RCA-1 Silicon Wafer Cleaning

INRF application note
Process name: RCA01

Overview
The famous RCA-1 clean (sometime called "standard clean-1" , SC-1) developed by Werner Kern at RCA laboratories in the late 1960's, is a procedure for removing organic residue and films from silicon wafers. The decontamination works based on sequential oxidative desorption and complexing with H2O2-NH4OH-H2O (RCA1). A second RCA-2 clean (SC-2) is often used H2O2-HCI-H2O to further clean the surface. RCA-1 clean is used to remove organic residues from silicon wafers. In the process, it oxidizes the silicon and leaves a thin oxide on the surface of the wafer, which should be removed if a pure silicon surface is desired.

This is a level-1 process and requires basic INRF safety certification. The use of dangerous chemicals requires that the user may not perform the process alone.

Time needed

This process takes 30 minutes to complete in total.

Materials needed

Ammonium hydroxide
Hydrogen peroxide
Pyrex bath containers
Hot plate

Preparation
Setup time for this process is about (5 minutes). This process takes about (20 minutes) to complete. The general recipe is for RCA-1 cleanser is: 5 parts water (H2O), 1 part 27% ammonium hydroxide (NH4OH), 1 part 30% hydrogen peroxide (H2O2).

325 ml DI water
65 ml NH4OH (27%)
65 ml H2O2 (30%)

Procedure (RCA-1)

Put 325 ml DI water in a Pyrex beaker, add 65 ml NH4OH (27%) and then heat to 70 +/- 5 deg C on hotplate. Remove from hotplate and add 65 ml H2O2 (30%). Solution will bubble vigorously after 1-2 minutes, indicating that it is ready for use. Soak the silicon wafer in the solution for 15 minutes. When finished, transfer the wafer to a container with overflowing DI water from a tap to rinse and remove the solution. After several water changes, remover the wafer under flowing water. (Still water surface can contain organic residue that will redeposit on the wafer surface when removing wafer.)

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Clean up

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. Old RCA cleaning solution cannot be used since it loses its effectiveness in 24 hours at room temperature, 30 minutes at 70 deg C). Rinse all lab ware three times in clean water.

Safety and emergency

All INRF safety and procedural regulations must be followed. Review the INRF standard operating procedures for fire, chemical spill, and chemical exposure. Use of RCA requires at least one other person in the clean room (buddy system). RCA clean should be performed in a laminar flow bench, using nitrile gloves and eye protection.

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. Any small spills should be wiped up immediately with wipes. Dispose the wipes in the corrosive waste container.

In case of exposure to skin or eyes, flush immediately with water for 15 minutes. Remove all clothing that are exposed and flush with water. Report to INRF staff or report to EH&S. Seek medical attention to ensure that the burns are minimal.

In case of large spill, follow the INRF Standard Operating Procedure for chemical spills.

References

Kevin M. Walsh, *University of Louisville Standard Operating Procedures,* http;//mitghmr,spd.Louisville.edu/lutz/resources/sops/

Prudent Practices in the Laboratory, national Research Council, 1995.

W. Kern and J. Vossen, Eds.,*Thin Film Processes,* Academic Press; New York, 1978, Ch V-1.

W. Kern, Ed, *Handbook of Semiconductor Cleaning Technology,* Noyes publishing; Park Ridge, NJ, 1993, Ch 1.

RCA-1 wafer clean Checklist

The following checklist is designed to aid the researcher when performing this process.

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RCA-1 clean

Prepare RCA bath; 5 parts water (H20), 1 part 27% ammonium hydroxide (NH4OH), 1 part 30% hydrogen peroxide (H2O2).

Soak wafer in RCA-1 bath at 70 deg C for 15 minutes.

DI rinse and blow dry.

Clean up, dispose wastes.