Arizona State University NanoFab

OXFORD PLASMALAB 80PLUS (CLOEY)

Rev D

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1. Purpose / Scope

1.1. This document is intended to give the User an understanding of the proper procedure for the use of this tool. Should question arise that are not covered in the document it is requested that you ask a CSSER Staff member prior to continuing with any experiments as you might damage the tool, your sample or contaminate the chamber resulting in the possibility of causing harm to another person's project..

2. Reference Documents

2.1. Chemical Safety & Hazardous Waste Management Rules & Procedures

2.2. CSSER Rules & Procedures Handbook

3. Equipment / Supplies / Material

3.1. Wafer or standard tweezers

3.2. Isopropyl Alcohol

3.3. Clean room wipes

4. Safety

4.1. Follow all safety procedures outlined in the CSSER Handbook

4.2. Follow all Lock Out - Tag Out procedures where they may apply.

4.3. Follow safety procedures for high voltage when working with high voltage or RF energy.

4.4. Follow safety and handling procedures when working with high pressure, pyrophoric, or toxic gases.

4.5. In an emergency:

4.5.1. In an emergency, such as risk of personal injury, press the EMO (big red button) on the front of the tool. This will turn off all power to the machine, including the roughing pump in the sub-fab. Contact CSSER staff if this button is pressed.

5. Set Up Procedures

5.1. There are standard recipes on the tool. You will have access to change etch times only. Any attempt to modify the recipes, pump parameters or purge cycles will result in loss of clean room privileges. Contact CSSER Staff if you need to develop/modify an existing recipe (Additional charges may apply).

5.2. If using BCL3 or CL2 chemistry the manual gas valve located in the VMB behind the gas pod should be turned on at this point.

If you are running:

***Parylene: you are required to perform a 30minute O2 clean upon completion of your process.**

***CF4: you must use the Graphite plate, failure to do so could result in loss of cleanroom privileges & possible cost associated with replacement of the Quartz plate.**

You should also run an O2 clean process after running CF4 before performing any etch using a chlorine gas to avoid fluorine based polymers on your samples..

5.3. Check UP/DOWN status of tool; DO NOT proceed if tool is DOWN. If you encounter any problems during your process contact a member of staff, place the tool sign to DOWN, and enter a Service Request.

5.4. At Process tab click on "Chamber" to verify a recipe is not running at present, if so wait till it has completed before continuing with any type of "Vent" or "pumping" cycle.

6. Operation Procedures

6.1. System Start Up

6.1.1. Log into the ISAAC's system using your ASU RITE ID card.

6.1.2. From the on screen menu select **SYSTEM/PUMPING** to verify the status of the tool. All interlocks above the chamber diagram should be **GREEN.** Check that the chamber pressure is below 5.5×10^{-5} Torr before proceeding.

6.1.3. To log-on to the system select **SYSTEM/PASSWORD** from the menu and enter your username and password followed by selecting **OK.**

6.2. Loading a Sample

6.2.1. Select **SYSTEM/PUMPING** and press **STOP** followed by **VENT.** The unit will go through two vent operations, the first for 120 seconds, the second for 200 seconds. The chamber cannot be opened to atmosphere until the indicator reads **VENTING FINISHED**. Also be aware that the Pod interlock changes from green to red, indicating gas flow through the MFCs (Mass Flow Controllers) has been cut-off.

6.2.2. To open the chamber lid, rotate the switch on the chamber body to **CHAMBER UP** and press both blue buttons simultaneously. The lid will raise and rotate 90 degrees, ensure that the lid has come to a complete stop before proceeding.

6.2.3. Place your sample in the center of the quartz platen. When using whole 4" wafers orient them with the flat towards the operator, for etch repeatability.

6.2.4. To close the lid change the switch to **CHAMBER DOWN**, and hold down the two blue buttons until the lid returns to the closed position.

6.3. Chamber Pump Down

6.3.1. To pump the chamber to base pressure press **STOP** followed by **EVACUATE** on the PC. You will be immediately prompted for a wafer ID. You are required to input a unique wafer ID, this helps in troubleshooting and locating your run in the tool logs. Having entered your wafer ID click **OK.** There will be a short delay of approximately 20 seconds before you will hear the chamber pump commence. Allow the chamber to pump below base pressure indicated by **BASE PRESSURE REACHED** before proceeding.

6.4. Recipe Selection & Set Up

6.4.1. Select **PROCESS\RECIPES**. The recipe window is split into two main areas, recipe creation and recipe edit. As a USER you only have access to recipe edit. To load your desired recipe select **LOAD**. You will be prompted to overwrite the previous recipe, select **YES** and select your recipe from the list shown.

6.4.2. The etch process generally consists of a pump step, followed by the etch step, followed by another pump step. To alter the etch time highlight the step denoted as **ETCH**, and left click on the mouse and select **EDIT** from the drop down screen. When you hit enter, the time will be saved for your process.

DO NOT ATTEMPT TO ALTER ANY OTHER PARAMETERS. THIS INCLUDES PUMP TIMES AND STANDARD RECIPES SUCH AS THE OXYGEN CLEAN AND LINE PUMP.

6.5. Etch Process

6.5.1. To run the etch process simply select RUN from the recipe window. The system will automatically switch to CHAMBER 1 view, which provides a schematic live display of the tool conditions. The following features are of note:

If you need to abort a running process:

While a recipe is running, you can ABORT the process by pressing the STOP ALL PROCESS button in the top right corner of the screen. This will turn off process gases, RF, and open the throttle valve. The turbo will still be pumping the chamber.

A screen will come up when you press the STOP button, asking if you wish to shut down the system. PRESS NO!!! A yes response will shut down the pumps. A full system restart is then required.

6.5.2. The top left of the screen shows the current step, recipe time for the step, and actual elapsed time. On the right are the MFCs set points and actual flows. On the bottom of the screen, the left side shows the vacuum set point and actual values. The right side displays forward and reflected RF power and bias voltage.

During the etch process make sure to enter the RF reflected power and the DC bias into the paper logbook.

6.5.3.After completing the entire process, including the post etch pump step, a yellow warning will pop up. Acknowledge the alarm by selecting ACCEPT.

6.6. Chamber Vent/Pump Down

6.6.1.This is automated by the manufacturer to perform several pump and purge cycles. When the chamber has reached atmosphere, open the chamber lid, remove your sample

6.6.2. Close the chamber lid ensuring that it is fully closed.

6.6.3. Pump the chamber to base pressure press **STOP** followed by **EVACUATE** on the PC.

6.7. Line Pump Down and Chamber Clean

6.7.1. If you used BCL3 and/or CL2 as a source gas the gas line needs to be pumped out to prevent corrosion of the system. Shut off the manual valve for BCL3 and/or CL2 at the VMB for the gas stick used, just before the regulator and run the recipe named BCL3/CL2 PUMP OUT.

6.7.2. When processing is completed, log off the tool by selecting "Verify", no password is required. The tool will go into "View-Only" mode.

6.7.3. After logging out of the control software, log out of the ISAAC's system using your ASU RITE ID card.

7. Forms

7.1. Oxford 80+ Run Sheets

USER:	DATE:	START TIME:	END TIME:
ETCHED MATERIAL:		ETCHED MATERIAL DEPOSITION / GROWTH METHOD: DVCEP MAEB-E)EBUT ETATS(ECANRUF NUPS)ETATS(REHTO	
SUBSTRATE:			
ETCH RECIPE:		O2 CLEAN:	
ETCH TIME: mins		REF POWER: W	
DC BIAS: V		ETCH RATE: Å/min	
COMMENTS:			

USER:	DATE:	START TIME:	END TIME:
ETCHED MATERIAL:		ETCHED MATERIAL DEPOSITION / GROWTH METHOD: DVCEP MAEB-E)EBUT ETATS(ECANRUF NUPS)ETATS(REHTO	
SUBSTRATE:			
ETCH RECIPE:		O2 CLEAN:	
ETCH TIME: mins		REF POWER: W	
DC BIAS: V		ETCH RATE: Å/min	
COMMENTS:			

USER:	DATE:	START TIME:	END TIME:
ETCHED MATERIAL:		ETCHED MATERIAL DEPOSITION / GROWTH METHOD: DVCEP MAEB-E)EBUT ETATS(ECANRUF NUPS)ETATS(REHTO	
SUBSTRATE:			
ETCH RECIPE:		O2 CLEAN:	
ETCH TIME: mins		REF POWER: W	
DC BIAS: V		ETCH RATE: Å/min	
COMMENTS:			

8. Tables

8.1. Standard Recipes

	Si ETCH*	Al ETCH	Cr ETCH*	Nitride Etch
GAS 1 (sccm)	Cl2 - 10	BCl3 - 40	Cl2 - 10	CF4 50
GAS 2 (sccm)	-	CL2 - 5	O_2 - 10	Ar 5.0
Pressure (mtorr)	30	25	100	30
Power (Watts)	200	250	100	200

*** SF6 Recipe Note: This has a 20 second SiO2 punch through step!**

8.2. Etch Rates (performed on standard patterned & blanket etch 4” wafers)

	Film			
Recipe	Silicon	Al	Cr	Nitride
Silicon	775			
Aluminum w/o PT		2141		
Aluminum w/PT*		2267		
Chrome			430	
Nitride(Graphite plate)				650
***Zep**	590			

All Etch rates in Å/Min

9. Revision History

Effective Date	Originator	DESCRIPTION OF REVISION	Issue
1/18/05	Gez Laws	Initial Release	2
3/15/06	Tim Eschrich		3
11/5/10	Jon Martin	Documents format was changed to a uniform procedure.	A
7/2/12	Jon Martin	Addition of etch process section 6.0 regarding Parylene	B
7/29/14	Jon Martin	Addition of CF4 to process parameters & general cleanup of procedure	C
4/6/15	Kevin Hilgers	New SOP format and ISAAC's log-in procedure added.	D
			E
			F