Operation Instruction of Unaxis ICP Etcher

Check and/or Change Substrate Temperature:

1. From main manual screen, click on **MAINTENANCE** button, then, **DIRECT I/O**, then, **ENERGY SOURCES**.
2. **Focus on PM1** by clicking on the module box (hatch lines should appear inside of the box).
3. Under **Analog Actuators** category, make sure input value of **temperature4 temperature Setpt-deg** is 200, if not, check the small square box left to the reading (x should appear inside of box), then, change the value by typing it and hitting **Enter** key in computer keyboard.

Load Wafer(s):

1. From main manual screen, click on **MAINTENANCE** button, then, **DIRECT I/O**.
2. **Focus on LM**.
3. Click on **Vent** button, wait until LM pressure up to ~ 755 T before opening door.
4. Glue your sample on one of 4" sapphire carriers using Dow-Corning's High Vacuum Silicone Grease.
5. Take one of cassettes out and insert the sapphire carrier (holding the carrier at the edge spot opposite to the major flat), on which the sample was glued, to a slot, the major flat should be parallel to the cassette side without the pins.
6. Put the cassette back to the holding position (the pin side of the cassette should be toward the inside of the LM chamber).
7. Close door **gently** and click on **Pump Down** button (wait LM pressure down below 100 mT before transferring wafer and you will hear a sound of opening the door between LM and TM).

Create & Edit Etch Recipe Steps:

1. From main manual screen, click on **EDITORS** button.
2. **Focus on PM1**.
3. Click on **EDIT STEP**.
4. Choose **InP Process-200°C** in **Category Filter**.
5. Choose **InP Gas Stabilization-200°C:** changing pressure, working gases flowing rate, if necessary, then, input your own Category Name, Process Step Name, as well as Author Name, finally, click on **SAVE STEP** button.
6. Choose **InP Ignition-200°C:** changing pressure, RF1 (RIE) and RF2 (ICP) forward powers, working gases flowing rate, if necessary, then, input your own Category Name, Process Step Name, as well as Author Name, finally, click on **SAVE STEP** button.
7. Choose **InP Etch-200°C:** changing pressure, RF1 (RIE) and RF2 (ICP) forward powers, working gases flowing rate (if you want to use Laser/CCD Camera Endpoint system, you need to change the setting of CameraMode from none to Manual by keeping clicking on it), if necessary, then, input your own Category Name, Process Step Name, as well as Author Name, finally, click on **SAVE STEP** button.

Create & Edit Etch Sequence:

1. From main manual screen, click on **EDITORS** button.
2. **Focus on PM1**.
3. Click on **EDIT SEQUENCE**.
4. Choose **InP Process** in **Category Filter**.
5. Choose **InP Etch-200°C** (with Ar pre-clean procedure) or **InP Etch-1-200°C** (without Ar pre-clean procedure).
6. Remove the process steps: **InP Gas Stabilization-200°C**, **InP Ignition-200°C** and **InP Etch-200°C** from the sequence.
7. Insert the three new process steps, you have just created, into the sequence.
8. Input your own Category Name, Sequence Name, as well as Owner Name, then, click on **SAVE** button.

Transfer Wafer from LM to PM1:

1. From main manual screen, click on **MAINTENANCE**, then click on **CHANGE MODE**, make sure all modules are in maintenance mode, if not, click on **MAINTENANCE ALL**.
2. Click on **ROBOTICS**.
3. **Focus on LM**.

4. Click on **Map Carrier(s)** button to map all wafers in both cassettes (Cassette 1: on the left; Cassette 2: on the right).
5. In **Set Source** box, pick up the wafer in process LM-Cassette, then, click on **Set**.
6. **Focus on PM1**.
7. In **Set Destination box**, click on **Set**.
8. Click on **Transfer Now**.

Set Laser/CCD Camera Endpoint System (if you want):

1. From main manual screen, click on **EDITORS** button, then, **CAMERA POSITION**.
2. Turn **Laser/CCD Camera Endpoint** system on by putting switch, on control box attached to camera system, down and you should see laser spot on screen.
3. Position the spot incrementally or directly (three methods) to where you want to monitor the endpoint on your sample.
4. Maximum the intensity of laser spot by adjusting the focus of camera.
5. Return to main manual screen, click on **DATA MENU**, then, CONFIG DATA.
6. In the box of **Configure Trace Data for PM1**, under **Logged Measurables**, choose **PeakDetectorSensor** (this sensor is used by the system to record the raw interferogram data).
7. If you want to change the plot settings (amplitudes, time span, and scale factor), input new ones, then, click on **ADD:** the chosen one should appear under **Measurable Name**, finally, click on **APPLY** button.

InP Wafer Etch:

1. Make sure the temperature reading of oil heater (**PrestoÒ Julabo**) reaches to 200°C (otherwise, just wait for the temperature being reached).
2. Make sure the cooling water temperature on the front LED panel of **System III, Liquid/Liquid Heat Exchanger** is 40°C (if it is not, please refer to the attachment at the end of this manual)
3. From main manual screen, click on **MAINTENANCE**, then **DIRECT I/O**, then, **ENERGY SOURCES**.
4. Under **Analog Sensors** category, check the two small square boxes left to **Temperature1Temperature-degC** (the PM1 chamber inside wall's temperature) and **Temperature2Temperature-degC** (the PM1 chamber outside wall's temperature) (x should appear inside of boxes) to fix those two temperature readings [leave the other two boxes left to **Temperature3Temperature-degC** (cooling water temperature) and **Temperature4Temperature-degC** (substrate temperature of PM1 chamber) to be open].
5. From main manual screen, click on **MAINTENANCE**, and then **CHANGE MODE**.
6. **Focus on PM1** and click on **ENGINEERING** mode button.
7. Click on **MANUAL OPS**.
8. In **Manual Processing** box, go to **Sequences Category Filter** to pick up the one, which you have created before.
9. Pick up the etch sequence that you have created.
10. Click on **Execute Sequence**.
11. If you want to use the **Laser/CCD Endpoint system**, click on **RETURN** to back to main manual screen, then, **DATA MENU** followed by **VIEW DATA**.
12. During plasma etching, if you see the sample's etching target has been reached, click on **STOP** button at the top of screen, then **STOP PM1 PROCESSING** button under **Process Chambers Control**.
13. The alarm will sound, click on **ALARMS** button, choose **Next Step**, click on **Recover** and **MANUAL OPS** buttons to return manual operation screen (the system will run the steps next to the etch step).
14. After finishing the sequence, turn the **Laser/CCD Endpoint system** off.

Transfer Wafer from PM1 to LM:

1. From main manual screen, click on **MAINTENANCE**, and then click on **CHANGE MODE**, change PM1 mode from engineering to maintenance by clicking on **MAINTENANCE**.
2. Click on **ROBOTICS**, then, **Clear Material**.

Remove Wafer(s):

1. From main manual screen, click on **MAINTENANCE** button, then, **DIRECT I/O**.
2. **Focus on LM.**

3. Click on **Vent** button, wait until LM pressure up to ~ 755 T before opening door.
4. Remove wafer(s) from cassettes.
5. Close door and click on **Pump Down** button.
6. Remove your sample from Si wafer carrier and clean the carrier's surface using Isopropanol, then, wipe it out using clean-room paper.

Change Substrate Temperature to 180°C (in the evening and weekend only):

1. From main manual screen, click on **MAINTENANCE** button, then, **DIRECT I/O**, then, **ENERGY SOURCES**.
2. **Focus on PM1**
3. Under **Analog Actuators** category, check the small square box left to the reading of **temperature4 temperature Setpt-deg** (x should appear inside of box), change the value to 180 and hit **Enter** key in computer keyboard.

Attachment:

Sometimes, we found that the Heat Exchanger (supplying the coolant to ICP plasma power generator of PM1), sitting on floor in front of Unaxis Tool on your left side beside Oil Heater, shuts off itself because the coolant level is too low. When this happens, you will see the setting temperature (40°C) of the coolant, displayed on the front LED panel of the machine, drops to room temperature. You need to add some coolant (Ethylene Glycol) to the system and restart the machine. Here is the procedure of how to do it:

1. Open the lid (by turning one of the screws), the smaller one on the top of the machine (Liquid/Liquid Heat Exchanger) which sits on floor in front of Unaxis machine on your left side, beside the oil heater machine.
2. Open the cap of coolant tanker by turning it.
3. Insert the plastic fennel into the opening of the tanker and pour some coolant (the Ethylene Glycol bottle sits beside the machine) into the tanker until water is full.
4. Close the cap and the lid.
5. Press the Stop/Start button, on the front panel of the machine, to restart the machine (you will hear the sound of the coolant pumping again).
6. Wait until the setting temperature is reached (40°C) before etching your sample.