UiB NanoStructures Laboratory

Standard Operating Procedure

Plasmatherm 790+ Reactive-ion etcher

Purpose of the instrument:

The Plasmatherm 790+ reactive-ion etcher is used to selectively and an-isotropicly etch organic, metal, semi-conductor, or oxide thin-films. The main purpose is to transfer patterns in resist layers to other thin film layers without under-etching the mask layer.

Location of the instrument:

Allégaten 55, cleanroom in room 286 (entrance via 276, E-Beam lithography Lab)

Primary Staff Contacts:

Sabrina Eder (Mob: 94 20 4733, E-mail: sabrina.eder@uib.no)

Martin Greve (Mob: 900 79 974, E-mail: martin.greve@uib.no)

Instrument booking:

Via the corresponding google calendar.

Instrument access:

The instrument can be booked by approved users after an introduction and basic training by UiB personnel.

For training requests please contact primary staff.

Service Contacts:

Steve Brown, Plasmatherm Europe Ltd (Ireland),

(Tel: +353-1-8216792, Mob.: +353-87-2698039,

E-mail: steve@plasmathermeurope.com)

Tech support: Email: techsupport@plasmatherm.com

Available etch gases:

CF4, CHF3, Argon, Helium, and Oxygen.

WARNINGS

The process gases themselves are not toxic, but the process products contain the very toxic substance HF, so be aware of this when the system is malfunctioning and that your sample may become toxic in the process. Other dangers include the UV emission from the viewport, squeezing your fingers with the chamber lid, hot surfaces and electric high-tension. Study the manual in detail.

The UiB NanoStructures Lab is operated for the benefit of all researchers. YOU MUST HAVE RECEIVED PERSONAL TRAINING ON THE INSTRUMENT TO BE PERMITTED TO OPERATE IT! IF YOU HAVE BEEN TRAINED AND ARE STILL UNCERTAIN AS TO HOW TO OPERATE THE INSTRUMENT CONTACT ONE OF THE STAFF MEMBERS. If you encounter any problems with this piece of equipment, please contact the staff member listed above immediately. There is never a penalty for asking questions. If the equipment is not behaving exactly the way it should, contact a staff member. This SOP only serves as a quick reference. For further details consult the manual and/or service engineers.

Maintenance Procedures

Turn off Plasmatherm

1. Make sure the process chamber is pumped down, and the system is in stand-by mode.
2. Set system status to 'On' by clicking on the 'On' button at the bottom left of the System Monitor software.
3. In the utilities menu select 'turbo pump off'.
4. Wait until the turbo pump has spun down. The message does not always appear - you can check at the back of the tool if the turbo pump controller shows 'Levitation', indicating that it has successfully stopped. If you press on the 'On' button again at the bottom left of the software it will say 'turbo off complete'
5. Shutdown the system-monitor software by selecting 'Exit' in the utilities menu.
6. Shutdown Windows 98, wait for computer to shutdown completely.
7. Turn off the mechanical pump by pressing the corresponding red button at the front of the tool.
8. Turn off the tool by pressing the red 'machine' button at the front of the tool.
9. Shutdown N2 flow at the mechanical pump, by setting the pressure regulator to 0 bar.
10. Set the Mains Switch at the power distribution box to OFF.
11. Shut the N2 valve at the back of the system.
12. Shut the pressurized air valve at the back of the system.

Turn on Plasmatherm

1. Set the Mains Switch at the power distribution box to ON.
2. Open the N2 valve at the back of the tool.
3. Open the pressurized air valve at the back of the tool.
4. Press the green 'Machine' button at the front of the tool.
5. Press the green 'Mech Pump' button at the front of the tool.
6. Once the computer has started up log into the system monitor software with username 'ope' and pwd 'ope'. (Administrator mode can be accessed with username '3333' and pwd '3333'.
7. In the utilities menu select 'Turbo on'. Wait until the turbo has completed running up (Turbo symbol turns green).
8. Click on the Standby button at the bottom left of the system monitor software.
9. In the utilities menu select 'Pump chamber (turbo)'

User administration

1. Select 'On' mode.
2. In the service menu select 'Configuration'.
3. Enter username '3333' and pwd '3333'
4. This gives access to additional menus
5. For example to setup a new user look at the 'Security' menu

Facilities installation

Here is a list of the facilities required by the system (can be also found in the manual) and some notes on how they are

implemented here at UiB:

1. **Cooling water (Isvann):** This is supplied using the heat pump outside of the lab in the fenced off area(on the window side, the area can be accessed using the 'yellow' key from Gjert) and a pump and buffer cylinder that are located at the facilities room in 168 (snekkerverksted). There are three separate sub-systems supplied with cooling water that are part of the RIE system:
    a. Fluid input panel at the back of the system (used to cool at least the turbo pump)
    b. Heat exchanger (small box in the service corridor behind the RIE)
    c. Drytek Process Backing Pump (located to the left of the tool outside of the cleanroom in the service corridor)

    The cooling water should have a temperature of 18 degrees and supply these three subsystems with different water flows:

Fluid Input Panel
40 psi (275 kPa) differential, 15° to 20°C Max temp
(must be above dew point) > 100 Kohm/cm resistivity.
Flow depends on options purchased,
Min 2 GPM (8 L/m), Max 3 GPM (11 L/m).

Heat Exchanger
40 psi (275 kPa) differential, 15° to 20°C Max temp
(must be above dew point) > 100 Kohm/cm resistivity.
Flow depends on options purchased,
Min 2 GPM (8 L/m), Max 3 GPM (11 L/m).

Figure 1: Cold water requirements for heat exchanger and main tool.

	Unit	PS80
PERFORMANCE		
Pumping Speed	L/min	1300/1600
	m3/hr	80/96
	cfm	47/57
Ultimate Vacuum	Torr	7.5E-03
	mbar	≤100
POWER		
	Hp	4
	KW	2.98
CONNECTION		
Inlet connect	NW/ISO	NW50
Outlet Connect	NW	40
WATER		
Flow	L/min	3-7
Temperature	C	18-30
INSTALLATION		
Weight	kg	280
Noise level	dB	<68
Operating Temp	C	5C-40C
NITROGEN		
Pressure	kg/cm2	0.5-1
Dilute flow	L/min	0-60
Sealing flow	L/min	0-20

Figure 2: Specification of Drytek mechanical pump.

If the cooling water stops the mechanical pump will stop automatically (it will also stop if the pump starts to overheat, in case there is water flow, but the water starts to be too warm). This should be avoided so turn off the system if there are problems with the cold water supply.

2. **Compressed air:** This is supplied via the house compressed air which is typically at 7 bar. There is an oil filter in room 268 above and to the left of the emergency exit door.

Compressed Air:

Clean, dry, 80 - 95 psig (550-655 kPa). Flow rate less than 1 slpm. Average flow rate < 1 L/m, oil free to 50 ppm. max moisture content -70°C to -40°C dew point, and filtered to max particle size of 3 microns.

3. **Nitrogen 5.0:** It is generated from the compressed air using a nitrogen generator that is located in the Fyrrom of the physics building. So if the compressed air goes offline also expect the nitrogen to stop flowing. This is supplied to three different parts of the tool:
    a. General purpose nitrogen at the fluid panel at the back of the tool

General Purpose Nitrogen (Fluid Input Panel):

Nitrogen, 5-20 psig (35-140 kPa) 300-350 sccm
(99.999% purity recommended).

    b. Vent gas to vent the process chamber and purge gas lines. It is connected through the blue 6mm nylon tube that goes into the gas box at the back of the tool.

PM Vent Gas:

Nitrogen, 10-25 psig (70-172 kPa) <1000 sccm
(99.999% purity recommended)
helium leak tested to less than 4.9×10^{-9} scc/sec

    c. Mechanical pump purge and seal gas. See figure 2.

    The pressure is set to 1.7 bar eventhough this is a little bit above the max pressure for the general purpose nitrogen - if the pressure is lower it will not be large enough to trigger the 'atmosphere' signal at the end of the vent process.
4. **Process gases:** CF4, CHF3, Argon, Helium, Oxygen. These are located in the gas safety cupboard in the storage room and are connected to the gas box at the back of the tool via 5 separate 6mm stainless steel tubes (Installed by Yarapraxair). The gases CF4 and CHF3 are less than optimal purity but are the maximum that could be supplied by Yarapraxair. (The gases had the same purity at MIT as well)

Process Gases (6 max for PECVD / 8 max for RIE):

10-25 psig (70-172 kPa),
(99.999% purity recommended)
all lines helium leak tested to less than 4.9×10^{-9} scc/sec.

5. **Gas panel exhaust:** This is also connected to the exhaust system of the lab with the white flexible 10cm diameter tube.
6. **Pump exhaust:** Since the exhaust of the mechanical pump is toxic it is connected in a leak-tight manner to the Scrubber (which is located to the left of f the outer-lab fumehood), where the exhaust is washed with water spray and the water is then neutralized with the neutralizer in room 168.
7. **Electricity:** The main fuse for the system is located in the facilities room in room 168. Required according to manual: 380V, 3 phase, 5 wire, 40A.

Document History

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