Usage Policies Notebook for Anicon 125 / 150mm Low Temperature Oxide and Polysilicon System

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INRF UCIrvine

Emergency Plan for Anicon 150 mm

Standard Operating Procedures for Emergencies

Contact information

Person	Phone number
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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
Vacuum	Implosion
High temperature	Burn or ignition source
High voltage	Electrical shock, ignition source
H_2 (hydrogen) gas	Highly flammable gas
SiH_4 (silane) gas	Pyrophoric (explodes on contact with air)
O_2 (oxygen) gas	Oxidizing gas
N_2 (nitrogen) gas	Asphyxiant

Alarms or indications of danger

Alarm type	Condition and response
Alarm on scrubber in utility room W2330	Problem with scrubber. Halt any process which is running. Correct problem or notify the staff or the lab manager before continuing.
Alarm on console	Problem with state of process. Halt process. Correct problem or notify the staff or the lab manager before continuing.
Pungent or foul smell	Gas leak. Shutdown tool at once and evacuate 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 front of the tool*. This will shutdown the system, and will stop the gas flow into the system. 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 few minutes available, *press the large red emergency shut-off button at the front of the tool*. This will shutdown the system, and will stop the gas flow into the system. Next, check the gases in the utility room W2331, adjacent to the LPCVD room. If there is no fire or smoke and no smell of gases, enter the room and close off all the gas cylinders by turning them fully clockwise. Check the oxygen tank in room W2331, feel the door for possible fire, and if it is safe, close the oxygen tank by turning the valve at the cylinder head fully clockwise. Leave the facility at once, and then contact the staff and the lab manager.

Usage Policies for Anicon LTO 150mm

Standard policies for usage

The Anicon CVD 150mm is used for deposition of low temperature and low pressure silicon dioxide, polysilicon, and amorphous silicon.

Contact information

The INRF staff or the lab manager may be reached at (949) 824-8239 or (562) 522-8328.

Authorized users

Only the INRF staff and the super users who have completed the training and passed certification may 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 oxide and polysilicon. 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 all activity in the log sheets provided. All users must log when they use the Anicon system (name, process, date and time), which gases they used, quantity, and when they completed their process in the user log. If users notice anything unusual, they should note it in the user log, and add details in the main comments area on the log sheet. Any maintenance to the tool will be logged in the maintenance log (maintenance staff only).

Safety equipment

There are excess flow valves for SiH_4, H_2, doping 1 (DP1), and doping 2 (DP2) as safety equipment for use on this equipment, cleanroom gloves and tweezers should be used when handling pieces in the chambers. Care should be taken to avoid burns when working near the Anicon hotplate.

Standard equipment and materials

The laboratory provides the following gases: O_2, SiH_4, H_2, N_2. Other gases must be cleared with the lab manager.

User maintenance

Users are requested to clean the chamber after use by first vacuuming out the chamber then wipe down with the isopropanol, if necessary. (Wait until the unit is cool to do that.) Dispose of the cloth in a waste container marked for flammable solid waste.

Pollution Control

Turn on the scrubber when using the following gases: SiH_4, H_2, O_2. Dispose of alcohol soaked wipes in a waste container marked for flammable solid waste. On completion of the process, the evacuation of the gas lines will be performed by the staff.

Scheduling

Reservations can be done on-line, also the system can be used on a first-come, first serve basis if no reservation was made.

Other issues

Users should remain physically present in the cleanroom facility during the entire use of the Anicon system. This includes the time when the system pumps down the chamber, and when the hotplate is warming up.

The vacuum chamber should be left in "low vacuum" mode (typically about 30 mTorr) when it is not in use. All processes involving corrosive flammable and poisonous gases should include several purge steps before completion. All the gases should be turned off at the cylinders when the process is finished.

Users should not modify any standard recipe in the software. New recipes can be created, but once created, they should stay unedited. A modified recipe should be given a new name. This allows the staff to track down the history of a problem later, if that is necessary.

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

Non-standard use

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

Usage Notes for Anicon 125 / 150 mm

Guide for using the Anicon correctly

Gas cylinders

All gas cylinders should be turned on or off at the cylinder head. At no time should a user adjust a pressure regulator. Clockwise for all valves, means CLOSED. The standard off configuration for the system is to close the cylinders and delivery valve, but leave all other valves alone.

CVD procedure for Low Temp oxide and Polysilicon deposition

Follow these steps for deposition of oxide (SiOx) or polysilicon on a silicon substrate. For oxide processes, SiH_4 and O_2 are used; for polysilicon, SiH_4 and H_2 are used.

Verify that the vacuum pumps are running, that the chilled water, the compressed air and Nitrogen are on.
Turn on the computer monitor; if it is not already on, logon and enter the password. Clear any fault condition before starting the process. Record the date, the time and your name in the user log sheets. Make sure that the scrubber system is on and ready.

A. UNLOAD BOATS

1. If the hoist is down, Check the chamber pressure, it must be <50 mTorr on the indicator.

   a – If the pressure is > 50 mTorr, open the SOFT START type (O) and press Enter to open the valve.

   b - If the pressure is < 50 mTorr , close the SOFT START, type (C) and then press Enter. Open the ISO valve type (O) and then press Enter. Pump to the base pressure P1 = 38 mTorr.

   c - Close the ISO valve by typing (C) and pressing Enter.

   d - Open the N_2 Backfill valve by typing (O) and pressing Enter, this will raise the chamber pressure to atmospheric pressure.

   e - Raise the Hoist, by typing (U) and pressing Enter to raise the hoist.

   f - Close the Backfill valve, by typing (C) and pressing Enter after the hoist begins to rise.

2. If the loader robotic arm is in the SAFE (retracted) Position, type (U) and press Enter for unload. If the wafer boats are in the chamber, they will be unloaded.
3. Set the desired process temperature, using the computer keyboard type in 420°C (standard LTO process temperature) Check the chamber temperature on the temperature control panel display. Type (D) and press Enter to lower the hoist.

Note: the following twenty steps set up the system to flow O_2 during temperature stabilization. This will remove moisture and contaminants that might be in the chamber.

B. GAS LINES EVACUATION

4. Open the SOFT START, type (O) and then press Enter to open the valve.
5. When the pressure is < 50 mTorr, close the SOFT START, type (C) and press Enter, open the ISO valve, type (O) and press Enter.
6. With all the gas valves still closed at the cylinder, and the chamber temperature at 420°C. Adjust the reactive gas flow controller to fully open, hold down Ctrl and using the + key increase to 250 SCCM. This evacuates the gas lines and flow controllers up to the shut-off valves at the cylinders.
7. Pump the chamber to the base pressure of 38 mTorr.
8. Set the pressure controller to 100 mTorr by holding down the Ctrl key and using the + key to increase the desired pressure value.
9. Close all the gas flow controllers to fully close. Hold down the Ctrl key and using the – key to decrease the pressure value to 0 SCCM.

C. LOAD BOATS

10. Close the ISO valve by typing (C) and pressing enter.
11. Open the N_2 backfill by typing (O) and pressing enter, this will raise the chamber pressure to atmosphere.
12. Raise the hoist by typing (U) and pressing Enter, the hoist will be raised.
13. Close the N_2 backfill by typing (C) and pressing Enter.
14. The robotic arm boat loader is in the safe position, type (H) for the robotic arm loader to go to the home position then press enter, and now you can load the boats.
15. Load the wafer boats onto the robotic arm forks. The boats are marked with F for front. Make sure that the F is facing you. The wafer flats are pointing down. The cap of the boat is keyed.
16. Type (L) and press Enter to place the boats in the chamber and return the robotic arm to the safe position.
17. Lower the chamber by typing (D) and pressing Enter, to lower the hoist (DN).
18. Open the soft start by typing (O) and pressing Enter, to open valve.
19. When the chamber pressure is <50 mTorr close the soft start by typing (C) and pressing Enter, then open the ISO valve by typing (O) and pressing Entern to open the valve.
20. Pump the chamber to the base pressure of 38 mTorr.

D. LEAK RATE TEST

21. With the main valves off, adjust SiH_4, DP1 and DP2 gas flow controllers to fully open. (This purges the gas lines and flow controllers up to the shut-off valves.)
22. Close the O_2 gas main valve and adjust the O_2 gas flow controller to fully open, by holding down the Ctrl key, and using the + key to increase the flow.
23. Close the ballast by typing (C) and pressing Enter, to close the valve.
24. When the base pressure has reached 38 mTorr, close the ISO valve by typing (C) and pressing Enter, the valve will close.
25. Check the chamber pressure at one-minute interval for four minutes, the leak rate should be less than 15 mTorr / min.
26. Adjust the O_2, the SiH_4, the DP1, and the DP2 gas flow controllers to zero by holding down the Ctrl key, and using + and – keys to increase or decrease the flows.
27. Open the ISO by typing (O) and pressing Enter.
28. Open the ballast by typing (O) and pressing Enter.
29. Open the O_2 gas by typing (O) and pressing Enter, than adjust the gas flow by holding down the Ctrl key, and using the + key to set the flow to 250 SCCM, (standard LTO process).

E. PREPARATION FOR DEPOSITION

24. All the gas flow controllers are fully closed.
25. Open the ballast by typing (O) and pressing Enter, (the flow rate is factory set).
26. The O_2 gas flow controller is at zero, open the valve to adjust the O_2 gas flow by holding down the Ctrl key and using the + key to increase the flow to 250 SCCM.
27. Set the process pressure by holding down the Ctrl key and using the + key to increase the process pressure to 100 mTorr (standard LTO process). Check the pressure until it stabilizes at the set point. Allow the temperature to stabilize before proceeding to the next step.
28. All the gas lines are now open to the tool from the gas cylinders. Slowly charge the system.

F. DEPOSITION PHASE

29. Allow the O_2 gas to flow for a minimum of two minutes.
30. Open the SiH_4 gas by typing (O) and pressing Enter. Set the desired flow by holding down the Ctrl key and using the + or – keys to control the gas flow (standard process flow rate: 250 SCCM).
31. Start timing the deposition process when the silane gas flow begins.
32. Monitor the chamber pressure and the flow rates during deposition.

G. END DEPOSITION & REMOVE BOATS

33. When the deposition phase is completed, switch off the SiH_4 gas by closing the valve, type (C) and press Enter. Ramp the SiH_4 flow controller down to 0 by using the Ctrl key and the - key. Leave the O_2 gas flow on for two minutes to react any residual SiH_4 gas in the chamber. Switch the O_2 gas off by Typing (C) and pressing Enter. Ramp the O_2 gas flow controller down to 0 by using the Ctrl key and the - key, let the system pump the chamber down to 38 mTorr for three minutes.
34. Close the ballast valve by typing (C) and pressing Enter, to close the valve.
35. Pump the chamber to the base pressure of 38 mTorr.
36. Close the ISO valve by typing (C) and pressing Enter.
37. Open the N_2 backfill by typing (O) and pressing Enter, to raise the chamber pressure to atmosphere.
38. To get the hoist up type (U) and press Enter.
39. Close the N_2 backfill after the hoist begins to rise, by typing (C) and pressing Enter.
40. Remove the wafer boats from the chamber (unload the chamber by typing U and pressing Enter).
41. Remove the boats from the loader robotic arm then return the loader to the safe position by typing (S) and pressing Enter.

E. **STANDBY MODE**

42. Lower the hoist without wafer boats inside the chamber by typing (L) and pressing Enter.
43. The auto loader fork is in the “SAFE” Position, if not, type (S) and press Enter.
44. Open the SOFT START valve by typing (O) and pressing Enter.
45. When the pressure is < 50 mTorr, close the SOFT START valve by typing (C) and pressing Enter. Open the ISO valve by typing (O) and pressing Enter.
46. Pump down the chamber to a base pressure of 38 mTorr.
47. Evacuate the gas lines back to the cylinders SiH_4 or reactive gases, and pump the line down to 30” of Vacuum.
48. Before lowering the chamber process temperature, all reactive gas lines must have been evacuated. Lower the temperature to 20°C, by using the keyboard to decrease the set point, by holding down the Ctrl key and pressing the– key. Check the chamber temperature from time to time to make sure that temperature is decreasing.
49. Close the ISO valve by typing (C) and pressing Enter, to close the valve.
50. Log off, and shut down the PC.