

Standard Clean 1 (RCA Organic/Particle Clean)

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.

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The purpose of this clean is to remove organic contamination and particles from your wafers. It will rapidly attack most organic materials and some metals. This clean should not be used to strip resist – use acetone or Remover 1165 for that purpose. Use the RCA Standard Clean 1 as a final “polishing” clean to remove the last residues or to clean new wafers before you start processing.

Extreme danger: Peroxide reacts violently (explosively) with organic solvents such as acetone and isopropanol. If you somehow mix peroxide with acetone or isopropanol (for example by using the wrong waste bottle) it is going to explode violently. TAKE EXTREME CARE NOT TO MIX PEROXIDE WITH ORGANIC SOLVENTS!

Pressurization danger for peroxide waste: Peroxide waste evolves oxygen gas which can pressurize and break the waste bottle, the bottle must have a vented cap to allow pressurization to be released.

1. Material Requirements:

1.1 Equipment: One 1000 mL glass beaker for your sample, two 1000 mL glass beakers (for rinse), stainless steel tweezers, PTFE (Teflon) wafer holders or sample holders.

1.2 Chemicals: Ammonium Hydroxide (30% NH_4OH), Hydrogen Peroxide (30% H_2O_2)

1.2.1 Hazards associated with chemicals:

1.2.1.1 Hydrogen Peroxide: Liquid or vapors are serious health hazards; and can cause severe burns.

1.2.1.2 Ammonium Hydroxide: Liquid is extremely basic and corrosive. Exposure can cause severe burns.

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, goggles, and face shield.

2.0 Procedure:

Complete all processes in the fume hood

2.1 Standard Clean

- 2.1.1 Get two water rinse beakers 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 Fill the rinse beakers with deionized water such that the water level will cover the entire sample.
- 2.1.3 Place several fab wipes in a pile in the hood. Get a glass beaker or glass petri dish that will fit your samples comfortably (you should find one labeled "Ammonium Hydroxide / Hydrogen Peroxide" or "RCA SC 1" on the shelves). If the samples come within 10% of the top of the container, get a larger container. Put it on the fab wipes in the hood.
- 2.1.4 Create a 5:1:1 solution of deionized water (5 parts), 30% ammonium hydroxide (1 part), and 30% hydrogen peroxide (1 part). The chemicals should be added in the order listed.
 - 2.1.4.1 Example: A 1000ml beaker works well for a 4" wafer:
 - 2.1.4.1.1 Add 625ml of DI water to the beaker
 - 2.1.4.1.2 Add 125ml of 30% ammonium hydroxide
 - 2.1.4.1.3 Add 125ml of 30% hydrogen peroxide
- 2.1.5 The mixture will become warm. Be careful when you handle it.
- 2.1.6 Carefully stir the solution with an appropriately-sized Teflon wafer holder. Leaving the wafer holder in the beaker will stop big bubbles from forming at the surface.
- 2.1.7 Bring the mixture up to 75°C ($\pm 5^\circ\text{C}$) on a hot plate. Measure with a thermometer to verify the solution temperature.
- 2.1.8 When the solution is at temperature, immerse the wafer in the beaker using the Teflon wafer holder.

2.2 DI water rinse:10 min:

- 2.2.1 When the clean is complete, transfer the sample carefully to the first DI water rinse beaker
- 2.2.2 If you used tweezers/thermometer, 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 Transfer the sample to the second DI rinse beaker, and rinse 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 gun.

2.4 Clean-up:

- 2.4.1 The etchant should not be used for multiple etches. Once heated the solution is only effective for 30 minutes.
- 2.4.2 Turn off the hotplate.

- 2.4.3 Allow the solution to cool for three hours before disposal. There should be no bubbles left in the solution after this amount of time.
- 2.4.4 Dispose of the cool mixture of it in a HDPE or glass bottle, label "Standard Clean 1: Ammonium Hydroxide, Hydrogen Peroxide" with the red 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. The waste is compatible with KOH waste and MF CD-26 (TMAH) waste.
- 2.4.5 Check off the "corrosive" box on the back of the waste label.
- 2.4.6 Rinse the process beaker once with DI water, and dump it into the waste bottle.
- 2.4.7 Dump the first DI rinse beaker into the waste bottle.
- 2.4.8 Dump the second DI rinse beaker into the 5 gallon HDPE "Dilute Acid Waste" container.
- 2.4.9 Rinse all three containers a second time with with DI water. This time, dump them into the 5 gallon HDPE "Dilute Acid Waste" container.
- 2.4.10 Return all lab ware to its proper location. The Petri dish and the beaker can drip dry on fab wipes in the hood or on the shelves.

3.0 Storage:

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

4.0 Waste Disposal:

4.1 Chemical: Ammonium Hydroxide

- 4.1.1 Solid waste for chemicals should go in the acid / base waste bin.
- 4.1.2 Liquid waste for chemicals should go in the Standard Clean-1 Etch waste bottle. This container can be glass or HDPE.
- 4.1.3 The waste can be mixed with potassium hydroxide (KOH) and tetramethylammonium hydroxide (TMAH ... in MFCD26 developer).

4.2 Chemical: Hydrogen Peroxide

- 4.2.1 Solid waste for chemicals should go in the acid / base waste bin.
- 4.2.2 Liquid waste for chemicals should go in the Standard Clean-1 Etch waste bottle. This container can be glass or HDPE. Ensure the waste bottle has a vented cap
- 4.2.3 The waste can be mixed with potassium hydroxide (KOH) and tetramethylammonium hydroxide (TMAH ... in MFCD26 developer). Take care not to mix the waste with solvent waste, such mixtures may explode.

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 Ammonium hydroxide, hydrogen peroxide, or a mixture of the two:

5.1.1.1 Get immediate medical attention. Call Tufts Emergency Medical Services are at x66911.

5.1.1.2 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.

5.1.1.3 Eye contact: Immediately flush with water for 20 minutes while holding the lids open. Get immediate medical attention.

5.1.1.4 Ingestion: Do not induce vomiting. Get immediate medical attention.

5.1.1.5 Inhalation: Remove to fresh air. Resuscitate if necessary. Take care not to inhale any fumes released from the victim's lungs.

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, notify the Tufts emergency services (x66911) immediately. Also 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.