520.495/530.495/580.495 Microfabrication Laboratory

Flow Cytometer **Laboratory Assignment 4** **Silicon Oxidation**	

This week we will continue the Flow Cytometer process by growing oxide over the fabricated channels. This oxide is necessary to electrically isolate the metal electrodes that will be deposited next week. But first we will strip all oxide from the wafers so that we have fresh silicon surface.

I. PRELAB ASSIGNMENT:

1. Based on the design requirements/specifications of 0.1 um thick oxide, please find the conditions for shortest oxidation time (Note: indicate the temperature and type of gaseous compounds).

2. What is a flow cytometer? How does it work? Who are the major manufactures?

II. LAB WORK:

Preliminaries:

1. Transfer wafers with tweezers, try to grasp the wafer at the same place each time, usually at the flat edge.
2. All processing and 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 **always**.

Task #1: BOE 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. Or, if already prepared and stored in a Teflon bottle, carefully pour buffered oxide etch into a Teflon Petri dish.

2. Fill a 2000 ml beaker with de-ionized water for rinsing.

3. Do a BOE etch until the wafers are free of silicon dioxide (they do not wet in water). Rinse the wafer by first immersing the wafer in the beaker of DI water, then again under running de-ionized water at the sink for 30 secs. Dry the wafer using the filtered nitrogen gun and inspect the wafer under the microscope.

Task #2: Wafer oxidation:

1. Before performing the dry oxidation step, make sure that:
   a. The furnace is at 1100° C and all 3 sections in the furnace are stable.
   b. The tube for the oxygen supply is connected to the furnace tube. The oxygen is turned on and the float set at 20.

Lab procedure prepared by A.G. Andreou, Fall 2003 and revised by H. Vo, T. Yeh and M. Ho and A.G. Andreou, Fall 2007, C. Sapsanis Fall 2018.

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 mins.

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

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. What is the color of the wafer before and after oxidation? Based on the color of the wafer how thick is the oxide? (see page 78 of the book).

2. Why is the thickness of the wafers different from the one that we started (do a calculation to show what should the predicted thickness be, based on the processing steps so far)?