SiO_2 Substrates Cleaning Using Piranha Solution

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1. Warnings

Piranha solution is a mixture of sulfuric acid (H_2SO_4) and hydrogen peroxide (H_2O_2). Due to its substantial oxidation property, it can clean organic residues on substrates and glassware. It is widely used to remove photoresist residues from silicon wafers. But great care should be taken while using and disposing of the solution. Please take care of the following points:

1. The mixture is exothermic, which means while mixing, the solution can reach temperatures up to 120° C. So, usage of an ice bath is highly recommended. Protective gear like neoprene gloves and safety goggles must be worn.
2. Take note of acidic concentrations. Make sure peroxide concentration is always less than 50%.
3. Always, peroxide should be added to the sulfuric acid, and the reverse should not be performed.
4. Hydrogen peroxide tends to self-decompose easily. So, the solution must be prepared freshly every time and used within 24 hrs.
5. Since peroxide induces oxygen gas, the solution should not be disposed of in organic or volatile waste containers.
6. It is recommended to *in situ* disposal after neutralization rather than store the solution in a container.

2. Solution Preparation

1. Prepare an ice bath in which an entire beaker or bottle (to be used for piranha preparation) can be buried. Make sure the entire work is done in a fumehood setup.
2. Add 30 ml (or desirable volume) of concentrated sulfuric acid in a clean beaker. Then, slowly add 10 ml of hydrogen peroxide (30%) to that solution.
3. If required, mix the two solutions with a glass stick. Heating and bubbles can be visible now.

3. Substrate Cleaning

1. Immerse the pre-cleaved SiO_2 substrates vertically inside the piranha solution. Then rinse slightly or sonicate it for a few minutes (Usually 2 mins).
2. Transfer the substrates to a DI water container and rinse thoroughly. Sonication for 2 mins up to 4 cycles is highly recommended. Piranha residual would have a negative impact and affect the coating of organic layers.
3. Dry the substrates using an inert gas gun or an air blower.
4. If required, other cleaning steps like IPA treatment or O_2 plasma cleaning can be done now.
5. Dispose of the piranha solution and clean any spills and drops on the working bench.