

# RCA-2 Cleaning Standard Operating Procedure

---

*Prepared by: Pauline Stevic*

*Date: May 22, 2018*

## 1. Purpose and application

The RCA-2 clean (sometimes called “standard clean-2”, SC-2), is a procedure for removing metal ions from silicon wafers. The decontamination works based on sequential oxidative desorption and complexing with  $\text{H}_2\text{O}_2$ -HCl- $\text{H}_2\text{O}$  (RCA-2). Typically this is preceded by an RCA-1 clean (SC-1,  $\text{H}_2\text{O}_2$ : $\text{NH}_4\text{OH}$ : $\text{H}_2\text{O}$ ) to remove organic residues. Chemical proportions: HCl: $\text{H}_2\text{O}_2$ : $\text{H}_2\text{O}$  1:1:5 [1].

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.

Only fresh solution should be used.

## 2. Equipment, Chemicals and Supplies

RCA-2 (1:1:5) is composed out of three chemicals:

1. Hydrochloric Acid (30 %)
2. Hydrogen Peroxide (30 %)
3. Balanced DI water

Hydrochloric acid (30%) is purchased from VWR International B.V.

<https://nl.vwr.com/store/product/707286/zoutzuur-30-suprapur-for-trace-analysis>

Hydrogen peroxide (30%) is purchased from VWR International B.V.

<https://nl.vwr.com/store/product/706316/waterstofperoxide-30-emprove-essential-ph-eur-bp-usp>

## 3. Personal Protective Equipment (PPE)

The following equipment should be used:

- Eye protection: Safety glasses and face shield is required.
- Protective gloves: Black neoprene gloves. Check gloves for leaks before use.
- Protective clothing or equipment: Apron.

## 4. Operational Procedures

1. Get three glass beakers or envelopes which will fit your sample and place them in the bench.

2. Write down your name and type of chemical for every beaker/envelope.
3. Fill two beaker/envelopes with DI water such that it will cover your sample. DI water is used for rinsing the etchant.
4. If you plan to heat the solution (recommended) set up an au bain-marie with a hotplate in the hood.
5. Put your measured amount of DI water in the last beaker, carefully add HCL.
6. Put the beaker/envelope filled with your solution in the au bain-marie (use a holder when you use an envelope) to bring it up to temperature. Use an temperature sensor housed within a glass enclosure to measure the temperature of the etchant. **Direct heating of inorganic mixtures at temperatures higher than 80 °C is only allowed in day time and only after personal approval of the set-up by the KN staff.**
7. Remove from hotplate and add H<sub>2</sub>O<sub>2</sub> (30 %). Solution will bubble vigorously at 1 – 2 minutes, indicating that it is ready for use.
8. Soak your sample in the solution for 10 minutes using a holder.

#### DI Water rinse

1. When the etch is complete, transfer the sample carefully to the first DI water rinse beaker/envelope and move the sample for 5 minutes in DI water.
2. If you use tweezers to move the sample, make sure you rinse your tweezers as well.
3. Transfer the sample to the second DI rinse beaker, and rinse for another 5 minutes while moving your sample.

#### Sample dry:

1. After the water rinse is finished, remove your samples and blow them dry with the N<sub>2</sub> gun.

#### Clean-up

1. Let the RCA-2 solution cool down to room temperature.
2. When the used etchant is at room temperature, pour it carefully over the other two beakers/envelopes filled with DI water.
3. Fill the beaker/envelope where you had your etchant with DI water.
4. Use the venturi to remove the waste from all the beakers/envelopes.
5. Rinse all the beakers/envelopes three times with DI water.
6. Turn all the beakers/envelopes upside down, wash the outside with DI water and blow them dry with the N<sub>2</sub> gun.
7. Return all labware to its proper location.
8. Clean the area and rinse it with DI water.
9. Wash your black gloves and leave them in the bench.

## 5. Primary Hazards

Hydrochloric Acid: Liquid or vapours are serious health hazards; and cause severe burns.

Hydrochloric acid is much more viscous than water, be prepared for this when you pour it.

Hydrogen Peroxide: Liquid or vapours are serious health hazards; and can cause severe burns. Hydrogen peroxide is an explosive chemical. Never leave the RCA process unattended. Do not store the hydrogen peroxide near the hotplate or any other source of heat.

## 6. Engineering Controls to Prevent and Mitigate Hazards

Carry out the procedure in a wet bench. Store bottles of chemicals (sealed tightly) in the inorganic cabinets. Work area should contain an eye wash, safety shower and a bottle of diphoterine. Check where you could find this in your neighbourhood.

The chemical are in the high risk category:

- Working with HIGH risk inorganic chemicals is not allowed in the after hours.
- A buddy must be present at all times.

## 7. First Aid and Emergency Procedures

Eye Contact: Immediately flush with diphoterine while lifting upper and lower eyelids occasionally (use the complete 500 ml for one eye and remove contact lenses if possible). After using diphoterine, flush with water for at least 15 minutes. Get immediate medical attention. Press the evacuation button.

Skin Contact: Remove contaminated clothing, wash skin with diphoterine. After using diphoterine, wash with water. If there is any irritation, get medical attention. Press the evacuation button.

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. Press the evacuation button.

Ingestion: Do not induce vomiting. Get immediate medical attention. Press the evacuation button.

In case of a spill: Press the evacuation button.

In case of a fire: Press the fire button.

## 8. Literature

- [1] "RCA-2 Silicon Wafer Cleaning," [Online]. Available: <https://www.inrf.uci.edu/wordpress/wp-content/uploads/sop-wet-silicon-rca-2.pdf>. [Accessed May 2018].