

ICPRIE Operation Manual

Sentech SI-500

Outsid lab:

1. Switching on the system:
 - Compressed air : 5-6 bar
 - N₂ for purging / vent PN₂ : 4 bar
 - Helium for Electrode back side cooling : 1.5-2.3 bar(**Preferably 1.5**)
 - Process gases(Ar,O₂,Cl₂,BCl₃ and SF₆) : 2 bar
 - N₂ purging in exhaust line : 1-2 bar
2. Switch on the cooling water for the Turbo and ICP Source (Inlet Valves)
(Flow: 8-10 lit/min, pressure 2-4 bar)
3. Switch on the tool exhaust and the pump exhaust along with scrubber unit(Toxic Gas Treatment)

Inside lab:

4. Regulate the compressed air valve to a pressure of (5-6) bar. Next open the required gas valves (both Swage Lock and VCR). PN₂ and He lines should be always open. (For GaAs Substrate we use Ar, Cl₂ and BCl₃).

5. Switch on the **MCB** on the wall. Switch on the **Main Switch** in the main distribution box and press Run on the **Main Switch** (Switches on the control rack as well as the foreline pumps)
6. Switch on the ICP cooling source. The procedure to be followed is **First Outlet and then Inlet**.
7. Switch on the heat exchanger. Press and Hold the **Start/Stop** switch on the Exchanger for 3 seconds and the release it.
8. Turn on the PC and login to the ICPRIE client software.
9. Turn on the VSK valve to create vacuum and do **Homepositioning** of the system to initialize all the transfer mechanisms including the gate valves.(If Homepositioning is failing then open and close the valve between the Loadlock chamber and the Reactor and then again try Homepositioning).

Purging of PN₂ from the BCL₃ and CL₂ :

10. Use START-STOP Purge mechanism to release the remaining PN₂ from the line(BCL₃ and CL₂).For purging the following procedure has to be followed:
 - a. Open the valve **VGQ** connected to the main process chamber, then the **VGQ** Outlet of the BCL₃ /CL₂ MFC and the last of the **VGE** inlet of the BCL₃ /CL₂ MFC.
 - b. Start raising the flow rate from 10 sccm to maximum value.(Follow the table)
 - c. Wait till the follow is reduced to zero along with it decrease the flow rate. Then close the valves in opposite sequence (**First close the VGE inlet then VGQ outlet and after that main VGQ valve**).
 - d. The maximum allowable flow rate when PN₂ and Original gas is present is shown below.

Line	PN₂ (sccm)	Original Gas (sccm)
BCL₃	40	75
CL₂	80	100

11. Turn on the BCL₃ /CL₂ line for 5 seconds from the gas cylinder outside the lab. (It is enough to etch 8-9 substrates).
12. Click on **Reactor**→**Fine vacuum** (This switches on the VVV valve automatically) The Fine Vacuum sequence is as follows:

- a. Throttle (DR) closes (initially it remain in control mode)
 - b. VVV opens
 - c. The line is evacuated
 - d. Throttle opens (DR)
13. Click on **Reactor**→**High vacuum**. This starts running the Turbo. Wait till you find the Turbo reaches a final speed of 630 Hz (as visible from the turbo controller panel). During this procedure, the following happens.
- a. At around a turbo speed of 50 Hz, a clear sound indicating that the Turbo blades are running fully and can be heard distinctly.
 - b. Then VSH is automatically opened for PN₂ purging of Turbo.
14. Wait until the Reactor Chamber base pressure reaches at least 1.33E-4 Pascal (typically 10E-6 Torr). A base pressure reaches at least lower than this is most welcome as it ensures a better etch process. Monitor through the data logging.

Sample loading and etching process

15. To load the sample in the load lock chamber we need to follow the steps sequentially:
- a. First open the valve VBSK connected to the loadlock.
 - b. Typically the loadlock pressure should reach that of atmosphere (101325 Pa or 760 Torr). Check whether the loadlock lift handle has become loose before opening it. Close the VBSK valve.
 - c. Next load the sample in the center of the GaAs Dummy wafer inside the loadlock and close the lid.
 - d. Open the VSK valve (loadlock evacuation).
16. After this write your own recipe file and run it. This will include everything starting from sample insertion to retraction from loadlock. After this our aim is to unload the samples from loadlock.
17. For this a safety procedure is followed if the gases used in the etch process are BCL₃ or CL₂. Do a **Start-Stop Purge** mechanism by alternatively venting and evacuating the loadlock to remove completely the corrosive gases from there and it has to be performed at least 3 times(**Open VBSK**→ **Close VBSK**→ **Open VSK**→ **Close VSK** repeat **cyclically**).

18. Unload the sample and close the lid. Evacuate the loadlock and keep it under vacuum till next run.
19. Typically purging process has to be followed for the process chamber if CL_2 or BCL_3 is used.

Purging of the Reactor chamber:

20. Use START-STOP Purge mechanism to release the remaining gases from the line (BCL_3 and CL_2). For purging the following procedure has to be followed:
 - a. Open the valve **VGQ** connected to the main process chamber, then the **VGQ** Outlet of the BCL_3 / CL_2 MFC and the last of the **VGE** inlet of the BCL_3 / CL_2 MFC.
 - b. Start raising the flow rate from 10 sccm to maximum value. (Follow the table).
 - c. Wait till the flow is reduced to zero along with it decrease the flow rate. Then close the valves in opposite sequence (**First close the VGE inlet then VGQ outlet and after that main VGQ valve**).
 - d. Then close all valves.
 - e. Only then open PN_2 from the T-purge assembly regulator and follow the Start-Stop cycle purge mechanism (follow a-d steps).
 - f. Always the last step is to open the PN_2 and keep it in the line.

Closing the system

1. Switch off the RF generator for the substrate electrode (back side of the control rack).
2. Switch off the ICP source (front of the control panel).
3. Close the throttle of the reactor chamber.
4. Stopping Turbo:
 - a. Stop VSH and then PTM. (**After closing VSH count till 10 and then close PTM**)
 - b. Wait for slowing down of the Turbo pump. When the Turbo speed falls below 50 Hz, close VVV and then switch off the Turbo from the control rack.
5. Switch off the ICP cooling (**Inlet followed by Outlet**).
6. Switch off the Heat Exchanger.
7. Logout from the ICPRIE client software and Turn off the PC.
8. Turn off the Main Switch behind the ICP control rack to power of the foreline pump and the Control rack.
9. Switch off the MCB mounted on the wall.

10. Switch off the cooling water for the Turbo and ICP Source (**Inlet Valves 1,6 and 9
Outside the lab**)