Usage Policies Notebook for Thermco Atmospheric Diffusion Furnace system

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Emergency Plan for Diffusion Furnaces

Standard Operating Procedures for Emergencies

Contact information

Person	Phone number
Lab Manager	Jake Hes, 949-824-8239 (day), 562-522-8328 (alternate)
Director	G.P. Li: 949-824-4194 (day), 949-824-2047 (alternate)
Staff	Mo Kebaili: 949-824-8239 (day), 949-494-5892 (alternate)
Super User	Carlos Ruiz (818) 527-6349 (Anytime, voicemail or text only)

Hazardous chemicals, gases, and conditions

Hazard name	Description of hazard
High temperature	Burn or ignition source
High voltage	Electrical shock, ignition source
Hydrogen	Highly flammable
O_2 (oxygen) gas	Highly oxidizer
N_2 (nitrogen) gas	Asphyxiant
Forming gas	Nonflammable gas
(5% H_2 and 95% N_2)	Compressed gas high pressure

Alarms or indications of danger

Alarm type	Condition and response
High temperature and low temperature on gas panel and zone controller	
O_2 flow Alarm	Problem with process state. Halt the process. Correct the problem or notify the staff or the lab manager before continuing.
Pungent or foul smell	Gas leak. Shutdown the tool at once and evacuate the area. Contact the staff and the lab manager.

Emergency shutdown plan #1

In the event of an emergency, when there is very little time, *press the large red emergency shut-off button at the entrance of the room*, this will shutdown the gas system, and stop the gas flow. Leave the facility at once, and then contact the lab manager or the staff.

Emergency shutdown plan #2

In the event of an emergency, when there are a few minutes available, *turn off gas switches on the gas panel, switch off the control power, and the main power*. This will stop gas flow into the system. If there is no fire, and no smell of gases, enter the room and close off all gas cylinders by turning their valves fully clockwise. Check the oxygen tank in room w, feel the door for possible fire, and if safe, close the oxygen tank by turning the valve cylinder fully clockwise. Leave the facility at once, and then contact the staff and the lab manager.

Usage Policies for Thermco Atmospheric Diffusion Furnace

Standard policies for usage

The Atmospheric diffusion furnace, can accept four-inch and six-inch substrates, each furnace tube is setup for a specific process. WET OXIDATION, DRY OXIDATION, LONG ANNEAL, STABILIZATION, SINTERING, BORON DIFFUSION. The furnace tubes are vertical, and the gas flows are controlled by rotameters and mass flow controllers. The temperature range is up to 1150°C.

Contact information

The INRF staff or the lab manager can be reached at (949) 824-8239 or (949) 824-9831.

Authorized users

Only INRF registered users who have completed the training and passed the certification can use this equipment. Users may only use the portion of the system for which they have been trained.

Training

Users must have received direct training from the staff in order to use this equipment. Training is different for dry oxide, wet oxide, boron diffusion, and annealing. Users are expected to understand the nature of the system, as well as the proper control and use of the gases. Training varies slightly, depending on the process to be performed. Contact the staff for details and to arrange for a training session.

Usage logs

Users are required to log in all activities in the provided log sheets. All users must log in when they used the furnace (date and time), which gases they used, and when they completed their process in the user log sheets. If users notice anything unusual, they should record it in the user log sheets, and add details in the main comments area on the log sheet. Any maintenance to the tool will be logged in the maintenance log sheet (maintenance staff only).

Safety equipment

There are O_2 flow switches for Oxidation tube, and over and under Temperature detection on all furnaces. As safety equipment for use on this equipment, cleanroom gloves and tweezers should be used when handling pieces in the tube. Care should be taken to avoid burns when working near the furnace tubes.

Standard equipment and materials

The laboratory provides the following gases: O_2, Forming gas, H_2, N_2, and boron Sources. Other gases must be cleared with the lab manager.

User maintenance

Users are requested to use the proper quartz ware for each furnace tube to keep the tubes contaminant free. Keep end caps on tubes when tubes are not in use to keep a positive pressure within the tube.

Waste disposal

Dispose of alcohol soaked wipes in a waste container marked for flammable solid waste.

Scheduling

Reservation can be done on-line, also, the system can be use on a first-come, first serve usage if no reservation was made.

Other issues

Users should remain physically present in the cleanroom facility during the entire usage of the furnace.

Gases should be closed at the gas cylinders when the processes are completed.

At no time should a user adjust a pressure regulator on a gas line. Gas control should be “on” or “off” only, using only the appropriate valves. For most gases, this is usually the valve at the cylinder head.

Non-standard use

Users may not modify any hardware on this equipment. For use of non-standard processes, gases or materials, contact the staff or the lab manager.

Usage Notes for Diffusion Furnace

Guide for using the Thermco Vertical furnace

Gas cylinders

All gas cylinders should be open or closed at the cylinder. At no time should a user adjust a pressure regulator. The clockwise direction for all the valves means CLOSED. The standard off configuration for the system is to close the cylinders, but leave all the valves alone.

Wet oxidation procedure for high temperature diffusion furnace "1150°C"

Follow these steps for deposition of oxide (SiO_2) on silicon substrates. For oxide processes, H_2 and O_2 gases are used.

Verify that the tube is at idle temperature of 600°C and nitrogen is flowing at 3000 sccm. Clear any fault condition before process operation. Record the date, the time and your name in the user log sheets.

Wet oxide process

1. Check that the temperatures of the three zone controllers are at the preset point (zone are named Load, center, and source).
2. Adjust the center zone controller to the process temperature (for standard wet oxide the temperature is 1000°C)
3. Allow the temperature to stabilize before proceeding to the next step.
4. When the temperature has stabilized remove the end cap and place the wafer boat onto the loader. Place the loader at the end of the tube, and push the wafer boat into the tube using the push rode into the center of the tube.
5. Replace the end cap onto the tube, and let the temperature stabilize again before proceeding to the next step.
6. Allow the N_2 gas to flow for a minimum of 5 minutes.
7. Turn off the N_2 gas flow, turn the O_2 gas on, and set the flow rate to 3.9 L/min flow for a minimum of 5 minutes.
8. Turn the H_2 gas on and set the flow rate to 7.2 L/min start timing the process when the H_2 gas flow begins.

Note: When the H_2 gas flow begins you will see a light blue flame at the end of the torch and if you place a glass slide at vent of the end cap you will see steam indicating that the SiO_2 deposition has begun.

9. When the SiO_2 deposition process is completed, turn the H_2 gas off, turn the O_2 gas off, and then turn the N_2 gas on. Set the N_2 gas flow rate to 3.0 L/min (3000 sccm). Close the H2 and the O2 gas cylinders in wXXXX by turning the main valves on the cylinders heads clockwise.
10. Set the center zone temperature controller to 600°C standby temperature.
11. Unload the wafer boat when the actual tube temperature is 600°C.
12. Record the date and the time in the user log sheets. Also note any potential problems during your oxide deposition process.