520.495/530.495/580.495 Microfabrication Laboratory

<table>
<tr><td>Flow Cytometer

Lab 7: Oxide Patterning</td><td> </td></tr>
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This week we will do lithography on the oxide so that we can remove it from everywhere except the areas that are covered with Al. We will first place the wafer that is coated with photoresist and in the mask aligner so that we can align the wafer to the mask #3 using the alignment keys on the wafer and the mask. After the wafer and the mask are properly aligned, we will expose the photoresist to transfer the desired pattern from the mask onto the wafer. We will then develop to remove the exposed photoresist and etch the oxide in the areas that are not covered by photoresist. Finally we will clean the photoresist from the wafers.

Preliminaries:

1. All the cleaning procedures (except using spin/rinse/dryer) should be done in the hood. Aprons, protective sleeves, gloves, face shield, lab coat, and goggles must be worn during cleaning procedures. Wear plastic disposable gloves at all times.

2. Transfer wafers with tweezers; try to grasp the wafer at the same place each time, usually at the flat edge.

I. PRELAB ASSIGNMENT:

1. Base on your experience with the BOE solution that made in the lab, how much time will you need to completely remove the oxide layer that is currently on your wafers?

II. LAB WORK:

Task #1: Photoresist deposition:

1. Dehydrate your wafers on the hot plate for 5 minutes at 120°C.
2. Set the photoresist spinner RPM at 2000 RPM (Revolutions Per Minute) with acceleration in approximately 5 second and the timer to 60 second for spinning.

3. Make sure that the vacuum is on after centering the wafer on the chuck. You can do that by gently trying to push the wafer off the chuck using the tweezers.
4. Carefully withdraw **positive photoresist SJR5740** from the bottle with the pipette. Again, to minimize contamination, do not touch any part of pipette or wafer that is going into the photoresist bottle.
5. Dispense photoresist on to the wafer slowly, and try not to create any air bubbles.
6. Double check that vacuum is on and cover the spinner then start spinning.
7. Soft-bake the wafer on the hot plate for 7 minutes at 105°C.

Task #2: Wafer Exposure:

1. Set wafer on to the chuck and follow the instruction on the screen. Use the alignment keys on the wafer and on the mask to align them.
2. Set exposure timer at 300 seconds. Press the expose button and turn away from the aligner during exposure.
3. Develop the photoresist by immersing the wafer in the CD26 developer for 25 minutes. Rinse the wafer by first immersing the wafer in the beaker of DI water, then again under running deionized water at the sink for 30 seconds. Dry the wafer and inspect the wafer under the microscope.
4. Hard-bake the wafer on the hot plate for 5 minutes at 105°C.
5. Carefully get the wafer off the hot plate and place them in their carriage.
6. Let the wafers cool down for 5 minutes in their carriers but in the laminar flow hood.

Task #3: Oxide Etch:

1. Make up buffered oxide etch in a 1000 ml plastic beaker. Weigh out 296 g NH_4F, and add to 425 ml of de-ionized water with stirring. Then add to this mixture 106 ml HF.
2. Carefully pour the buffered oxide etch into a Teflon petri dish. Fill a 2000 ml beaker with de-ionized water for rinsing.
3. Hold the wafer with tweezers and immerse into prepared BOE, with gentle agitation. According to the etching time you estimated, take the wafer out and observe the solution running off the back side of the wafer. If the etch has removed the unprotected silicon dioxide, the etchant will not wet the exposed silicon regions
4. Rinse wafers first in the 2000ml beaker filled with DI water for 1 minute followed by the running DI, dry using the filtered nitrogen gun, and inspect wafers under microscope.

Task #4: Photoresist Removal:

1. Fill a Teflon petri dish of acetone. Fill another with isopropanol

2. Immerse the wafers in the acetone for 2 minutes, then for 2 minutes in the isopropanol. Rinse with deionized water and then blow or spin dry the wafer.
3. Place your wafer in the wafer holder until next week.

III. POSTLAB ASSIGNMENT:

1. What are the potential problems if you under develop the photoresist?
2. Why don't you want to under etch the oxide?
3. What would happen if you over etch the oxide?
4. If the wafers are not correctly aligned to the mask, what would be the problems?
5. Why do we dehydrate or prime the wafers before applying the photoresist?

Lab procedure prepared by H. Vo and A.G. Andreou, Fall 2003, and revised by H. Vo, T. Yee, M. Ho and A.G. Andreou,, Fall 2007.