

Six-stack Thermco Furnace



University of Notre Dame

Department of Electrical Engineering

General Precautions

Contacts

For problems, clarifications of procedures, or general information pertaining to this machine, please contact lab staff at staff-ndnf-list@nd.edu

FURNACE OPERATION

Furnace rules: Immediately before any wafers go into a furnace, they must be given an RCA clean! No metal goes in any tube (other than #3) EVER! No photoresist or other organics in any furnace. Open a furnace tube only when a “High N₂” step is running in the gas program. Return boat to the proper furnace when finished! Do not mix quartzware between tubes. **Do not touch any quartzware with your bare hands! If you do, it must be cleaned with HF, and everybody hates HF!**

Lab equipment and materials: Full battle gear is required for the RCA cleaning step and HF etch step. Use High Temperature Gloves for handling the hot quartz furnace tube cap.

Safety: The furnaces are hot and require care to avoid burns. The quartz boat retains heat for a long time. Be careful! Wafers are transferred to the oxidation boat and the transport end cap (called a Pig) which will be attached to the tube. Always assume these items are hot.

Advice: Furnace processes are generally run just after an RCA clean. When you come into the lab start the furnace and RCA baths. By the time you’ve finished the RCA clean, the furnace will be at temperature, ready for your wafers. Check the posted furnace profile for the location of the “flat zone.” When inserting your wafers, be sure that the boat lands in the middle of flat zone. The part of the push rod inserted into the furnace will be very hot, while the end that remains out of the furnace will remain cool to the touch. Be mindful of others as you pull out the hot pushrod.

SIMPLIFIED PROCEDURE

1. Enable the proper tube in iLab.
2. Load your recipe (click “Tube Recipe,” then “Load Recipe.” Select your recipe, and click “Close Programmer.”)
3. Press “Load Tube” to begin heating the tube and flowing high N₂. High N₂ must be flowing whenever the endcap is removed from the tube.
4. Transfer the wafers from the cassette (after the RCA clean) to the oxidation boat.
5. Transfer the boat containing the wafers into the appropriate furnace.
6. Click “Start Program.”
7. When complete, transfer the boat containing the wafers from the furnace back into the Pig. (High N₂ should be running)
8. Let wafers cool at furnace station (20 min or more).
9. Transport the Pig containing wafers to the MOS Cleaning station.
10. Transfer wafers from the boat to the cassette after the wafers have cooled.
11. Place boat back in the mouth of the tube. Be sure high N₂ is running!
12. Click “Abort Tube” to return tube to standby.
13. Disable the furnace in iLab.

DETAILED PROCEDURE:

1. Enable the proper furnace in iLab.
2. Activate the furnace control computer (wake it up from sleep). Log into the “Student” account. There is no password.
3. The main control panel is displayed on the screen. Click the “Tube X Recipe” button for the tube you plan to use.

4. The recipe programmer will appear. Click the “Load Recipe” button on the top-left of the panel. Select your recipe from the list that appears.
5. Press the “Close Programmer” button.
6. Click the “Load Tube” button for your selected tube. This will activate high N₂, and will raise the temperature to 750 °C. The “Load Tube” button will disappear and be replaced with a “Start Program” button. Perform the RCA wafer clean. If you do not complete within 2 hours, the furnace will return to idle. In this event, repeat this step.
7. If you are using TransLC (tube 1 only), check to be sure that there is not a low level alarm. If there is, report this in iLab.
8. Remove the end cap from the furnace tube, and place the Pig on the mouth of the furnace tube. Pull the oxidation boat from the mouth of furnace into the Pig. Carefully remove the Pig from the furnace tube and replace the end cap. **DO NOT PLACE THE END CAP TIGHTLY ONTO THE FURNACE! YOU SHOULD BE ABLE TO WIGGLE IT A FEW MILLIMETERS.** As the furnace tube heats up it will expand and the cap can get stuck. If it will be more than 2 hours before the wafers are ready to load, stop the loading sequence by clicking on the “Abort Tube” button (you started it so that high N₂ would flow when the tube was open).
9. When the RCA clean of the wafers is done, carry the Pig to the cleaning bench and transfer your clean and dry wafers to the boat with the front side of the wafers away from the pushrod loop. Put the wafers as far from the pushrod loop as possible, leaving a couple of open slots between wafers, if possible. Put the boat back in the Pig with the front side of the wafers facing the open end of the Pig.
10. Carry the wafers to the furnace. Remove the end cap from the furnace, and put the Pig on the mouth of the furnace tube ensuring that the Pig is stable. Leave the wafers in the Pig for 2 min. so that the ambient atmosphere is replaced by the furnace tube atmosphere.
11. Push the boat into the mouth of the furnace. Be careful, as it can be a little tricky to get the boat over the lip of the furnace mouth. Slowly push the boat to the center of the tube. Take about 3-5 min. to traverse from the mouth of the furnace to the “flat zone” of the tube. Refer to the furnace profile to determine the location of the flat zone, and use the provided meter stick to measure the position of the boat in the tube.
12. Take the Pig off the tube and recap the furnace tube. Put the Pig back on the furnace station.
13. Click the “Start Program” button for your tube.
14. Following completion of the program, the furnace temperature will be set to 400 °C and high nitrogen will be activated. Remove the end cap and place the Pig on the furnace mouth. (Remember to check that high N₂ is flowing when you take off the furnace end cap. If the program has finished and N₂ has dropped to 0.5 SLM, press the “High Nitrogen” button to reactivate the flow). Pull the boat out of the center of the furnace taking about 5 min to traverse from the hot zone to the mouth of the furnace. Leave the boat at the mouth for 2 min. Then leave it in the Pig for 2 min.
15. Remove the pig and place it on the furnace station (metal shelf at furnace). Recap the tube.
16. Let the Pig and wafers cool for ~20 minutes before moving the Pig to the MOS cleaning hood. Remove the wafers from the boat.
17. With N₂ flowing (click “High Nitrogen” if needed), return the boat to the tube mouth
18. Click “Abort Tube” to reset the tube to standby. Disable the furnace in iLab.