Student Lab Mark IV Furnace SOP

1. Scope

1.1 This document provides the operating procedure for the Mark IV Furnace in the Student Lab.

2. Table of Contents

3. Reference Documents

3.1 Referenced within this Document

3.1.1 None

3.2 External Documents

3.2.1 None

4. Equipment and/or Materials

4.1 Mark IV Furnace

4.2 Sample/Wafer

4.3 Logbook

4.4 Quartz Ware

4.5 Heat Resistant Gloves

4.6 O2

4.7 N2

5. Safety

5.1 Follow all Nanofab safety procedures.

5.2 Never touch the quartzware with dirty gloves or bare hands.

6. Setup Procedures

6.1 Log Information in Log Book

6.1.1 Record all necessary setup and processing information into the log book.

6.2 Turn on Main Power

6.2.1 Turn on the main power switch to the furnace. See *Figure 1, Main Power Switch*.

7. Wet Oxidation

7.1 Set Furnace and Bubbler Temperatures

7.1.1 Using the temperature controllers set the oxidation furnace tube temperature to the desired oxidation temperature. See *Figure 2, Temperature Controllers*.

NOTE: It takes 2-3 hours for the furnace to heat up.

NOTE: The oxidation furnace is the bottom right hand tube.

Figure 1, Main Power Switch

Figure 2, Temperature Controllers

7.1.2 Turn on the line heating variacs. See *Figure 3, Variacs*.

7.1.3 Turn the bubbler variac on (located at the rear of the furnace stack). See *Figure 3*.

7.1.4 Set the bubbler variac dial to 60.

NOTE: This will heat the bubbler up to 95 C in approximately 2 hours.

7.1.5 Fill in data into the process logbook.

7.1.6 If the water level in the bubbler is not 1 inch above the heating jacket fill it to that location with DI water. See *Figure 6, Bubbler and Filling Procedure*.

7.1.6.1 Unscrew filler cap.

7.1.6.2 Insert funnel.

7.1.6.3 Fill with DI water to 1 inch above heating jacket.

7.1.6.4 Remove funnel.

7.1.6.5 Close filler cap.

7.1.7 Wait for the furnace and bubbler to reach the desired temperature.

Bubbler Variac

Line Heating Variacs

Figure 3, Variacs

7.2 Load Wafers

7.2.1 Put on clean gloves. Never touch the quartzware with dirty gloves or bare hands.

7.2.2 This furnace can only be used for clean, dry silicon wafers. DO NOT put in wafers that have photoresist, metals, or any other contaminants on the surface.

7.2.3 Make sure N2 is flowing into the tube.

7.2.4 Use tweezers to place your clean dry wafers in the quartz boat located on the quartz ware table. See *Figure 4, Quartzware*.

7.2.5 Using the short quartz rod pull the quartz boat into the trunk (quartz tube with the handle on it). See *Figure 4.*

7.2.6 Place the heat resistant glove on your hands, then remove the furnace end cap and place it on the quartz ware table.

7.2.7 Place the trunk on the end of the furnace tube.

7.2.8 Using the short quartz rod slowly push the quartz boat into the end of the furnace tube.

7.2.9 Remove the trunk and place it on the quartz ware table.

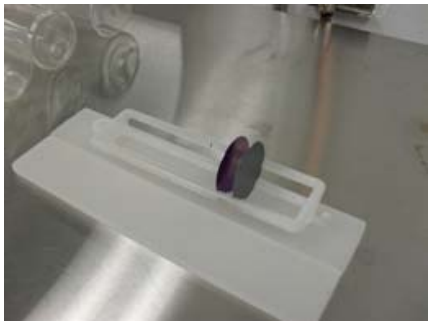
7.2.10 Use the long quartz rod located at the side of the furnace tube to push the quartz boat into the center of the furnace at a rate of 1 inch every 20 seconds.

7.2.11 Let the wafers sit in the furnace for 10 min.

7.3 Start Oxidation

7.3.1 Open the valve on the O2 Cylinder. Use the regulator on the O2 cylinder to set the gas flow to 20 psi. See *Figure 5, O2 Cylinder*.

7.3.2 Make sure the O2 cylinder has enough oxygen tank pressure left for your run (approximately 50 psi/hour).



Quartz Boat

Trunks

Figure 4, Quartzware

7.3.3 Flip the O2 switch to the on position and adjust the flow to 3. See *Figure 7, Gas Flow Control Panel*.

7.3.4 Flip the N2 switch to the off position. See *Figure 7*.

7.3.5 Turn the manifold switch to allow O2 to flow through the bubbler and into the furnace (Open position). See *Figure 7*.

7.3.6 Record the oxidation start time.

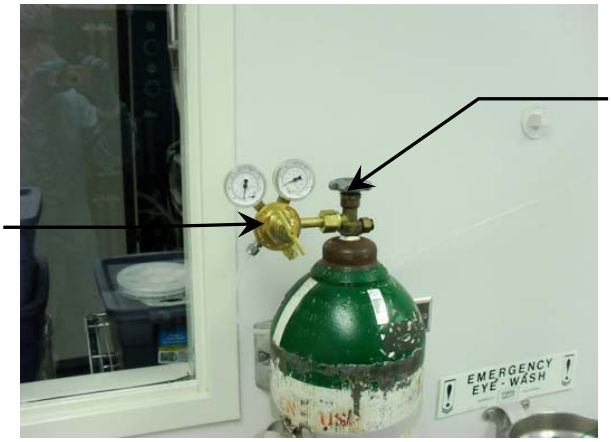


Figure 5, O2 Cylinder

7.4 Unload Wafers and Shut Down Furnace

7.4.1 When the desired oxidation time is reached set the furnace temperature to 400 C and turn the variac off.

7.4.2 Turn the manifold switch to Closed position.

7.4.3 Flip the N2 switch to the on position and set to 8.

7.4.4 Flip the O2 switch to the off position.

7.4.5 Run N2 post oxidation anneal for 10min.

7.4.6 Place the heat resistant gloves on your hands, then remove the furnace end cap and place it on the quartz ware table.

7.4.7 Using the long quartz rod pull the quartz boat to the end of the tube at a rate of 1” every 20 seconds.

7.4.8 Place the trunk on the end of the furnace tube.

7.4.9 Using the short quartz rod pull the quartz boat into the trunk.

7.4.10 Remove the trunk and place it on the quartz ware table.

7.4.11 Allow wafers to cool in quartz boat 5 minutes before removing.

7.4.12 Close the valve on the oxygen gas cylinder.

7.4.13 Turn off the variac power supply.

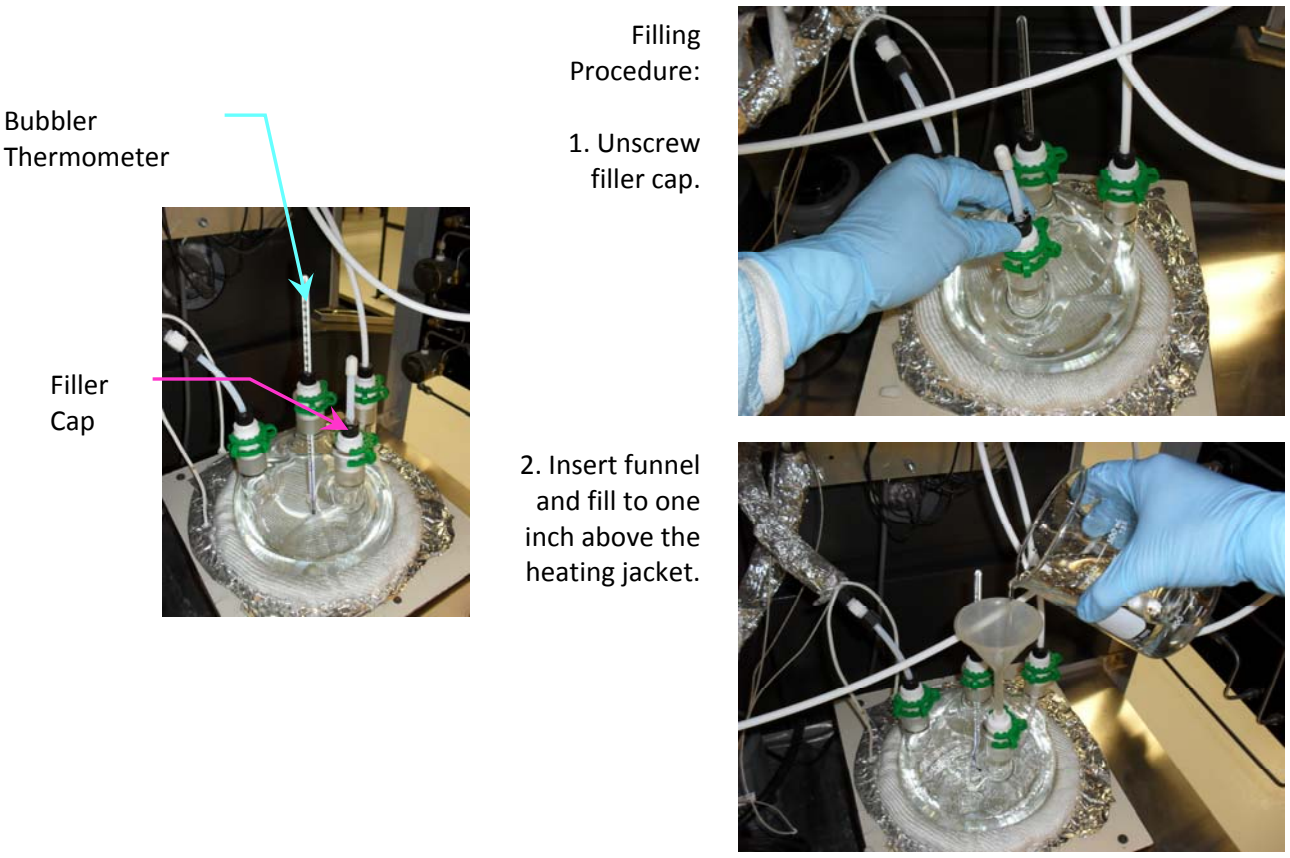


Figure 6, Bubbler and Filling Procedure

8. Dry Oxidation

8.1 Set Furnace Temperature

8.1.1 Using the temperature controllers set the oxidation furnace tube temperature to the desired oxidation temperature. See *Figure 2, Temperature Controllers.*

NOTE: It takes 2-3 hours for the furnace to heat up.

NOTE: The oxidation furnace is the bottom right hand tube.

8.1.2 Fill in data into the process logbook.

8.1.3 Wait for the furnace to stabilize at the desired temperature.

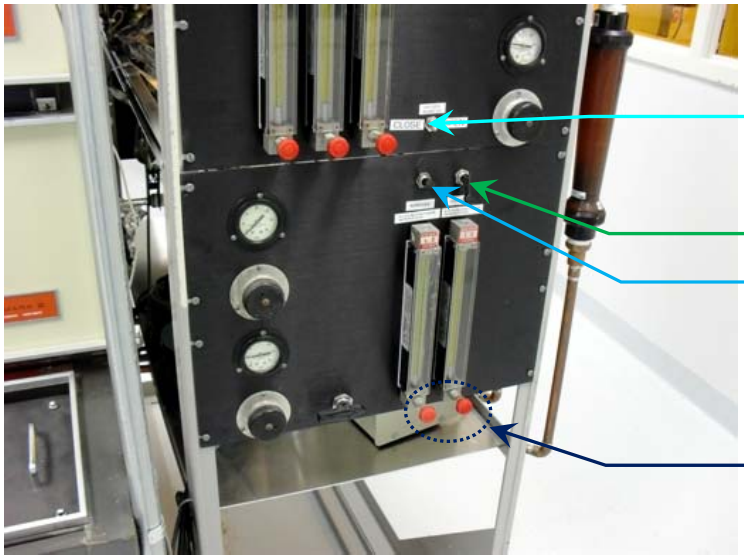


Figure 7, Gas Flow Control Panel

8.2 Load Wafers

8.2.1 Put on clean gloves.

8.2.2 This furnace can only be used for clean, dry silicon wafers. DO NOT put in wafers that have photoresist, metals, or any other contaminants on the surface.

8.2.3 Make sure N2 is flowing into the tube.

8.2.4 Use tweezers to place your clean dry wafers in the quartz boat located on the quartz ware table. See *Figure 4, Quartzware*.

8.2.5 Using the short quartz rod pull the quartz boat into the trunk (quartz tube with the handle on it). See *Figure 4*.

8.2.6 Place the heat resistant glove on your hands, then remove the furnace end cap and place it on the quartz ware table.

8.2.7 Place the trunk on the end of the furnace tube.

8.2.8 Using the short quartz rod slowly push the quartz boat into the end of the furnace tube.

8.2.9 Remove the trunk and place it on the quartz ware table.

8.2.10 Use the long quartz rod located at the side of the furnace tube to push the quartz boat into the center of the furnace at a rate of 1 inch every 20 seconds.

8.2.11 Let the wafers sit in the furnace for 10 min.

8.3 Start Oxidation

8.3.1 Open the valve on the O2 cylinder. Set flow to 20 psi. See *Figure 5, O2 Cylinder*.

8.3.2 Make sure the O2 cylinder has enough oxygen tank pressure left for your run (approximately 50 psi/hour).

8.3.3 Flip the O2 switch to the on position and adjust the flow to 3. See *Figure 7, Gas Flow Control Panel*.

8.3.4 Flip the N2 switch to the off position. See *Figure 7*.

8.3.5 Record the oxidation start time.

8.4 Unload Wafers and Shut Down Furnace

8.4.1 When the desired oxidation time is reached set the furnace temperature to 400 C and turn off the variac.

8.4.2 Flip the N2 switch to the on position and set to 8.

8.4.3 Flip the O2 switch to the off position.

8.4.4 Run N2 post oxidation anneal for 10 min.

8.4.5 Place the heat resistant glove on your hands, then remove the furnace end cap and place it on the quartz ware table.

8.4.6 Using the long quartz rod pull the quartz boat to the end of the tube at a rate of 1” every 20 second.

8.4.7 Place the trunk on the end of the furnace tube.

8.4.8 Using the short quartz rod, pull the quartz boat into the trunk.

8.4.9 Remove the trunk and place it on the quartz ware table.

8.4.10 Close the valve on the oxygen gas cylinder.

8.4.11 Allow wafers to cool in quartz boat 5 minutes before removing.

8.5 Warnings

WARNING
Furnace is extremely hot. Always use heat resistant gloves.

9. Revision History

Rev	Date	Originator	Description of Changes
1	11 Feb 2010	Sam Bell	