

GENERAL PROCESS AND OPERATION SPECIFICATION

Oxford Instruments PlasmaLab 80Plus – PECVD Deposition Tool

I. SCOPE

- a. The purpose of this document is to describe requirements and basic operating instructions for the Oxford Instruments Plasmalab 80Plus PECVD. The PECVD tool is intended for plasma-enhanced physical vapor deposition of silicon oxide, silicon nitride or silicon oxy-nitride films over various substrates.

II. SAFETY

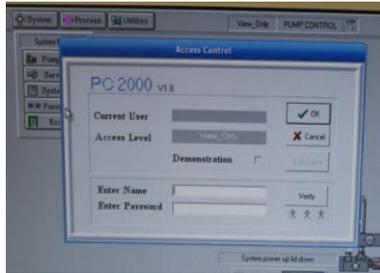
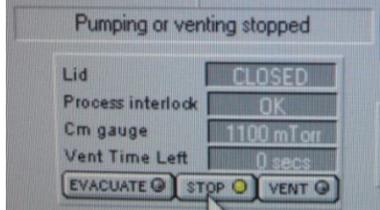
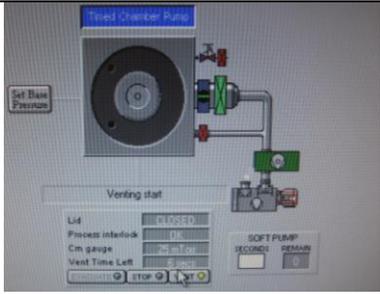
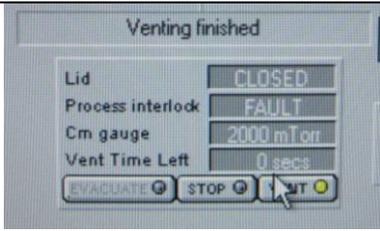
- a. Be sure that you are trained and signed off to use this equipment.
- b. Be sure to keep all doors and protective shields in place before operating this equipment.
- c. Use care when operating around high voltage or high current.
- d. Use care when operating in RF mode of operation. Avoid coming near any electrodes or conductors carrying RF energy.
- e. High pressure gas cylinders for this tool are stored in ventilated gas cabinets located in the 7H1 service corridor. Be sure to ask a staff member for assistance to change out any gases.
- f. A recipe can be aborted at any time by selecting STOP ALL PROCESSES, located in the top right corner of the software display.
- g. When the chamber is open, do not touch the inside of the chamber or the gas shower head.
- h. Beware of residual process gases when opening the chamber. Gases such as NH_3 , SiH_4 and CF_4 are very toxic. Do not skip the final pump step in deposition or clean recipes.
- i. If you are unsure about any procedure or indication while operating this equipment be sure to contact a staff member or trainer for assistance.

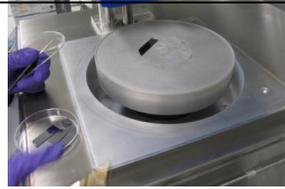
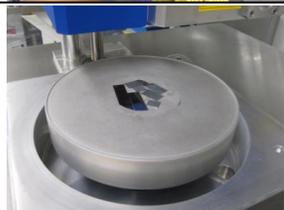
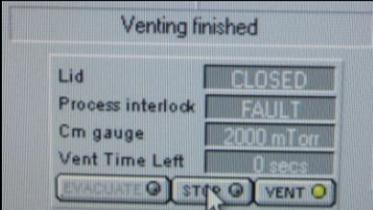
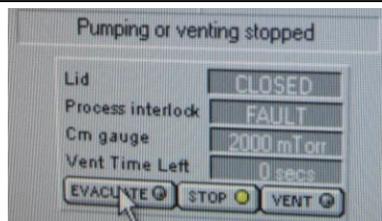
III. APPLICABLE DOCUMENTS, MATERIALS AND REQUIREMENTS

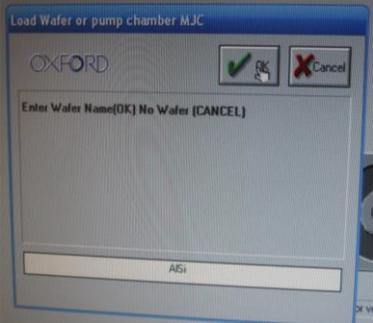
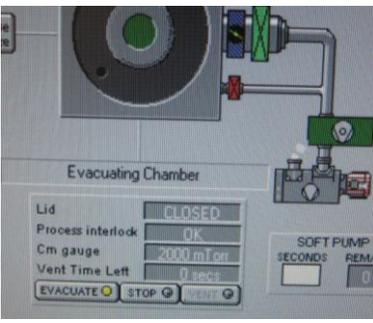
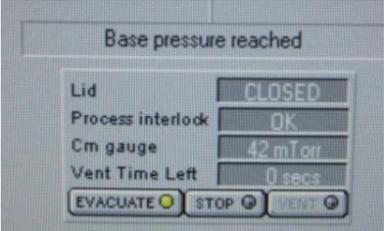
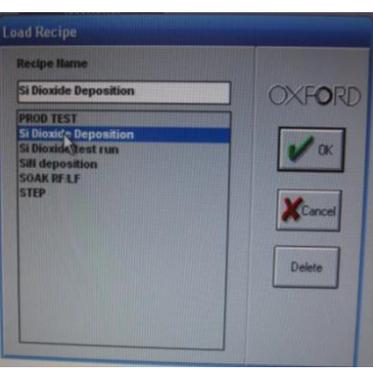
- a. For more information about the detailed operation of this tool refer to the Oxford factory manual – “Plasmalab80Plus Compact Plasma System.” File name: Texas A&M 94-219873 System Manual.pdf.
- b. This tool is intended for a relatively wide range of substrate and target materials.
- c. This tool is configured to run with the following gases for normal processing: N_2 , N_2O , NH_3 , SiH_4/N_2 . In addition, O_2 and CF_4 is available only for running in “clean” mode. Clean mode is not available to regular users and can only be run with manager access.
- d. Gases are stored in the service corridor, but are available under software recipe control.
- e. This tool uses a mechanical pump (Leybold-Heraeus D90AC) with an Alcatel Blower RSV 600 to maintain adequate working pressures with relatively high gas flow rates. Ask a staff member for assistance to turn these pumps on or off as needed.

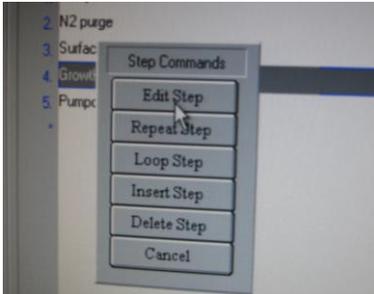
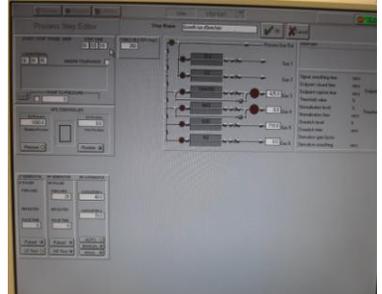
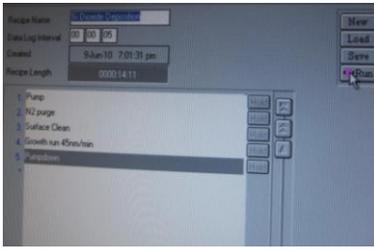
IV. OPERATION

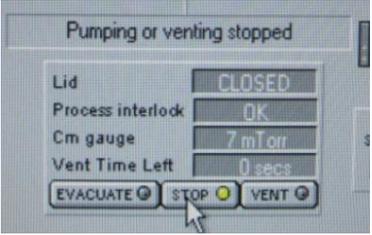
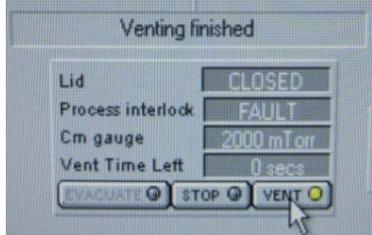
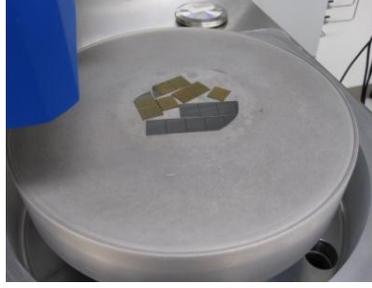
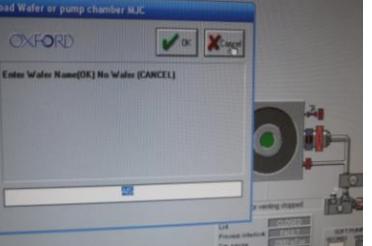
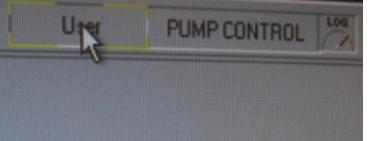
- a. Fill out the PECVD logbook to record a history of materials and process parameters.
- b. Normal operations – follow steps described below. The factory manual is available on line, or on the PC for the tool to provide more detailed information.

#	Step	Photo	Note
	Ensure that the vacuum pumps are running – located in service hallway.		Ask staff to turn on the PECVD pump before running.
1	Log in the system by clicking “View Only” or “System->Password”		Case sensitive
2	Click “System->Pumping” if pump control is not shown. Click “Stop” to end evacuate		
3	After “Stop” light turn to yellow. Click “Vent” to vent to atmosphere		
4	Wait for count down, around 3 minutes until it displayed “Venting finished”, the chamber can be opened.		

5	To open the chamber, switch the knob to “Chamber Up” position.		
6	Put both thumbs on the left and right hoists, press at the same time, chamber will open		
7	Until the chamber is fully opened, place the sample in the middle of the holder plate	 <p>Do not touch the holder plate, it may be very hot!!</p>	
8	To close the chamber, switch the knob to “Chamber Down” position. Put both thumbs on the left and right hoists, press at the same time, chamber now will close		
9	<p>A) Before evacuating the chamber, ensure that the “Soft Pump Time” is > 30 seconds – easier on blower and keeps small samples from moving.</p> <p>B) In the “Pumping” page, click “Stop”, then click “Evacuate”.</p>		

10	Enter wafer name, then click "OK"		
11	Evacuating, wait until display "Base pressure reach"		
12	Click "Process"-> "Recipes"		Load Process recipes for viewing and selection. If only "clean" recipes are visible, then the tool is still in clean mode. Contact a staff person to return the tool to normal mode.
13	Edit current recipe or click "Load" to load old recipes.		

14	<p>Left click on the recipe's step, step menu shows up.</p> <p>Click "Edit Step", setting for this step will be displayed. DO NOT exceed 200W RF Power, or 1000mTorr pressure.</p>		
15	<p>Click "Process"->"Recipes", click "Run" to start the process</p>		
16	<p>Enter wafer name again, the display will jump to each step and start.</p>		
17	<p>When process is done, an "Yellow Alert" will show up, display "End of process reached", click "Continue"</p>		
18	<p>Go back to "System"->"Pumping"</p>		

19	Repeat "Stop"->"Vent" like previous step		
20	Open chamber. Switch to "Chamber Up". Press two hoists.		
21	Take out the samples, put it on the side of the machine to cool down, close the chamber by switching to "Chamber Down". Press two hoists.		
22	Click "Stop"->"Evacuate" again, click "Cancel" if no samples		It will still evacuate.
23	Click "User" on top		

24	Click "Verify", and click "OK" to log out		
25	Tell staff you are done using PECVD.		

V. QUALITY

- a. Substrates and thin film materials used in this machine are intended to provide a wide variety of alternatives to AggieFab users. No guarantee is made regarding effects of cross contamination due to particular substrates or targets in the history of operations for this tool on future users.

VI. SIGNATURES AND REVISION HISTORY

- a. Author of this document: Larry Rehn and Cheng-Chung Chang
- b. Author Title or Role: Technical Manager/Student Lab User
- c. Date: 5/2/2014
- d. Revision: Original Issue

Approvals:

Technical Manager Signature: _____

Date: _____

Revision History:

Revision	Author	Date
Original Issue	L. Rehn	5/2/2014
Rev A		
Rev B		
Rev C		

APPENDIX 1

Typical Deposition Rates for Silicon Oxide and Silicon Nitride Layers

Deposited Film/Layer	Recipe Name:	Gases: SiH ₄ /N ₂ = 425 sccm	
SiO₂	SiO ₂ Deposition	N ₂ O = 710 sccm	
		T = 350°C, p = 1000 mTorr	
		RF power = 20W	
time (min)	thickness (nm)	Refractive Index	
1	42.4	1.4	
2	94.14	1.47	
5	223.1	1.58	
10	478.7	1.5	

Deposited Film/Layer	Recipe Name:	Gases: SiH ₄ /N ₂ = 120 sccm	
SiN_x	SiN _x dep 13nm/min	N ₂ = 900 sccm	
		T = 350°C, p = 600 mTorr	
		RF power = 60W	
time (min)	thickness (nm)	Refractive Index	
2	12.17	2.06	
5	24.2	2	
10	41.48	2.05	
20	75.2	2.15	

Deposited Film/Layer	Recipe Name:	Gases: SiH ₄ /N ₂ = 125 sccm	
Si₃N₄	Si ₃ N ₄ Growth 7.2nm/min	N ₂ = 700 sccm	
		T = 350°C, p = 600 mTorr	
		RF power = 15W	
time (min)	thickness (nm)	Refractive Index	
7	50	1.98	
14	100	1.98	
42	310	1.98	