

Laboratory Assignment 2 Photolithography

Objectives:

1. Gain familiarity with photolithography using a traditional positive photoresist.
2. Learn the basic photoresist reflow technique
3. Investigate the photoresist topology a.) after performing traditional lithography b.) after performing reflow.

I. Prelab work:

1. Explain the difference between positive and negative photoresist.
2. Given a single photoresist formula, what is the most direct method of controlling the thickness of the photoresist on a silicon wafer?
3. If you are given one photoresist - A to create a film with thickness of 1 μm and a second photoresist - B to create a film with thickness of 20 μm , what physical property would you expect to differ most between the two photoresists and how would you expect this property to differ (e.g. $A > B$ or $A < B$).

II. Lab Work:

1. Obtain three silicon wafers for your group, label the wafers A, B and C.
2. Spin 3mL of S1813 photoresist at 3000 rpm for 60 seconds on each wafer.
3. Hard bake each wafer at 200°C for 20 minutes.
4. Spin 3mL of SJR5740 on wafer B at 2000 rpm for 60 seconds.
5. After spinning, hold at room temperature for no less than 5 minutes.
6. Soft bake at 105°C for 6 minutes on a hot plate.
7. Hold at room temperature for no less than 5 minutes.
8. Place in the mask aligner and expose using the "positive mask" for 55 seconds with a dose of 14mW/cm².
9. Immediately remove the wafer from the aligner after exposure and let it rest for no less than 5 minutes.
10. Develop the photoresist in 453 developer.
11. Rinse with water.
12. Measure the photoresist with the profilometer.
13. Reflow the photoresist for 30 minutes at 200°C on a hot plate.
14. Measure the photoresist with the profilometer.

III. Post-Lab Work:

1. Describe the observed differences between the profiles you obtained before and after the reflow step. Include cross-section sketches in your descriptions.
2. Explain what happens to the photoresist during the reflow step and which force(s) govern the topology of the photoresist during reflow.