



IIT Bombay Nanofabrication Facility

Tool Name: ALD (Atomic Layer Deposition)

Standard Operating Procedure (SOP)

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Tool's Overview

Checklist (Before starting the tool)

1. Facilities check before starting the system. Facility team would set pressures.
2. Argon (25 psi) gas must be always ON
3. If you are using Ammonia cylinder pressure should be 3~5 psi
4. If you are using Oxygen/ Nitrogen cylinder pressure should be 30 psi

System Start UP

1. Switch "ON" MCB behind the system. 3 Phase MCB is for pump and 1 Phase MCB is for equipment.
2. Switch ON the rotary pump. On display panel press Control- press pump and enter.
3. GN2 for solenoid operations should be at 80 psi
4. Ensure EMO is released
5. Press reset button. Button should glow.
6. MCB on tool must be started CB1 is for Main supply, CB2 is for E Box, CB4 is for RF generator, PC, matching unit etc.
7. Start the PC.
8. Turn E Box ON using the switch provided at E Box
9. Start software. System will initialize.
10. Ensure door for chamber is closed.

11. In software press 'Pump' to pump down the chamber.
12. Start heater (Click on Heater). Check the set temperatures at various heaters for chamber and precursors. Heater number 12,13,14,15, Precursor delivery line and ALD valves must be at 150 degrees Celsius at standby mode.

Process run (thermal and plasma)

13. Set the temperature of precursors (Check Note. For precursor temperatures). Once the desired temperature is achieved wait for 30 mins. This ensures that cylinder has attended required temperature.
14. Run recipe for head space with precursor cylinder closed for that particular precursor. Ensure entire atmosphere between cylinder and valve is removed.
15. In software go to Process tab. Choose any parameter on recipe and right click for loading new recipe.
16. Recipes are saved in C drive in Cambridge Nanotech folder -> Sub folder Recipe-> Maintenance and Process.
17. Select the recipe for head space purge for that particular precursor and run the recipe. You should not get any precursor peaks during this run.
18. Press vent and let pressure reach 840. Press Ok on pop up message after door is opened.
19. Open the door for chamber. Using load arm remove chuck from chamber.
20. Load the sample on chuck and transfer inside the chamber using loading arm.
21. Ensure that chuck is placed at the center and close door.
22. Press Pump button in s/w to pump down system.
23. In software go to Process tab. Choose any parameter on recipe and right click for loading new recipe.
24. Recipes are saved in C drive in Cambridge Nanotech folder -> Sub folder Recipe-> Maintenance and Process.
25. Select the recipe for process.
26. For using QCM we need to add MFC4 Ar switch ON step and set value to 42 sccm. This step should be included before cycle loop starts.
27. Changes in any existing recipe can be done and can be saved with QCM settings. You can also create a new recipe and save it. After setting recipe open the precursor valve.
- 28. If you are doing a Plasma process, open the required gas valve which is placed behind the system.**
29. Open Inficon STM software which is available on desktop.
30. In STMs/w, under Setup tab, select 'Display Thickness' and 'Datalog'
31. In STMs/w go to Operate. We can change film, add new film or select existing film from list as per our film requirement.
32. For starting any new measurement we have to press New run, Zero timer and zero film thickness.
33. Start the process in our Fiji s/w.
34. In STM s/w click on Resume for starting measurement.
35. After process is completed close precursor valve and press Pause in STM s/w.
36. Press Vent in software. Once pressure is 840 open the chamber door and unload chuck using loading arm and remove sample.
37. After removing sample put back chuck and close door.
38. Press Pump in S/W and pump down chamber. Run Head space recipe for that particular precursor.

Evacuation of Ammonia gas after process

1. If ammonia gas is used for any process then line should be evacuated before leaving the system.
2. Close ammonia valve behind the system. In S/w give set value as 143sccm and click on manually start flow for MFC 4.
3. Wait until present value becomes 0

Shut down procedure

1. Press Heater OFF button in s/w
2. Press Stop Program-> Yes
3. Close the program
4. Turn OFF EBox
5. Turn OFF MCB from the system panel sequentially as CB4, CB2, CB1.
6. Turn OFF pump on the pump controller. Press O -> Enter.
7. Switch off MCB on wall (3 phase for pump and 1 phase for equipment)
8. Close all facilities gases and chiller water

Note:

1. Precursor temperature (degrees)
 - a. Aluminium- RT
 - b. Hafnium- 75
 - c. Titanium – 75
 - d. Zirconium- 75
 - e. Diethyl zinc- RT
 - f. Silane- RT
 - g. Molybdenum (with booster) - 60
 - h. DEA-
 - i. Nickel - 120