NCMN
Nebraska Center for Materials and Nanoscience
University of Nebraska

Oxford PlasmaLab 100 DRIE Operating Procedure

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Author(s): Anand Sarella
Phone: 402-472-3773
Email: asarella2@unl.edu

1 Introduction

1.1 Key Words

Deep Reactive Ion Etching (DRIE), Inductively Coupled Plasma (ICP)

1.2 Purpose

This document provides instructions for operating the Oxford PlasmaLab 100 Deep reactive ion etching (DRIE) system, which provides state-of-the-art plasma etch capability. Use of this tool requires the understanding of the fundamentals of plasma etching knowledge.

1.3 Applicability

1.3.1 Locations

The tool is located at **Clean room of nanoscience research center**.

1.3.2 Safety

The safety concern is the system uses high voltage electricity and high pressure gases. Some working gases might be **toxic**.

1.3.3 Restrictions and Limitations

- Must be a qualified user of DRIE.
- The imitation for the substrate is that it must not damage the system.

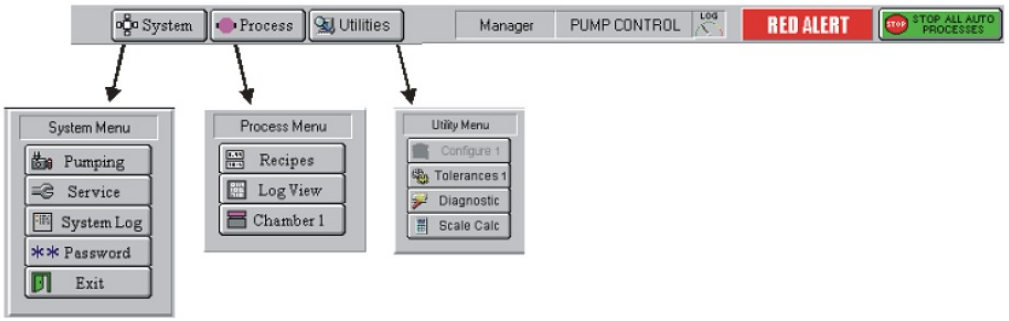
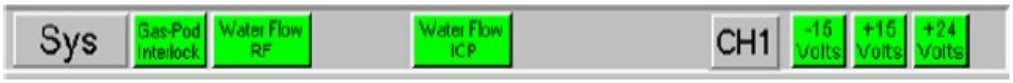
1.4 Restrictions on Working Alone

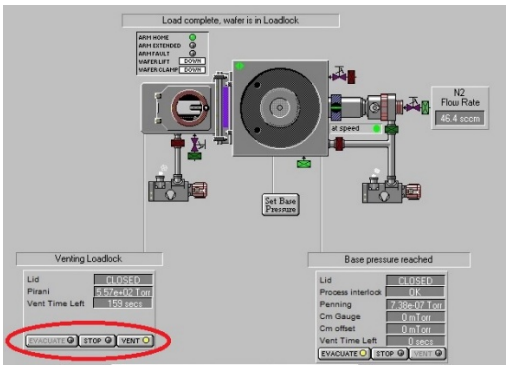
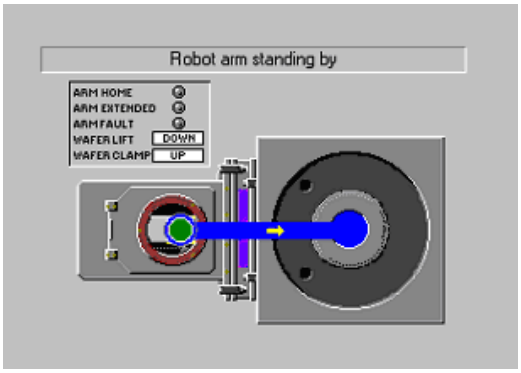
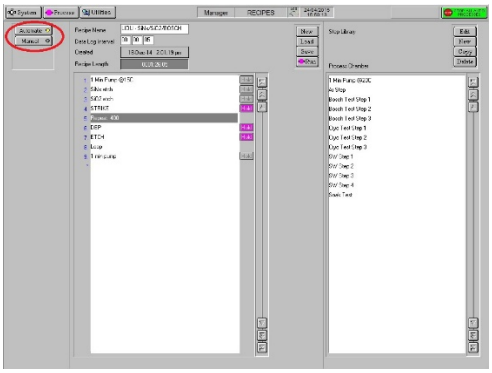
- Normal working hours are from 8am to 6pm M-F.
- Working alone is permitted with completion of an orientation to this written procedure and hands-on training from the specialist.
- Assistance from the specialist is available during working hours only. If an error occurs during off-hours, record the error in the Logfile and send an email to the specialist. **Do not try to fix or adjust anything by yourself.** Tool will be checked in the following work day. User will be notified when sample left in chamber is available for pickup.
- Problems with equipment malfunctions, breakage, etc. should be reported to the specialist and recorded in the tool Logfile. **Again do not try to fix or adjust anything by yourself.**
- In case of gas leakage or any other danger, press the "EMO" button on the front panel of the system and leave the room immediately. Contact the specialist right away.
- For any emergency involving injuries, fire, chemical spills, etc., call **911.**

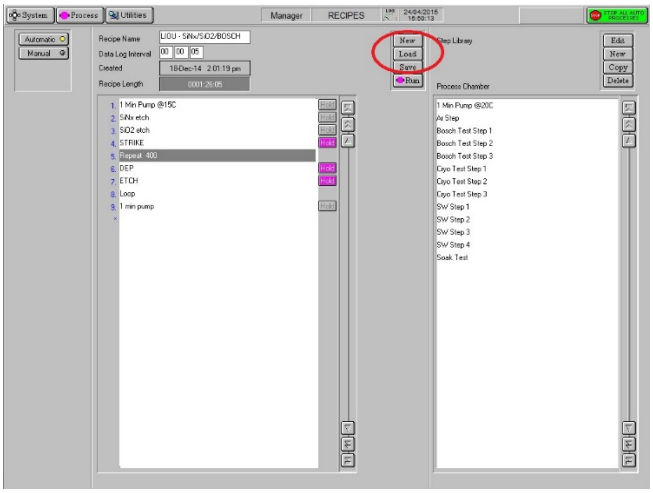
2 Preparations

- Receive this procedure from the specialist.

3 Execution (Step-by-step work breakdown)

Step #	Action
1.	**Logon equipment through NCMN FOM software**: • Logon through NCMN FOM screen lock 
2.	**Checking status of the system before starting**: • Make sure the Oxford user control interface PC 2000 is running on the left monitor. If not, inform Specialist.  • The system is under proper vacuum condition: Load-lock chamber is ~10^{-2} Torr; process chamber is ~10^{-6} Torr. • Make sure NO sample is in the chamber or load-lock. • Ensure that the system status indicators are all green 

3.	**Loading the Sample in load-lock:** • Click “Stop” button then the “Vent” button under load-lock pump to vent the load-lock. Wait until the procedure finish (~3 min). **Do not** interrupt this process. • Open the load-lock lid. Put the sample on the sample holder and align it to the markers on the holder accordingly. Close the load-lock lid. • Click “Stop” button then the “Evacuate” button under load-lock pump to pump the load-lock. Wait until the procedure finish (~5 min). **Do not** interrupt this process.  
4.	**Transferring the Sample in process chamber:** **Manual process** • In the control software, click on the load-lock wafer mimic. The blue arrowed path is displayed showing the available destination. • Click on the process chamber wafer indicator. The wafer is transferred to the process chamber. **Do not** interrupt this process. **Automatic process** • In the “Process” page, choose “Automatic” on the top left corner, the system will automatically transfer the sample to the process chamber when the process starts and transfer the sample back to the load-lock after the process finishes or if the process failed.  

5.	**Loading the Recipe:** • In the control software, click “Process” button to switch the interface to the process control page. • Click “load” button and following the screen to load the pre-save recipe. 
6.	**Creating and Editing the recipes:** Steps Recipe steps are stored in the Step Library list. The list can contain any number of steps, depending on available hard disk space. When the displayed list is full, it becomes scrollable to allow you to view all of the list contents. **To create a new recipe step, use the following procedure:** 1) In the Step Library panel, select the NEW button. The Step Edit page is displayed. 2) Enter the step parameters as required, then click on OK. The step is automatically saved. **To create a recipe step, based on an existing recipe step, use the following procedure:** 1) Select a recipe step from the Step Library list, i.e. click on it to highlight it. 2) Select the COPY button. Enter a new step name. 3) Edit the step parameters as required, then click on OK. The new recipe step is automatically saved. **To edit an existing recipe, use the following procedure:** 1) Select a recipe step from the Step Library list, i.e. click on it to highlight it. 2) In the Step Library panel, click on the Edit button. 3) Edit the step’s process parameters as required, then click on OK. The step is automatically saved. NOTE: Changing an existing recipe step will not alter saved recipes, which use the old version of that step. **To delete a recipe step, use the following procedure:**

	1) Select the recipe step from the Step Library list, i.e. click on it to highlight it. 2) Select the DELETE button; the selected recipe step is deleted. **To build a recipe, use the following procedure:** 1) In the Recipe panel, select the NEW button. 2) Click on a recipe step in the Step Library list, hold the left mouse button down then drag the mouse pointer to the Step Name field next to the asterisk (*) then release the mouse button. The step name is displayed in the Step Name field. 3) Repeat 2) as required to add further steps to the recipe. Note that once you have filled the Step Name field, the recipe step list becomes scrollable, enabling you to add a maximum total of 1000 steps. 4) To remove a step from the list, click on it to highlight it then select the Delete step button from the Step Commands pop-up menu. Any further steps will move up the list by one place. 5) To add a step before an existing step, click on the existing step then select the Insert step button from Step Commands pop-up menu. The selected step and all those following it will move down the list by one place. You can then drag another step from the Step Library list into the now vacant field. 6) When all steps have been added, enter a time into the Data Log Interval field, then enter a name for the recipe in the Recipe Name field. Finally, select the SAVE button. **To edit a recipe, use the following procedure:** 1) Select the LOAD button, then select the recipe to be edited. 2) In the Step Commands pop-up menu, click on the Edit Step button, then edit the process parameters as required. Note that editing a recipe step will not affect the associated step, i.e. a step having the same filename, in the Library of Available Steps. 3) To remove a step from the list, click on it to highlight it then select the DELETE STEP button from the Step Commands pop-up menu. Any further steps will move up the list by one place. 4) To add a step before an existing step, click on the existing step then select the INSERT STEP button. The selected step and all those following it will move down the list by one place. You can then drag another step from the Step Library list into the now vacant field.
7.	**Run a recipe:** Click “Run” button on the page to run the loaded recipe.

8.	**Transferring the Sample back to load-lock:** **Manual process** • Click "System" button on the top right corner to enable the drop-down menu and then click "Pumping" to switch to the pump page. • Click on the load-lock wafer mimic. The blue arrowed path is displayed showing the available destination. • Click on the load-lock wafer indicator. The wafer is transferred to the process chamber. **Do not** interrupt this process. **Automatic process** • If "Automatic" is chosen in the "Process" page, the system will automatically transfer the sample to the load-lock when the process finishes.
9.	**Unloading the Sample from load-lock:** • In the control software, click "Stop" button then the "Vent" button under load-lock pump to vent the load-lock. Wait until the procedure finish (~3 min). **Do not** interrupt this process. • Open the load-lock lid. take the sample out. Close the load-lock lid. • In the control software, click "Stop" button then the "Evacuate" button under load-lock pump to pump the load-lock. Wait until the procedure finish (~5 min). **Do not** interrupt this process.
10.	**Log file Entries:** Fill out the log file in the right monitor with the corresponding parameters.
11.	**Log off the NCMN FOM software:** • **Do not** exit PC2000. • Press "Log off" button in the NCMN FOM to log off the system.
13.	**Clean up all samples, pens, and notebooks from the area.**
End	**End of Procedure**

4 Post-Performance

4.1 Recordkeeping

Completely fill out the logfile.

4.2 Feedback

Report any unusual or problematic behavior of the setup by contacting the specialist.

5 User Access Level

Normal User – Requires specialist to be present

Expert User – Does not require specialist to be present