

## **Laboratory Assignment**

### **Wafer Oxidation**

#### **Objectives:**

This week we'll begin the class project by first forming an insulating layer of silicon dioxide on the wafers in a high temperature furnace. Since the wafers are clean out of the box we must be careful not to contaminate them before oxidation. Make sure not to touch the wafers with anything but the wafer tweezers. The oxidation of silicon is covered in Chapter 3 of the textbook.

#### **Preliminaries:**

1. Transfer wafers with tweezers, try to grasp the wafer at the same place each time, usually at the flat edge.
2. Turn on the water supply to cooling coils of the furnace before turning it on. Check for proper flow of water at the drain. Turn it off when done and after the temperature has dropped to below 200°C. Have Nitrogen gas running through the furnace tube while furnace is running without wafers inside, set float tube to 10.

#### **I. Prelab Assignment:**

1. Why do we need to grow silicon dioxide on the silicon wafers? Why don't we just deposit the metal lines directly on the silicon?
2. Why is it important to have gas running through the furnace tube even though there is nothing in it?

#### **II. Lab Work:**

##### **Task #1: Wafer thickness measurement.**

The wafers that we will use come with a nominal thickness between 350 and 600 micron. To find out the exact thickness of your wafer, use the micro-caliper in the lab. Clean the surfaces of the micro-caliper that come in contact with the wafer so that you do not contaminate the wafer.

Exercise great caution in closing the caliper on the wafer as it does not take much to break a silicon wafer. This is something you ought to remember throughout the lab sessions.

## **Task #2: Wafer oxidation.**

1. Before performing the wet oxidation step, make sure that:

- The furnace is at 1100° and all 3 sections in the furnace are stable
- The water temperature inside heating mantle is near 100°C (rheostat set at 20) and water is boiling.
- The tube from the boiling water flask is indeed connected to the inlet of the oxidation furnace.
- The oxygen is turned on and the float set at 20

2. Transfer wafers from the single carriers into the quartz wafer "boat". Place the wafer "boat" into the quartz carrier. Remove the end cap of the furnace and slide the boat into the furnace with the quartz push rod. (Don't touch any part of the rod that will go in the furnace so as not to introduce any contamination.) To prevent the wafers from breaking due to a rapid temperature change, push the boat in slowly (approx 5 inches every minute for 5 minutes, use red tape marks on the floor). Oxidize for 60 minutes.

3. Remove the wafers from the furnace with the quartz push rod (again over 5 minutes time) and set wafers under the hood until completely cooled about 15 minutes.

4. When wafers cooled place them carefully in plastic wafer carriers and mark the carriers with your section and names. This is how wafers will be stored from one laboratory session to another.

## **III. Postlab Assignment:**

1. Note the colors of the wafers before and after oxidation. What color is your wafer? Can we estimate the thickness of the oxide from the change in color? Explain why? What is your estimate for the thickness of the oxide?

2. Based on the amount of time and oxidation temperature, estimate how much oxide was deposited on the wafers. Justify your answer with a table, graph or calculation.

*Lab procedure prepared by A.G. Andreou, Fall 1998; modified by Francesco Tejada, 2002.*