

MiniBrute Furnace

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Location: Fab

Primary Trainer: Les Schowalter (587-879-1516, les.schowalter@ualberta.ca)

Secondary Trainer: Stephanie Bozic (587-879-1515, sbozic@ualberta.ca)

OVERVIEW

The MiniBrute furnaces are used to grow thermal oxides (SiO_2) on silicon substrates and for annealing of nonmetal samples.

SAFETY PRECAUTIONS

The MiniBrute furnaces operate at HIGH TEMPERATURES. Be sure to wait until the furnace is cool before opening the tubes. Asbestos gloves are available for handling of hot substrates. There is an electrical hazard while doing thermal oxide growth with water being used around the controls. Be careful and use the funnel to properly transfer the water.

If you are bringing any new materials into the NanoFab for use in your process, it is necessary to fill out a chemical import form (available on our website, <http://www.nanofab.ualberta.ca>) and supply an MSDS data sheet to Stephanie Bozic.

OPERATING INSTRUCTIONS

You must log into this tool when setting up and while furnace is on. You may log out once the furnace is turned off.

Wet Thermal Oxide Growth (SiO₂):

1. Load Piranha cleaned wafers into quartz boat(s). Boats are located on top of wheeled carriers on the sliding metal racks in front of the furnaces.
2. Remove exterior metal door by lifting straight up and then pulling forward. Do this carefully so as to not bump and possibly break any of the expensive quartz material. The metal door can then be set on the bottom shelf of the racks in front of the furnaces.
3. Carefully remove the quartz cap of the tube. Carefully set the cap on the bottom shelf of the racks in front of the furnaces.
4. The rack loader can be gently slid up against the opening of the tube.
5. Using the quartz rod stored on top of the furnaces, the boat(s) can be gently pushed into the center of the tube.
6. Slide the rack back from the opening of the furnace.
7. Carefully replace the quartz cap of the tube with the opening facing toward the back vent port. Make sure it is not pushed on tight or there may be difficulty taking it off again.
8. Replace metal door.
9. Consult the log book and Oxidation Growth curves to determine the furnace temperature and length of run needed to obtain the thickness desired. Note: The furnace must be off during nonstaffed hours.
10. At the front of the furnace; toggle the breaker labeled CONTROL to the ON position using the center controller on the front, set the desired temperature using the up and down triangles to change the smaller font numbers (set temperature), the larger font numbers display the actual temperature. Furnace temperature (must not exceed 1100C).
11. Toggle the breaker labeled ELEMENT to the ON position. Set up the CAUTION: HOT! Sign on the sliding rack.
12. Turn on the power to the heating mantle under the round bottom flask. Check that the set temperature is to 94C. Ensure controller isn't left on setup or else heater won't work.
13. At the back control panel, toggle the gas flow from OFF to ON. For middle furnace turn the handle to indicate OXIDATION.
14. Check the nitrogen flow gauge; ensure it is flowing at 40. Adjust using the dial at the bottom of the gauge until proper flow is reached. Check N₂ flow again after a few minutes since it takes a few minutes to settle.
15. Fill plastic beaker with DI water from a wet deck. At the back of the furnaces, remove the nitrogen bubbler from the neck of the round bottom flask.
16. Using the funnel fill DI water level to the top line on the round bottom flask. Return periodically, about every 45 minutes to check to water level and continue to refill so that the water remains at between the two lines.
17. Begin timing once the furnace has reached within 2C of set temperature.
18. Enter your information in the MiniBrute log book.
19. Remember to periodically check the DI water level (suggested once every 45 minutes). The water level must remain above the level of the heating mantel.
20. When the time is finished, at the front of the furnace toggle ELEMENT breaker to the OFF position.
21. At the back of the furnace, turn handle to OFF (on middle tube if used), turn power for the heating mantle OFF and toggle the gas flow OFF.

22. Wafers need to remain in the furnace until it cools <200C. They may remain overnight or weekend as long as they are removed first thing the next staffed work day.

Annealing in middle furnace:

1. Load substrates into quartz boats.
2. At the back of the furnace; toggle Nitrogen flow to ON. Turn handle to ANNEALING.
3. Check Nitrogen flow gauge; adjust Nitrogen flow using the dial underneath the gauge to desired flow.
4. At the front of the furnace, toggle the breaker labeled CONTROL to the ON position. Set up the CAUTION: HOT! sign.
5. Using the center controller on the front, set the furnace temperature (must not exceed 1100C). Use the up and down triangles to change the smaller font numbers (set temperature). The larger front numbers display the actual temperature. Turn the ELEMENT breaker on.
6. If wafers need to be handled while still hot be sure to wear the heavy asbestos gloves. DO NOT set the hot metal door or quartz tube cap on anything flammable.
7. Enter your information in the MiniBrute log book.
8. When finished, at the front of the furnace toggle ELEMENT breaker to the OFF position.
9. At the back of the furnace, turn handle to OFF and toggle the gas flow OFF.

TROUBLESHOOTING

If you encounter an unexpected error or require assistance please contact the primary or secondary trainer listed above. Should they not be available, please contact any staff member for assistance.

APPROVAL

Qualified Trainer: Les Schowalter
Training Coordinator: Stephanie Bozic