

Reminder: No shorts in the lab, lab-coats required, safety goggles and gloves required, wherever required acid protecting special gloves mandatory. Violators will not be allowed to attend the lab.

Note: You are required to prepare KOH etch bath during the early stage of your lab. You will need this in Step IV (given below) for KOH etching.

I. Photolithography:

1. Get the oxidized silicon wafer and spin on positive photoresist on both sides of wafer. Do this process sequentially. Do first back side and then the front side of the wafer (the term “front” means that the side which you are going to expose and pattern)
2. Soft bake the wafer for 2 minutes.
3. Using the provided mask, transfer the pattern onto the wafer, develop in 352 developer solution.
4. Hard bake the wafer for 8 minutes.
5. Put the wafer in the RIE chamber for reactive ion etching of silicon oxide. For this follow the procedure in step II.

II. Reactive Ion Etching:

Very important note: The wafer that you are using must have photoresist on both sides. RIE has the tendency to etch the back side of the edges of the wafer along the periphery, so coat your wafer with positive photoresist on both sides.

1. Start the RIE booster pump in the back room.
2. Turn on the cooling water vacuum pump. Make sure that the container is filled with enough amount of water. If water is dirty replace it with fresh DI water.
3. Venting the chamber by pressing Manual + Vent buttons simultaneously. These buttons are found on the function panel. Let Data reading attain zero value and then wait for 10 seconds.
4. After venting is complete the pressure in the reactive ion etching chamber will be normalized to atmospheric pressure and can be opened. Open by pushing the black button at the front of the chamber, and simultaneously pulling the lever on the left side of the chamber. Place the wafers with the side to be etched facing upwards.
5. Select Manual + Rough (the system will switch over to high vacuum mode automatically). At this point fill out the RIE log sheet.
6. In this experiment gas used is SF₆ and it is in Line Two and designated as Gas 2. You have to keep this in mind while selecting the parameters.
7. To change the default or stored parameters turn the probe key on the function panel to “Change Parameters” (to the right).
8. Select Set + Gas2 and enter 50% data.
9. Select Set + Throttle pressure to 300 millitorr.
10. Select Set + RF level to 40% of the total power (which is 300W).
11. Change the mode key again onto “Manual Operation”.
12. Initiate etching process by:
 - a. Gas 2 – Manual + Gas 2

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- b. Throttle Pressure – Manual + Throttle Pressure
 - c. RF level – Manual + RF Power
13. Recheck your parameters by:
 - a. Gas 2 – Read + Gas 2
 - b. Throttle Pressure – Read + Throttle Pressure
 - c. RF level – Read + RF Power
14. Read RF level reflected power and turn RF matching load on gas control panel to the smallest possible reading (which may be between 3 and 6).
15. Keep note of duration of etching. Etch for about 15 minutes. (Variable).
16. Once finished etching, shut down the RIE chamber as indicated in step 12, i.e.,
 - a. Stop Manual Throttle
 - b. Stop Manual Gas
 - c. Stop RF Power
17. When pressure on the panel nearly approaches zero hit Manual + Vent to pressurize the chamber again.
18. Open the chamber and remove etched wafers.
19. Hit Auto + Vent to pump down the RIE chamber.
20. Shut down cooling water pump.
21. Shut down booster pump.

III. Cleaning of Wafer:

1. Remove the positive photoresist with acetone and rinse in DI water.
2. Clean the wafer with Piranha etch (70% sulfuric acid + 30% hydrogen peroxide by volume) for about 1 minute. NOTE: USE ACID-RESISTANT GLOVES.
3. Rinse wafer in DI water.
4. Dip wafer for 10 seconds in HF or BOE etch and rinse it immediately with DI water. NOTE: USE ACID-RESISTANT GLOVES.
5. Dry wafer and place in the boat in preparation for KOH etching.

IV. KOH etching:

Requirements:

- Clean glassware (quartz or thermoresistant such as borosilicate glass)
 - Preparation of KOH solution 20% by weight in DI water (Prepare 1L solution)
 - Constant temperature bath for the KOH etching is required. Select temperature at 80°C. Etching is facilitated by agitation action, so stirrer may be used.
 - To maintain the concentration of the solution keep the solution covered (say with aluminum foil)
1. Immerse all wafers in the bath at the same time.
 2. Take out wafers- one at a time- at various time increments (10, 15, 20, 25, 30 minutes) and rinse with DI water. Dry with compressed N₂.
 3. Examine the wafer under the light microscope and measure the etch profile using the Dektak profilometer.
 4. For various times, you will get different depths. Plot the depth versus time and determine the etch rate.