

## UFNF Unaxis ICP/RIE Etch

### SOP

- System Description and materials notes: Unaxis Shuttlelock Reactive Ion Etcher with Inductively Coupled Plasma Module. Etch Capabilities: SiO<sub>2</sub>, Si<sub>3</sub>N<sub>4</sub>, photoresist, polyimide, Al, dielectrics and other commonly used materials. The system is equipped with two 13.56 MHz RF power supplies. A 2KW Inductively Coupled power supply and a 600W RIE power supply. The substrate is Helium cooled. Process Gases Available: SF<sub>6</sub>, CL<sub>2</sub>, BCL<sub>3</sub>, CHF<sub>3</sub>, O<sub>2</sub>, Ar, H<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>. Only 4" (or 5" with a clamp change) wafers may be loaded into the system. Small samples may be mounted on top of a clean 4" wafer but keep in mind that this will defeat the He cooling capabilities. Process on full 4" wafers for best cooling results. **IMPORTANT:** The outer 5mm of the wafer must be completely free of photoresists, adhesives, tape etc...or the wafer will stick to the clamp, will not unload, and most likely be broken. UFNF has a 4" wafer edge exposure mask you may use to remove wafer edge photoresist.

#### Prerequisites for operating the Unaxis Tool:

- a) Receive "one on one" training and certification from UFNF Staff. Discuss your process with a staff member.
- b) Obtain a UFNF ID (if you do not already have one) by completing the [UFNF Lab Use Request Form](#).

#### **Safety**

- **Chamber** – Do not attempt to vent the process (right) chamber for any reason. Contact UFNF Staff for assistance.
- **Gases** – Chlorine Gas may be used only when UFNF Staff are present from 8am to 5pm Mon-Fri. Absolutely no one except UFNF Staff may access the gas cabinets and gas supply bottles for this system.
- **Lab Gas Detection Alarm** - The gases supplied to this system (among others throughout the lab) are monitored by leak detection sensors inside the lab and gas cabinets in the service corridor. If an alarm occurs, the red beacon and audible alarm in the southeast corner of the lab will sound. EVACUATE IMMEDIATELY. UFNF Staff will be notified immediately. If a High Level leak detection occurs, the entire Physics building will be evacuated.
- **High Voltage** - High Voltage Radio Frequency is used throughout the system. System maintenance may only be performed by Unaxis or UFNF Staff. Do not remove any tool covers or defeat any interlock on this system.

- **Moving Components** - The User must exert caution when opening and closing the loadlock lid. Your fingers after being violently detached by the chamber lid will prevent the system from reaching base pressure.

## 1.0 Pre-Operation

- 1.1 Tool Reservations may be made via the UFNF Reservation Page.  
<http://www.phys.ufl.edu/nanofab/reservations.html>
- 1.2 Change gloves. WARNING No solvents are allowed near the machine, change your gloves before operation!!
- 1.3 Fill out the Unaxis Excel Logbook on the desktop of the computer near the lab entrance.

## 2.0 Operation

- 2.1 The system must be in "Standby" mode for normal processing. If the system is in the "Ready" mode i.e. the "Ready" radio button near the bottom of the screen is highlighted, click the "Standby" radio button to switch modes.
- 2.2 Click "Window", "Overview Diagram". Verify that the "Right Chamber Pump" window displays "Turbo: On". If off, put the system in "ON" status by clicking the "ON" radio button in the lower left corner of the screen. Then click, "Utilities" (upper left) and "Turbo Pump On". Wait for the turbo to power up. Hint: The system status is always displayed on the top taskbar of the software window.
- 2.3 Verify the Right Chamber is pumped down by clicking "Service" (top menu), "Maintenance", "Pump", "Chamber or System".
- 2.4 Verify the loadlock is vented. The loadlock window should display "Atmosphere". If not, click "Service" (top menu), "Maintenance", "Vent", "loadlock" and wait for "Atmosphere" to appear in the loadlock status window. This may require 2 attempts.
- 2.5 Examine your sample. The backside and the outer 5mm of the wafer must be completely free of photoresists, tape, etc. Your wafer will not come back out alive if not. The backside of the wafer must be clean or the He cooling will not work properly.
- 2.6 Load your sample on the load arm with the wafer flat in the back. Close the lid and click "Service" (top menu), "Maintenance", "Pump", "Loadlock".
- 2.7 Load your wafer into the right chamber, click "Service", "Maintenance", "Wafer Handling" and on the next screen Wafer Transfer "Load". Exit out of this screen once the transfer is complete.
- 2.8 Click "Service" (top menu), "Manual" to enter the manual process screen.
- 2.9 Set the Helium flow to 10 (sccm) lower left of the screen. Turn on the Helium cooling by clicking "Helium - On" (top of screen). Wait 1-2 minutes for the Helium pressure to build up in the cooling gas loop. Check that the Helium Pressure (Torr) reading is  $>.35$ . If the pressure is low it may indicate that your sample carrier wafer is contaminated. Unload and check you sample. If you still have issues with He pressure, contact UFNF Staff.
- 2.10 Set all gas flows to 0.0 in the gas window and enter your desired gas set points. Click the "Gas" On" radio button.
- 2.11 Set the desired process pressure in the "Pressure - Chamber (mTorr)" window and click the "Pressure - On" radio button.
- 2.12 Set RF1 (RIE) and RF2 (ICP) to desired power.
- 2.13 Set the RF process time in the "Run" field. This is the etch time and will start counting when you click "RF On". Click "RF ON" when ready.

When the time has expired, everything will shut off automatically.

- 2.14 When the etch is complete, click the "Purge" button at the top of the screen and wait for 3 minutes before unloading your sample from the chamber. This is important as it will help cool the wafer so that it will unload properly and it will purge the chamber.
- 2.15 Unload your wafer. Click "Service", "Maintenance", "Wafer Handling" and on the next screen, Wafer Transfer "Unload". Exit out of this screen once the transfer is complete.
- 2.16 Vent the loadlock. Click "Service" (top menu), "Maintenance", "Vent", "loadlock" and wait for "Atmosphere" to be displayed. This may require 2 attempts.
- 2.17 When done etching all samples, place a clean dummy wafer back on the load arm.
- 2.18 Click "Standby" button ON (bottom left of screen)
- 2.19 Click "Process, Chamber, Load" and select file O2purge.bch, click OK
- 2.20 Click "Ready" button on bottom of screen.
- 2.21 Click "Run" on the right bottom of screen. You will see a recipe execution pop up window if done correctly. You can leave the tool. The wafer will load, process and unload automatically.