

# Decapping ICs (Nitric and Sulfuric Mix)

## 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.

For more information on removing IC casings see:

Murali, S.; Srikanth, N., "Acid Decapsulation of Epoxy Molded IC Packages With Copper Wire Bonds," *Electronics Packaging Manufacturing, IEEE Transactions on*, vol.29, no.3, pp.179,183, July 2006. doi: 10.1109/TEPM.2006.882499  
<http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=1707865&isnumber=36043>

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## 1. Material Requirements:

**1.1 Equipment:** 1 glass petri dish, 1 small mix beaker, 2 glass rinse beakers, 1 glass disposal beaker, plastic transfer pipettes, and PTFE (Teflon) or stainless steel tweezers

**1.2 Chemicals:** Nitric acid, Sulfuric Acid (96%)

**1.2.1 Hazards associated with chemicals:**

**1.2.1.1 Nitric Acid:**

1.2.1.1.1 Oxidizer. Decomposes in storage under conditions of excessive heat causing release of nitrogen oxides and oxygen that supports combustion. Decomposition could form a high temperature melt.

1.2.1.1.2 Inhalation: Vapors can cause breathing difficulties and lead to pneumonia and pulmonary edema, which may be fatal. Other symptoms may include coughing, choking, and irritation of the nose, throat, and respiratory tract

**1.2.1.2 Sulfuric Acid:**

1.2.1.2.1 Liquid or vapors are serious health hazards; and cause severe burns. Sulfuric acid is much more viscous than water, be prepared for this when you pour it.

**1.2.1.3 Do not mix with organic solvents or strong reducing agents:**

A common lab accident is when concentrated nitric acid is accidentally added to the organic waste bottle. It creates a

slow exothermic reaction and results in an explosion in the lab.

- 1.3 Engineering Controls: Store bottles of chemicals (sealed tightly) in cabinets with secondary containment. Work area should contain an eye wash and safety shower. All processing should be performed in the chemistry fume hood.
- 1.4 Personal Protective Equipment: Trionic gloves on top of nitrile gloves, apron, face shield, and safety glasses.

## 2.0 Procedure:

### Complete all processes in chemical fume hood

#### 2.1 Nitric acid clean

*Note: the polyethylene transfer pipettes are only suitable for short term Nitric acid exposure at low temperature*

- 2.1.1 Preheat hot plate with petri dish with integrated circuits in it to 90°C, you may cover it with a glass lid
- 2.1.2 Fill 2 beakers with DI water for rinsing and label “Rinse 1” and “Rinse 2”
- 2.1.3 Pour 10mL of Nitric Acid into a 100 mL beaker
- 2.1.4 Add 40 mL of Sulfuric Acid into the beaker to make an 20%:80% mixture
- 2.1.5 Fill a transfer pipette with acid and drip on heated IC of interest from mix beaker onto top of IC, avoid overflowing onto the leads.
- 2.1.6 Throw used pipette into disposal beaker
- 2.1.7 Visually inspect IC
- 2.1.8 Continue to repeat steps 2.1.3 – 2.1.4 until the IC is satisfactorily decapped. (Process should take about one half hour)
- 2.1.9 If residual epoxy debris remains use the rinse containers and repeat if necessary

#### 2.2 Disposal

- 2.2.1 When you finish using the etchant, dispose of it in a glass bottle, label “20% Sulfuric Acid, 80% Nitric Acid” with the hazardous waste tag. Keep the bottle in the satellite accumulation area (under the hood). If a waste bottle already exists, use that one, otherwise start a new one. For chemical compatibility with other waste bottles, consult the waste stream chart.
- 2.2.2 Dump any solid waste (the pipettes) from the disposal beaker in acid trash
- 2.2.3 Use the water in the two rinse beakers to rinse the process beaker, petri dish, and disposal beaker, dumping the rinse water into the nitric/sulfuric acid waste bottle.
- 2.2.4 Rinse all containers a second time with DI water, dumping them into the 5 gallon dilute acid/waste container.

- 2.2.5 Return all lab ware to its proper location. The Petri dish and the beaker can drip dry on the shelves.

### **3.0 Storage:**

- 3.1 Keep container tightly closed. Store on corrosion-proof area.

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### **4.0 Waste Disposal:**

#### **4.1 Acid mix**

- 4.1.1 Solid waste should go in the acid waste bin
- 4.1.2 Liquid waste for chemicals should go in the Sulfuric/Nitric acid waste bottle. This container should be glass.

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### **5.0 Accident Procedures:**

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

#### **5.1.1 Chemical: Nitric Acid**

- 5.1.1.1 In case of contact immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.
- 5.1.1.2 Ingestion: CALL A PHYSICIAN. If swallowed do not induce vomiting; If conscious, give water, milk or milk of magnesia.
- 5.1.1.3 Inhalation: If inhaled remove to fresh air. If not breathing give artificial respiration. If breathing is difficult give oxygen.

#### **5.1.2 Chemical: Sulfuric Acid**

- 5.1.2.1 Skin contact: Remove contaminated clothing, rinse affected area with water for 10 minutes. If there is a visible burn, get immediate medical attention. **Don't be shy. Call the medical center if you got Sulfuric Acid on your skin. Tufts Emergency Medical Services are at x66911.**
- 5.1.2.2 Eye contact: Immediately flush with water for 20 minutes while holding the lids open. Get immediate medical attention. **Call Tufts Emergency Medical Services are at x66911.**
- 5.1.2.3 Ingestion: Do not induce vomiting. Get immediate medical attention. **Call Tufts Emergency Medical Services are at x66911.**
- 5.1.2.4 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.**

#### **5.2 Spill:**

- 5.2.1 If a small, contained spill occurs, such as inside the hood, wipe it up with chemical wipes and dispose of in the appropriate trash container.

**5.2.2** If a large spill occurs that you are not comfortable cleaning up:

**5.2.2.1** 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.**