RCA-1 Wafer Cleaning

Standard Operating Procedure

Type of SOP: ☒Process ☐Hazardous Chemical ☐Hazardous Class

Overview

RCA-1 clean (sometimes called “standard clean-1”, SC-1) is used to remove organic residues from silicon wafers. The decontamination works based on sequential oxidative desorption and complexing with $\text{H}_2\text{O}_2$-$\text{NH}_4\text{OH}$-$\text{H}_2\text{O}$ (RCA1). A second RCA-2 clean (SC-2) is often used $\text{H}_2\text{O}_2$-$\text{HCl}$-$\text{H}_2\text{O}$ to further clean the surface. In the process, it oxidizes the silicon and leaves a thin oxide on the surface of the wafer, which is then should be removed to achieve a pure silicon surface.

This document will provide a detailed operation procedure of the RCA-1 Wet Bench.

Materials

- Ammonium hydroxide
- Hydrogen peroxide
- Pyrex bath containers
- Hot plate (or heated bath)

Bench Details

The wet bench for RCA-1 clean is located in the photolithography room of the EE Micro Fabrication Facility in the Fluke Hall at the University of Washington. The hot plate is located at the table next to the photolithography bench. This bench is capable of handling individual wafers or full cassettes of 50 mm and 100 mm wafers. It contains the following features

- RCA-1 Tank: Quartz recirculating heated bath w/ lid ($\text{H}_2\text{O}$, $\text{NH}_4\text{OH}$, $\text{H}_2\text{O}_2$).
- Rinse Tanks: Dump Rinse w/o lid ($\text{H}_2\text{O}$)
- DI sink

Personal Safety Equipment

All users must wear the following personal safety protective equipment at all times while working on this bench.
Respiratory protection: Generally not required when using a closed ventilation system.

Hand and Body Protection: As a minimum wear Butyl, Neoprene or rubber gloves. Wear heavy rubber apron, Tyvek coveralls, lab coat and/or Tyvek sleeves to protect clothes and body. Wear closed-toe shoes to protect the feet.

Eye Protection: Wear goggles together with a face shield to protect the face and eyes from splashes. Do not wear contact lenses.

Primary Hazards and Warnings

Do not store the solvents near the hotplate or any other source of heat.

Hydrogen peroxide is an explosive chemical. Keep it away from all solvents.

Ammonium hydroxide is a hazardous chemical. It is moderately toxic, strong irritant to skin, eyes, and mucus membranes.

Operation Procedure

Solution Preparation

Organic Clean solution (RCA-1) – $\text{H}_2\text{O}_2$:$\text{NH}_4\text{OH}$:$\text{H}_2\text{O}$ (5:1:1)

- 5.5 L DI water
- 1.1 L $\text{NH}_4\text{OH}$ (27%)
- 1.1 L $\text{H}_2\text{O}_2$ (30%)

Add about 5.5 L of DI water to the RCA-1 tank carefully and add 1.1 L of $\text{NH}_4\text{OH}$ to the RCA-1. Begin heating and recirculation the solution.

Wait for temperature to reach 75°C (~40 min) Add 1.1 L of $\text{H}_2\text{O}_2$ to the RCA-1 Tank

*Note: This step should be performed just prior to the RCA-1 clean.*

Cleaning Procedure

1) Wait for RCA-1 bath to be at least 75°C.

2) Ensure rinse tanks are full of water.

3) Add the $\text{H}_2\text{O}_2$ to the RCA-1 bath and wait for temperature to reach at least 70°C.
4) Place the wafer cassette in the RCA-1 tank, and wait for 15 minutes.

5) Transfer the wafers from the RCA-1 Tank to the rinse tank 1.

6) Let them rinse in 3 bath cycles.

**Spill and Accident Procedure**

Dilute small spills or leaks cautiously with plenty of water.

Major spills must be handled by a predetermined plan. Call 9911. Help contaminated or injured persons. Evacuate the spill area. Avoid breathing vapors. Keep others from entering contaminated area (e.g., use caution tape, barriers, etc.).

**Waste Disposal Procedure**

To dispose of the RCA-1 solution, dilute with cold water, let cool and sit for 10 minutes, then pour down the drain with plenty of cold water to flush. Rinse all labware three times in clean water.

**Approval Required**

Must demonstrate proficiency to cleanroom personal prior to working independently.

**Decontamination**

Ensure area is clean and dry. Do not leave out contaminated items.

**Designated Use Area**

Use closed ventilation systems (e.g. exhausted hood) for handling such as pouring liquid. Sash height should be kept low to avoid escaping fumes and provide a physical barrier. Use corrosion proof construction. Provide eyewash and quick-drench shower facilities convenient to work areas.