

## Oxide Growth

### Operating Instructions

1. Set the furnace temperature to 1000°C (see Fig.1).
2. Purge oxygen from the furnace using nitrogen gas for 2 minutes. To do this, open the valve on nitrogen source and set the nitrogen flow through the furnace to 1L/min by setting the glass ball at an appropriate value using the charts provided (see Fig.2).
3. Prepare three Si wafers by cleaning them with BOE for 2 minutes to remove the native oxides. Rinse the wafers with DI water and blow-dry them with nitrogen. In addition, clean the reference wafer for Filmetrics to ensure accurate thickness readings.
4. Use Filmetrics to verify that the native oxide has been completely removed from the wafers (load the program "SiO<sub>2</sub> on Si" and calibrate using the reference Si wafer). Perform three SiO<sub>2</sub> thickness measurements per wafer. The initial thickness of SiO<sub>2</sub> on the wafers should be 0 nm.
5. Place the wafers on the boat so that shiny surface of wafers faces the opposite directions.
6. Open the furnace and use the quartz pushing rod to slowly place the boat at the center of the furnace. Remember to take at least one minute to push in the boat containing wafers. Pushing or pulling the rod too quickly will result in its shattering due to thermal stress created by the large difference of temperatures inside and outside of the furnace.
7. Close the furnace; close nitrogen flow, wait for 2 minutes and then open the valve on oxygen cylinder and set flow with a constant flow rate of 1 L/min. Measure the oxygen flow rate using the glass float in the rotameter (see Fig.2) and the provided charts.
8. Let the wafers stay in furnace for 5 minutes.
9. After 5 minutes, turn off the oxygen flow and turn on the nitrogen flow at 1L/min for 2 minutes.
10. Take out the boat slowly and let it cool for 2 minutes on the copper cooling tray.
11. Use Filmetrics to measure the SiO<sub>2</sub> thickness on the wafers. Perform 3 measurements per wafer and compute the average and the standard deviation of the measured thickness.
12. Place the wafers back into the boat and repeat Steps 6-11 to obtain the SiO<sub>2</sub> thickness after the wafers spend the total of 5, 10, 20, 30, 40 and 50 minutes in the furnace.
13. Plot dependence of the SiO<sub>2</sub> thickness on time and determine the relevant diffusion and

reaction rates. Do these rates depend on the wafer orientation with respect to the oxygen flow?

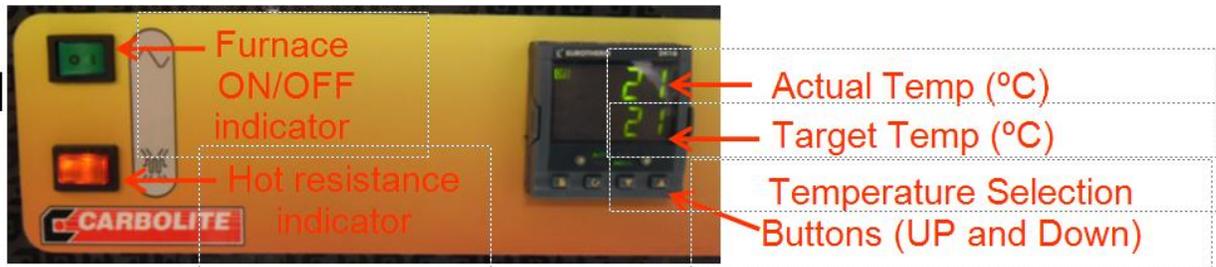


Fig.1 Control Panel of furnace

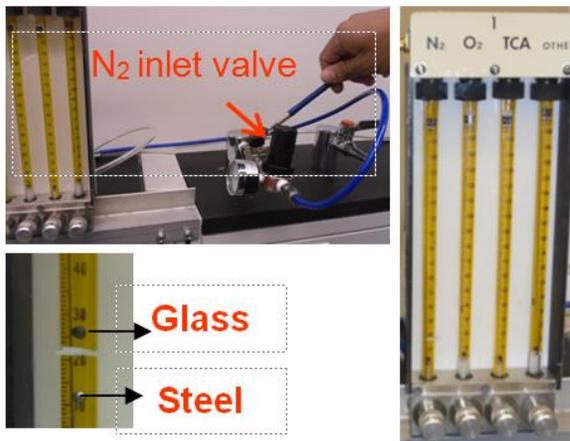


Fig.2 Control Panel of furnace

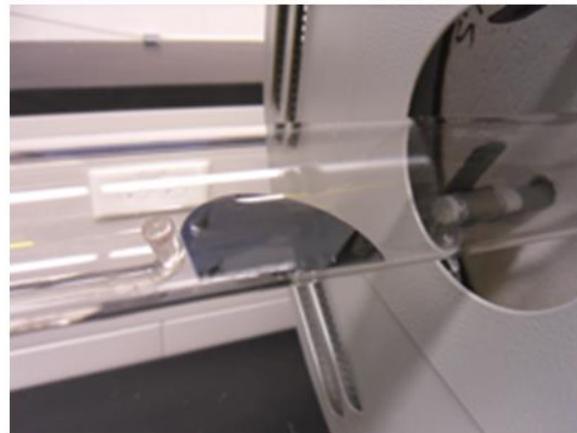


Fig.3 Push the sample into the tube

### Recommended Websites

- [1] [http://en.wikipedia.org/wiki/Thermal\\_oxidation](http://en.wikipedia.org/wiki/Thermal_oxidation)
- [2] <http://www.cleanroom.byu.edu/OxideTimeCalc.phtml>