Lab 6: Metal Evaporation

This week we will continue the waveguide process by thermal deposition (evaporation) of aluminum in the mirror areas. Before evaporating, we need to align and temporarily bond the shadow mask to the device wafer. The shadow mask will enable us to selectively deposit the metal on the mirror area only and thus, we won't need to do lithography to pattern the metal afterward.

Preliminaries:

1. Transfer wafers with tweezers, try to grasp the wafer at the same place each time, usually at the flat edge.
2. 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. Why do we need aluminum in waveguide?
4. Among aluminum, gold and copper, which has the best electrical properties? Aluminum is commonly used in IC, but not gold and copper. Why not?

II. LAB WORK:

Task #1: 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.

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. Draw important cross sections of your device after this lab (properly label all the layers, angles and planes.

3. Why did we deposit metal? What happen if the deposited metal layer a little bit thinner or thicker?

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

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