

MOS CLEANING PROCESS (RCA Clean)

IMPORTANT

No metal allowed in the MOS cleaning hood! This applies to metal tweezers!

LAB EQUIPMENT AND MATERIALS:

All personnel will wear a bunny suit, latex gloves, and eye protection while in the cleanroom. In addition, while at the MOS cleaning bench **“Full Battle Gear” is required: Apron, face-shield, and nitrile gauntlet gloves (green).**

Safety Notes:

Always clean your work area when you leave it. If you don't, you are leaving a hazard for the next group of students using the area.

Chemicals Required:

De-ionized Water (H_2O) (Resistivity $> 12 M\Omega$)

Sulfuric Acid (H_2SO_4)

Ammonia hydroxide (NH_4OH)

Hydrogen peroxide (H_2O_2)

Hydrochloric Acid (HCl)

Hydrofluoric acid:DI 1:50 (Don't worry, you don't have to mix this)

Lab Equipment Required:

Timer (on hood)

Wafer cassette (A dedicated cassette is kept in the MOS clean hood)

Controlled temperature baths

Dump rinsers

Spin rinse dryer

SIMPLIFIED PROCEDURE:

1. Check age of baths. Replace RCA 1&2 if more than three days old (and make new MOS-clean gloves), and replace Piranha if more than two weeks old.
2. Clean the wafers for 10 min. in Piranha etch, 3 : 1 H_2SO_4 : H_2O_2
3. Clean the wafers for 10 min. in a base solution (RCA 1) 30-40 : 1 : 1 DI : NH_4OH : H_2O_2 .
4. Clean the wafers for 10 min. in an acid solution (RCA 2) 30-40 : 1 : 1 DI : HCl : H_2O_2 .
5. HF dip.
6. Dry the wafers.

DETAILED PROCEDURE:

1. Remember that cleanliness is right next to Godliness in IC processing! No metal allowed in the hood. **Touch NOTHING in the hood with your regular gloves. Touch NOTHING outside the hood with the green gloves.**
2. Remove all photoresist and other organic material from the wafers before cleaning.
3. Enable the hood using Coral. Check the age of the baths on the hood's control screen. If the RCA baths are more than a three days old, you must mix a fresh batch for both baths, as detailed below, and make a fresh pair of MOS clean gloves. A new Piranha bath should be made if it is more than two weeks old. The HF bath should be changed each month, so if it is out of date inform the TA and the instructor. The H_2O_2 in the RCA and Piranha baths breaks

down in about 1 hour, so unless you are following directly behind another group, you will have to add peroxide as detailed below.

4. Start heating the baths. Turn on power to the bath heaters by pressing the blue enable button beside each of the temperature controllers above the hood. The temperature settings for the baths are already set: 120 °C for the piranha and 70 °C for RCA 1 & 2. It takes about 20-30 minutes for the baths to come to temperature.
5. Once the baths are at temperature, you can add the peroxide. Add 200 ml of H₂O₂ to the piranha (unless it is a new bath), 200 ml of H₂O₂ to RCA 1, and 200 ml H₂O₂ to RCA 2. If the bath is at its maximum level, prepare a fresh bath as detailed below. If the liquid level is too low to cover your wafers prepare a fresh bath.
6. Attach a handle to the cassette holding your wafers, and place the cassette into the piranha bath. Place the teflon tweezers in the bath too, and leave the lid open. Soak the wafers in the bath for 10 minutes (no more than 30 min.). When there is about 1 minute left, prepare the quick dump rinser (QDR) by going to the QDR page on the hood touch screen, and pushing the reset button for QDR 1. This fills the QDR with DI. Check that the QDR is set for two cycles. Remove the cassette and tweezers, place them in the dump rinser and press the start button for QDR1. Close the lid and turn off the piranha bath temperature controller by pressing the blue enable button.
7. The QDR will go through two rinse cycles. When the QDR is done, press the stop button for QDR1.
8. Place the wafers and tweezers in the RCA 1 bath (NH₄OH: H₂O₂), leave the lid open and soak for 10 min. (no more than 30). When there is about 1 minute left, prepare the quick dump rinser (QDR) by going to the QDR page on the hood touch screen, and pushing the reset button for QDR 2. Remove the cassette and tweezers and place them in QDR2, and press the start button. Close the bath cover, and turn off the RCA 1 temperature controller by pressing the blue enable button.
9. The QDR will go through two rinse cycles. When the QDR is done, press the stop button for QDR2.
10. Place the wafers and tweezers in the RCA 2 bath (HCl: H₂O₂), leave the lid open, and soak for 10 min. (no more than 30). When there is about 1 minute left, prepare the quick dump rinser (QDR) by going to the QDR page on the hood touch screen, and pushing the reset button for QDR 3. Remove the cassette and tweezers and place them in QDR3, and press the start button. Close the bath cover, and turn off the RCA 2 temperature controller by pressing the blue enable button.
11. The QDR will go through two rinse cycles. When the QDR is done, press the stop button for QDR3.
12. Before doing the HF dip, prepare QDR4 by going to the QDR page on the hood touch screen, and pushing the reset button for QDR 4. Place the tweezers in QDR 4. Place the cassette in the 50 : 1 HF solution for 2-5 seconds. Remove the cassette and let it drain for a 10 seconds (dripping back into the HF bin) before placing the cassette in QDR and pressing the start button. **Do not put the tweezers in the HF!**
13. The QDR will go through two rinse cycles. When the QDR is done, press the stop button for QDR4. Place the cassette into the spin rinse dryer. The cassette's H-bar should go in first. Close the door and press the green start button. The dryer will cycle through a pre-programmed sequence then stop.
14. Remove your cassette and proceed with loading the furnace.

Preparing Fresh RCA Baths

Prepare a pair of “MOS Clean” gloves by putting on a pair of green nitrile gloves and scrubbing them thoroughly under the DI gooseneck tap in the hood behind the MOS Clean Hood. You will see soap bubbles on the surface of the gloves that are from the mold-release compound. Scrub the gloves together and rinse until the bubbles go away. These are now your MOS Clean gloves. They should touch nothing other than things in the MOS clean hood.

Drain the RCA tanks by going to the Tanks page on the hood touch screen, and pushing the Drain buttons for Tank 2 and Tank 3. After they are empty, rinse the tanks thoroughly with DI water from the DI guns. Close the drain valves by pressing the Drain buttons again for Tanks 2 and 3. Fill each of the tanks with DI water from the DI gun until the water just touches the bottom of the top quartz loop at the back right corner of each tank. Add 200 ml of HCl to the RCA 2 tank. Add 200 ml of NH₄OH to the RCA 1 tank. Note: Rinse the graduated cylinder well after each use, using the DI sprayer to fill the cylinder, and QDR 1 as a sink to dump the DI. Turn the bath power on (the temperature should already be set to 70° C). Once the baths are at temperature, add 200 ml of H₂O₂ to RCA 1, and 200 ml of H₂O₂ to RCA 2, and you’re in business.

Update the tank refresh date on the hood’s control screen by going to the bath date page and touching the symbol for tanks 2 and 3.

Do not change the HF bath. Only specially trained personnel (the TA) should change the HF baths.

Preparing a Fresh Piranha Bath

Making a new Piranha bath is rather scary since you are working with concentrated acid, and the solution self heats when you mix it. **BE VERY CAREFUL!!!**

Drain the tank by going to the Tanks page on the hood touch screen, and pushing the Drain button for Tank 1. After it is empty, rinse the tank thoroughly with DI water from the DI gun. Close the drain valves by pressing the Drain button again for Tank 1. Add 5.25 liters of H₂SO₄ to the tank using the large graduated cylinder to measure the acid (note that a full (unopened) bottle of acid contains 3.8 l, so 1 full bottle plus 1.45 l). Next add 1.75 liters of H₂O₂, pouring it slowly into the bath. The peroxide tends to float on the acid, so take the triangular-shaped single-wafer holder and **slowly and carefully** stir the solution in the tank. As you stir the solution it will heat to close to 120 °C. If you get acid on your glove rinse them using the DI gun.

Update the tank refresh date on the hood’s control screen by going to the bath date page and touching the symbol for tank 1.

Preparing a Fresh 50:1 HF Bath (To be done only by approved personnel)

Only the TA or persons approved by Dr. Snider should change the HF bath. **Full battle gear (apron and face shield) is required.**

Drain the tank by going to the Tanks page on the hood touch screen, and pushing the Drain button for Tank 4. After it is empty, rinse the tank thoroughly with DI water from the DI gun. Close the drain valves by pressing the Drain button again for Tank 4. Fill the tank with DI water to the point where the surface is at the point where the “whiter” part of the tank begins. Then add an additional 1 (one) liter of DI water using the graduated cylinder. Next add the HF. Put on a pair of the green nitrile gloves (not the MOS clean gloves), and get a bottle of concentrated HF from the acid cabinet. Add 120 ml to bath 4 using the graduated cylinder. Rinse the cylinder thoroughly and return the HF bottle to the cabinet.