rinse the sample with copious water.

#### B. Disposal

1. Cool the etchant solution to room temperature
2. Neutralize the solution with dilute HCl to pH=7
3. Discard the mixture into the drain.

### SiO<sub>2</sub> etching:

#### A. Preparation and Use

1. In an approved fume hood, prepare SiO<sub>2</sub> etchant solution in a Teflon container (**Caution: Extreme care needs to be taken when handling HF**).
2. Place the sample in etchant solution and start timing the reaction.
3. After required profile is obtained, take the sample out of the etchant solution using Teflon tweezers, and rinse the sample with copious water.

## **B. Disposal**

1. Neutralize the solution with NaOH to pH=7
2. Add enough CaCl<sub>2</sub> until no more CaF<sub>2</sub> is precipitating out of the solution.
3. Discard the mixture into the drain.

## **Cr etching:**

### **A. Preparation and Use**

1. In an approved fume hood, prepare Cr etchant solution in a glass container. **Warning: Chromium and some of its oxides are carcinogenic. Carcinogens must be kept in secondary containers.**
2. Place the sample in etchant solution and start timing the reaction.
3. After required profile is obtained, take the sample out of the etchant solution using Teflon tweezers, and rinse the sample with copious water.

### **B. Disposal**

1. Neutralize the solution with NaOH to pH=7
2. Collect the waste into an aqueous waste bottle labeled for carcinogenic waste.

## **Au etching:**

### **A. Preparation and Use**

1. In an approved fume hood, prepare Au etchant solution in a glass container.
2. Place the sample in etchant solution and start timing the reaction.
3. After required profile is obtained, take the sample out of the etchant solution using Teflon tweezers, and rinse the sample with copious water.

**B. Disposal**

1. Dilute waste 100 times by volume with water.
2. Collect the solution into aqueous waste bottle that devoid of ammonia.
3. Record on waste container label.

**Procedure**

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**Troubleshooting:**

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