

# **Standard Operating Procedure**

## *Use of Plasma Enhanced Chemical Vapor Deposition (PECVD)*

**Facility:** Oxford PECVD System  
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**Scope:** This SOP details the general procedure for operation of the departments Plasma Enhanced Chemical Vapor Deposition (PECVD) system.

**Last Revision:** 11/11/2010

### **Introduction:**

PlasmaLab 80plus® PECVD system, made by Oxford Instruments, is a multipurpose tool capable of depositing silicon oxide, silicon nitride, amorphous silicon, and other films (under staff permission). Machine is controlled by a PC that runs the PlasmaLab 800 software. The sample susceptor is 10 inches in diameter that can hold a 6" or 8" wafer or several 4" and smaller wafers for processing. Compound III-V semiconductor material can also be processed in this tool on a carrier wafer. No organic material and/or photoresist-covered wafers are allowed in this tool.

### **Applications:**

PECVD is effective for depositing silicon oxide, silicon nitride, amorphous silicon, Carbon Nanotube Growth, Silicon nanowire etc..

### **System and Experiments:**

Schedule system usage online at [www.egr.msu.edu/erc-cleanroom](http://www.egr.msu.edu/erc-cleanroom)

### **Typical Operation: (for 3000Å of SiO<sub>2</sub> on a Si wafer)**

#### **Safety First:**

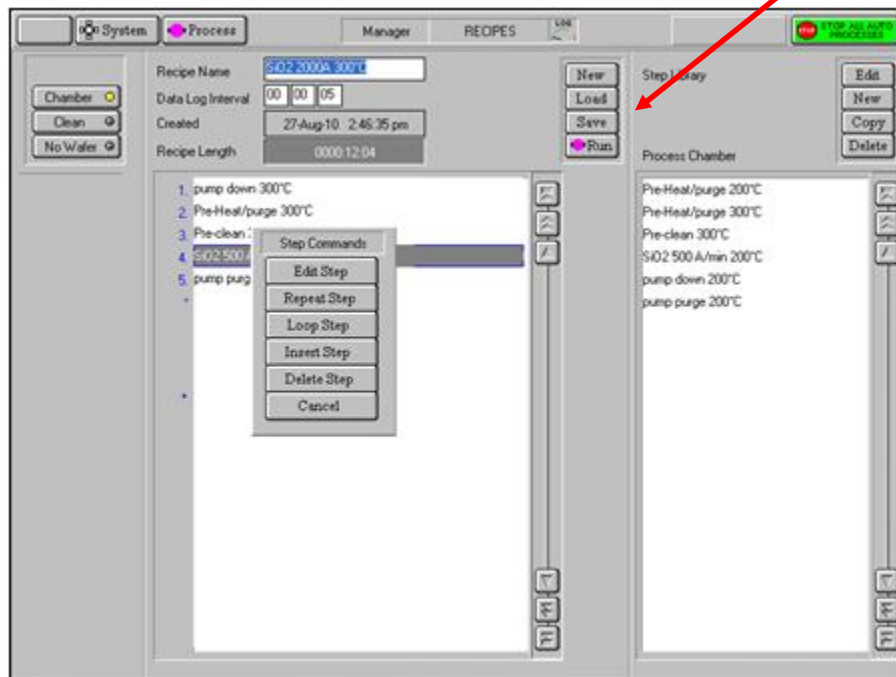
- 1) Within the PECVD system, high voltages are used. Be sure the safety guards on the system are in place, and there are no exposed wires on the system.
- 2) Ultraviolet light emits from the PECVD system while there is a plasma. Avoid staring at it for extended periods of time.
- 3) The sample platen is maintained at 300°C. This can cause burns, melt your gloves, and melt polymer tweezers. Care must be taken to use metal tweezers (often using two tweezers to help get under a wafer), and to not touch the sample platen.

### **Operating Procedure:**

- 1) Log in to the logbook. Include the date, your name, a description of your run, and any difficulties or other comments that help to maintain the system.
- 2) Confirm that the system sample platen is at 300°C by looking at the temperature controller located behind the access panel on the front of the system.
- 3) Turn on the computer. There is no password for the computer. On the login screen, leave the password space blank and just click 'OK'
- 4) If the platen is at 300°C, then you can begin. If it is not at 300°C, then you need to double click on the "Heater ChamberA" desktop icon. When you double click this icon a quick flash of a window appears which sets up the necessary communications between the computer and temperature controller in the system. In the PC2000 software you will need to run Process → Chamber1, then set zero for all gasses, and zero for the LF power and HF power. Set the temperature to 300°C, click the run button. Check that the set point temperature on the system has reset to 300°C. You can now stop the process as this has set the temperature set point, then you would go to System → Pumping, and Stop the pump, and wait for temperature stabilization of the system before starting the full process.
- 5) Double click the PC2000 desktop icon.
- 6) Software login window will appear. Enter your username and password
- 7) Under the System → Pumping submenu, click on the picture of the rough pump to turn it on.
- 8) Then click the Evacuate button.
- 9) After the base pressure is reached, click the Stop button, then the Vent button.

10) Under Process → Recipes → Chamber click the Load button. A library of already saved recipes will appear. Pick a recipe that is, or is near your goal (you can modify the one you load and save it under a new name).

- a. For example one recipe name is: “SiO<sub>2</sub> 2000A 300°C” When this is loaded, you see the following steps in the recipe:
  - i. Pump down 300°C
  - ii. Pre-heat/purge 300°C
  - iii. Pre-clean 300°C
  - iv. SiO<sub>2</sub> 500 A/min 300°C
  - v. Pump purge 300°C
- b. If you wish, you can edit individual steps (such as step 4 above) by clicking on the step. Drag and drop process steps are available on the right of the recipe. After you have made changes, please Save the new recipe under a different filename.



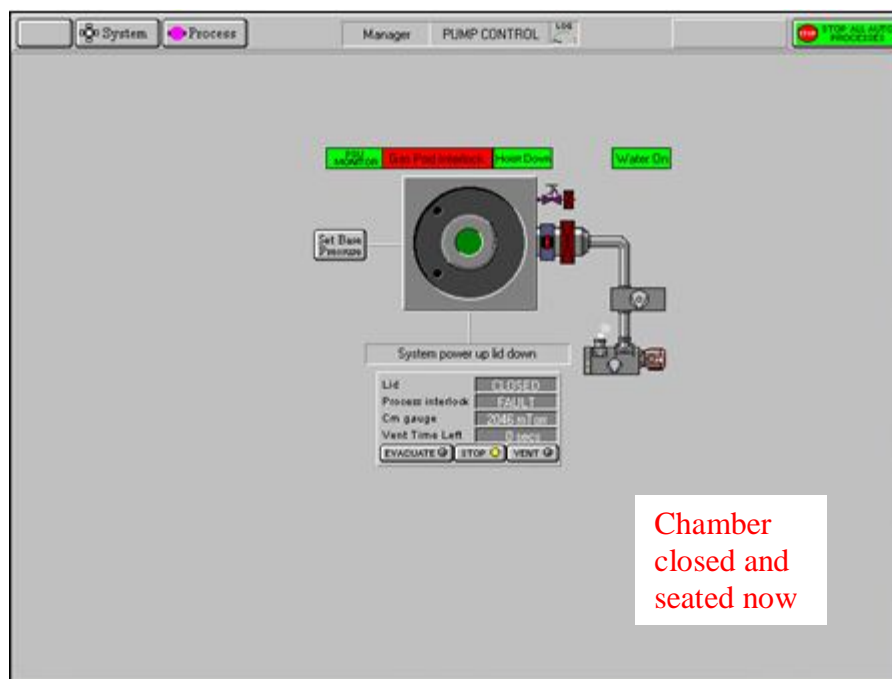
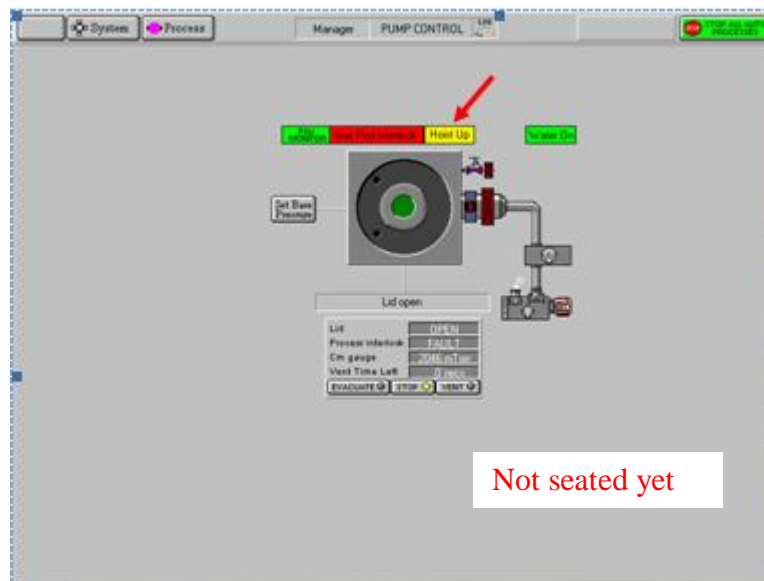
11) Under System → Pumping, press the Stop button (wait for ready). A message “Pumping or venting stopped” should show up in the message line.

12) Press the Vent button (this will take approximately 200 seconds).

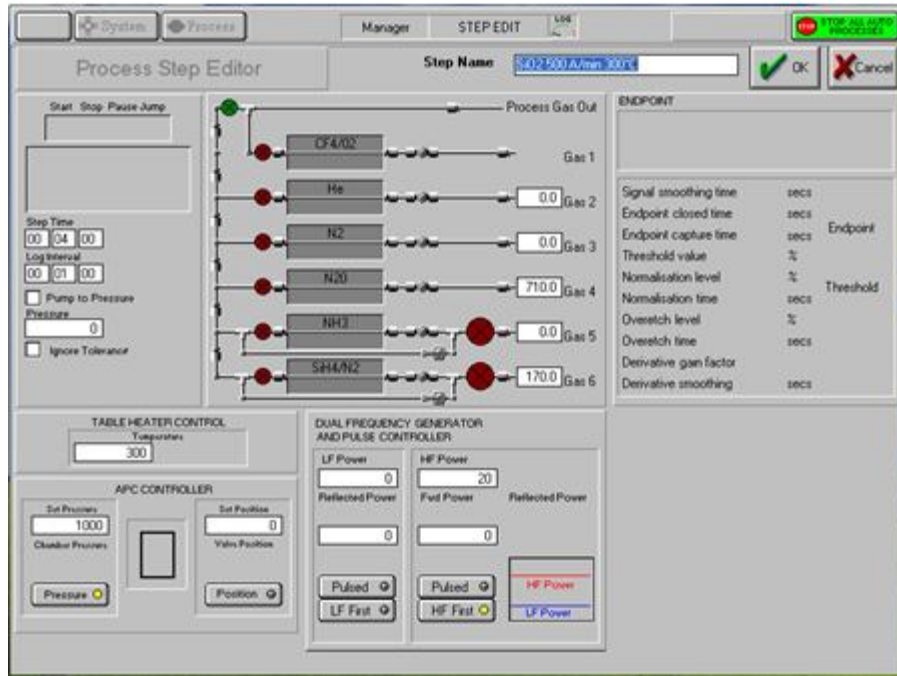
13) Open the chamber by first switching to Chamber Up on the front of the system, then hold down both of the Hoist buttons to raise the chamber cover.

14) Use metal tweezers to place your samples on the stage (BE CAREFUL – THE SAMPLE STAGE IS HOT). The sample stage will burn, melt gloves, and melt plastic tweezers. Use metal tweezers, and do NOT touch the sample stage.

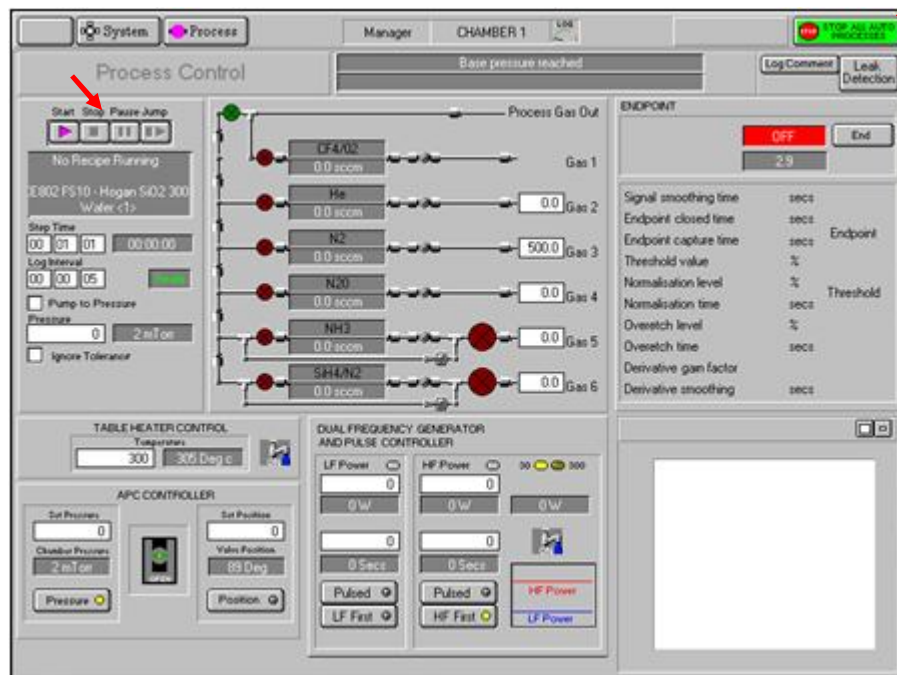
- 15) On the front of the system, switch to Chamber Down, then press down on both of the Hoist buttons to close and seat the chamber. The software indicates when the chamber is properly seated.



- 16) In the software, click the Evacuate button (under the System submenu).
- 17) Under Process → Recipe, verify the loaded recipe is the one you want, then click the Run button. The system will automatically pump to the base pressure. While it is running, the top of the screen in the software will indicate if any parameter is out of tolerance.



- 18) When the process is finished a YELLOW ALERT window shows up on the screen, click "Accept".
- 19) If there is trouble during the run and you feel the process must be shut down, the following methods with increasing severity can be used to shut it down:
  - a. Press the stop button of the ▷ □ || □▷ buttons
  - b. Press the Stop All Auto Processes button in the upper right of the screen
  - c. Press the Emergency Stop button located on the front of the system.



- 20) After the YELLOW ALERT shows up on the screen, and the process is finished, then click on System → Pumping, press the Stop button, followed by the Vent button.
- 21) Wait for the vent process to finish, then click the Stop button.
- 22) On the front of the system, switch to Chamber Up, and depress both Hoist buttons simultaneously to open the chamber.
- 23) Remove your samples (BE CAREFUL – THE SAMPLE STAGE IS HOT). The sample stage will burn, melt gloves, and melt plastic tweezers. Use metal tweezers, and do NOT touch the sample stage.
- 24) Switch to Chamber Down, and hold down on both Hoist buttons to close and seat the chamber.
- 25) Press the Evacuate button.
- 26) Wait for “Base pressure reached” message, then press the Stop button.
- 27) Click on the rough pump image to shut it off.
- 28) Under System → press Exit
- 29) Add any notes to the logbook if needed.