520.495/530.495/580.495 Microfabrication Laboratory

Flow Cytometer **Lab 5: Metal Evaporation**	

This week we will continue the Flow Cytometer process by thermal deposition (evaporation) of aluminum in the electrode areas. After the thermal evaporation we will spin photoresist on the fresh material to get ready for next week's photolithography.

Preliminaries:

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

2. Using the spin/rinse/dryer: Turn on nitrogen gas (50 psi). Test the spin/rinse/dryer to make sure that the door seals after pressing start. Line the wafers in the blue wafer holder so that the wafers are far apart. After rinsing and drying, do not open washer door until wafer holder has automatically turned right side up.

4. 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.

I. PRELAB ASSIGNMENT:

1. Draw the cross section of the current state of your device.
2. What is the density and melting temperature of Al?
3. What is the purpose of this lab?
4. Among aluminum, gold and copper, which has the best electrical properties?

II. LAB WORK:

Task #1: Cleaning aluminum –raw material-:

1. Prepare PAN etching solution in 200 ml beaker. (75 ml phosphoric acid, 3 ml nitric acid, 15 ml acetic acid, 5 ml water).
2. Handling the wire with gloves, clean 2 g of aluminum wire by soaking for 5 minutes in ethanol, 5 minutes in PAN etch, then rinse with water, acetone and blow dry with nitrogen.
3. Clip into 1 inch pieces on clean piece of aluminum foil,
and cover until loaded into evaporator.

Task #2: Evaporation:

1. If not clean, use clean wipes and alcohol to clean the evaporator bell where aluminum is deposited during the previous evaporation cycle.
2. Place wafers onto the stage of the evaporator.
3. Load 1/2" pieces of Al wire into the "tungsten boat".
4. Pump down evaporator following instructions provided.
5. When a pressure of approximately 1×10^{-6} torr is reached, use the Variac to **slowly** increase the current through the boat. Aluminum should melt, and will begin to cover the wafers. If you increase the current too fast, the aluminum will splatter out of the “boat”! Continue the deposition until aluminum disappears from the “boat” (it takes between 5 and 10 minutes).
6. Let the evaporator come to ambient pressure following instructions of the lab assistants and take the wafers out of the evaporator bell.

Task #3: Photoresist Deposition:

1. 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.
2. 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.
3. Using a transfer pipette, carefully withdraw approximately 1 ml of positive photoresist **SJR5740** from the bottle into the pipette. Again, to minimize contamination, do not touch any part of syringe that is going into the photoresist bottle, and use a new pipette each time.
4. Dispense photoresist on to the wafer slowly, and try not to create any air bubbles.
5. Double check that the vacuum is on and cover the spinner. Now start spinning (60 seconds at 2000 R.P.M.)
6. Softbake wafers on hot plate at approximately 105°C for 7 minutes.
7. Carefully get the wafer off the hot plate and place them in their carriage to be stored (in a dark place) until next week.

III. POSTLAB ASSIGNMENT:

1. Based on today's lab work, how thick of an aluminum layer did you deposit? Compare this with the thickness as measured by the gauge on the machine.

2. What photoresist did we use today? Based on the spin-on procedure, how thick of a photoresist layer do you think you have on your wafer?

3. What does "positive photoresist" mean?

4. Is the thickness of the photoresist the same everywhere on the wafer? If not, what area has the thickest photoresist (draw a cross section of your device to illustrate this.)

5. Draw important cross sections of your device after this lab.

Why did we wait for the pressure of the evaporation chamber to go down to 1 x 10^{-6} torr before we initiate the evaporation process?

Lab procedure prepared by H. Vo and A.G. Andreou, Fall 2003.