



Modulab – Oxidation Furnace (Wet)

Safety

- The furnace gets extremely hot and remains hot to the touch hours after it has been turned off. Use extreme caution and use appropriate PPE.
- Do not place your hands or other body parts inside furnace.

Allowed Materials and Processes

The Oxidation Furnace (Wet) can be used to create a layer of oxide on your substrate.

You can use silicon or glass wafers.

Restricted Materials and Processes

Do not place sources from other furnaces in the Oxidation Furnace.

Important Equipment Notes

- Be extremely careful when handling quartz source tray and quartz rod
- Wafers may be loaded and unloaded at higher temperature (greater than 400 C) but must be done slowly to not thermal shock the wafers or the sources.
- Once unloaded, the wafers should be placed on one of the metal tables to completely cool (usually around a minute) before stored in the plastic case.
 - Clean a spot on one of the metal tables with a clean wipe and isopropyl alcohol before cooling wafers on it.
- Oxygen may also be used during some diffusion runs. If oxygen is needed, turn on the oxygen tank in the back of the clean room and turn on the oxygen valve connect on the right of the furnace. The oxygen gas flow should be set to 9 and left on for the desired time and temperature during the specific diffusion.
- Heating up and cooling down times:
 - To heat up to 400 C, the furnace takes around 10 minutes.
 - To heat up to 1000 C, it takes about 30 minutes.
 - To cool down from 1000 C to 400 C, it takes about 1.5 hours.

Operating Procedures

1. Check reservations and make one
2. Check tool status and configuration
 - a. Visit: <http://www.mmf.montana.edu/equipment-status.html>
3. Check lab status
 - a. Check that the N2 bottle pressure is above 400 PSI.
 - b. Check that N2 is on for lab.
 - c. If your process needs oxygen or argon, check the O2 or Ar bottle pressures as well.
4. Log into SUMS
5. Equipment checks
6. Plug in furnace and turn on.



- a. To turn on the furnace, hold the circular power button while switching the main power switch to the on position.
- b. Continue holding the reset button until the temperature readings appear on the display.
7. Record experiment parameters in the logbook located in the bin on the wall next to the furnaces.
8. Remove beaker from hot plate located at the right-hand side of the oxidation furnace and pull out the black stop.
 - a. Be extremely careful when removing beaker from hot plate as there are fragile tubes/quartz pieces surrounding the beaker.
9. Fill beaker with de-ionized water
 - a. Fill to halfway through the white oval on the beaker for a 90-minute oxidation.
 - b. Fill to slightly over the white oval on the beaker for a longer oxidation.
10. Replace the beaker on the hot plate, ensuring that the black stop is firmly secured and that the feeder tube is placed in the fitting connected to the oxidation furnace.
 - a. The feeder tube fitting will be loose, but make sure that the tube is inside of the socket.
 - b. The water bubbler tube can easily contact the beaker heater if you aren't careful. This is a potential source of contamination.
11. Turn on the hot plate and set the temperature knob to 60.
12. Once the water is boiling, decrease the temperature on the hot plate to 50.
13. Clean quartz rod and metal tray with isopropyl alcohol and clean wipe.
 - a. Use the rod and metal tray that are marked with no tape
14. Unload quartz source tray from furnace.
 - a. Place metal tray at the entrance of the furnace, making sure the furnace tube and the metal tray are lined up and flat.
 - b. Slowly push quartz rod into furnace, making sure to keep the end of the rod as low as possible.
 - c. Hook the end of the rod through the loop on the quartz source tray.
 - d. Slowly pull rod and quartz source tray towards entrance of furnace.
 - e. When you reach the end of the furnace tube and the start of the metal tray, slightly lift the metal tray on the side closest to you.
 - f. Continue to pull the quartz source tray until most of the quartz source tray is on the metal tray.
 - g. Lower the metal tray back down to its original resting position.
 - h. Pull the quartz source tray all the way out of the furnace tube and fully onto the metal tray.
15. Load desired number of wafers into quartz tray between the two extra wafers.
 - a. In other words, make sure that one spare is always in the front of the wafer tray and the second spare is directly behind the last user after loaded in tray.
16. Reload quartz source tray into the middle of the furnace.
 - a. Place loaded quartz source tray on metal tray.
 - b. Hook the end of quartz rod into loop of quartz source tray.
 - c. Gently push metal tray into the middle of the furnace.
 - i. You can check if the metal tray is in the middle of the furnace by marking the spot on the quartz rod that is at the entrance of the furnace. Remove the rod from the furnace and line up the marked spot with the entrance of the furnace on the outside. Where the end of the rod is located is where the start of the quartz source tray is.
17. Set desired temperature on the master control (center panel)
 - a. The other two zones will be automatically set by the master control



18. When the temperature of the furnace exceeds 400C, turn on the nitrogen gas and set the flow to 7
 - a. This valve is located at the right-hand side of the furnace
19. When the temperature of all three zones reaches the desired temperature, turn off the nitrogen and turn on the oxygen and set the flow of the oxygen to 9.
 - a. This valve is located at the right-hand side of the furnace next to the nitrogen valve.
20. Run the oxidation for the desired amount of time.
21. When the desired time has passed, turn off the oxygen and turn the nitrogen back on at a flow of 7.
22. Set the temperature on the master control of the furnace to 0 C.
23. Turn off hot plate.
24. Allow the temperature of the furnace to decrease below 400 C.
25. Turn off the Nitrogen gas flow valve.
26. Clean the metal tray and quartz rod with isopropyl alcohol.
 - a. Use the rod and metal tray that are NOT marked with tape.
27. Unload quartz source tray from the furnace.
 - a. Place metal tray at the entrance of the furnace, making sure the furnace tube and the metal tray are lined up and flat.
 - b. Slowly push quartz rod into furnace, making sure to keep the end of the rod as low as possible.
 - c. Hook the end of the rod through the loop on the quartz source tray.
 - d. Slowly pull rod and quartz source tray towards entrance of furnace.
 - e. When you reach the end of the furnace tube and the start of the metal tray, slightly lift the metal tray on the side closest to you.
 - f. Continue to pull the quartz source tray until most of the quartz source tray is on the metal tray.
 - g. Lower the metal tray back down to its original resting position.
 - h. Pull the quartz source tray all the way out of the furnace tube and fully onto the metal tray.
28. Remove wafers from quartz source tray.
29. Reload source tray into the furnace once wafers are removed.
30. Turn off furnace.
31. If no one else is in the lab, turn off house nitrogen switch located in between gowning room and lab entrance.

Troubleshooting

- Furnace is plugged in but will not turn on.
 - Check that someone is logged into SUMS
 - If no one is logged into SUMS contact MMF Staff

Version History

- 2020.1 – Original document written by Geneva Feist, Andrew Lingley, and Andrew Oliver.