Unaxis PECVD 790

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Unaxis PECVD Operating Instructions

Before starting your work be sure to make an entry into the log sheet. Write the time-in, first name (or initial) and last name, the film you are depositing, process conditions and the cumulative thickness. Please contact Dr. Fay at pfay@nd.edu for training.

Loading a Sample

To open the chamber, select the item "Vent" under the "Utilities" menu. The computer will automatically control the sequence to vent the chamber. When venting is complete the chamber icon on the vacuum diagram will turn blue and say 'Atmosphere'. You can open the chamber lid and place your sample on the platen. Wear gloves whenever your hands go inside the chamber. Close the lid, and select the "Pump Chamber (Lo Vac)" item under the "Utilities" menu, and press down on the chamber lid. The computer automatically executes the pumpdown sequence. Be sure to press down on the chamber lid, or the mechanical pump will try to rough out the room! Just apply enough pressure on the lid to seal the o-ring for 8-10 seconds.

Running a Process

1. Auto Mode
   This mode is used to run preset recipes. To load a process select "Load" under "Process" menu and select the recipe you want.

Silicon nitride	- sinx.prc
Silicon nitride (denser)	- sinn6.prc
Silicon dioxide	- sio2dep.prc
Cleaning chamber	- clean.prc
Seasoning chamber	- season.prc
Cleaning and seasoning	-cl-seas.prc

   After loading your recipe click READY softkey at the bottom of the screen and then click RUN. Clicking OK in the dialog box that appears runs your process. If you are depositing a film you will have to enter the deposition time (you can determine that from the required thickness of your film and its growth rate).

   Note: The system will sound an alarm when your process gets over. Make sure that you are near the system before that happens.

2. Manual Mode
   Use this mode if you have to deposit a layer using your own recipe! To enter the manual mode, select the item "Manual Mode" under the "Service" menu. This brings up a dialog screen where you can set the gas flow rates, pressure and RF power needed for your process.

Follow the steps shown on page # 8 to run your process. If you have to use your process many times you can program it into the computer using item "Build" under the "Process" menu.

When you are finished

Remove your sample and pump down the chamber. Fill out the 'Time Out' and 'Cumulative Thickness' column in the log sheet. Make sure that you leave the system in STANDBY mode by pressing the STANDBY key located at the bottom of the screen.

Cleaning and Seasoning of Chamber

When the cumulative thickness reaches 10,000Å the chamber has to be cleaned. Run the process "clean.prc" to clean the chamber. After cleaning the chamber 1000Å of oxide has to be deposited (without loading any wafer) to season the chamber. Run the process "season.prc" to accomplish this.

System Status Softkeys

ON: This is EQUIPMENT ON mode. The system enters this mode immediately after power up. During this mode the chamber(s) are isolated from the pump(s) by closing of the gate valves. Once the system is in this mode, all modes become accessible.

STANDBY: This button serves two purposes: it leaves the system in a vacuum state under temperature control or it performs STANDBY menu sequences.

READY: This button also serves two purposes: it prepares the system for processing of wafers and it performs the ready menu sequences. Select the READY button to enter the READY mode.

The system is always in one of the above three modes. The ON button is used to return to the EQUIPMENT-ON mode from STANDBY and READY modes. When the button is lit it indicates that the system is trying to attain that status. When a legend is illuminated it has attained or completed the mode.

Process Softkeys

RUN: When this button is selected during a READY state, the system enters the RUN mode.

ABORT: This key is used to exit the RUN mode regardless of what is presently occurring. The system will normally return to the READY mode or the EQUIPMENT-ON mode if aborting under error conditions.

HOLD (User Activated): Pressing the HOLD button requests the machine to HOLD (all gases, RF and pressure control are turned off).

HOLD (Machine Activated): The system is always put in a HOLD condition when an error is detected. After analyzing the problem, press the HOLD button to deactivate it and the machine will try to continue from the point at which an error occurred.

END STEP: By activating this key, the operator activates the termination of the current step and the system proceeds to the next step.

ALARM SILENCE: Press this key when you have to silence the Alarm. You will have to press HOLD key to activate the system again.

Silicon Nitride (Si_3N_4)

Recipe for Nitride Deposition

Flow Rates

SiH_4	: 60sccm
NH_3	: 7.5sccm
N_2	: 1000sccm

Temperature

Heat Exch.	: 60º C
Substrate	: 250º C
Power	: 25W
Pressure	: 1300mT
Growth Rate	: 150Å/minute

When:

Substrate	: 120º C
Power	: 200W
Growth	: 250 Å/minute

When;

Substrate	: 120º C
Power	: 100 W
Growth	: 210 Å/minute

Optical Properties of PECVD Silicon Nitride

(Measured by WVASE 32)

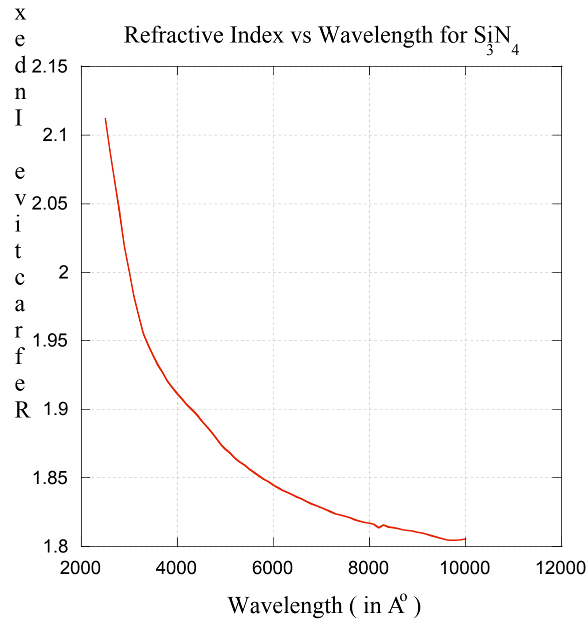

Figure 1. PECVD Silicon Nitride Refractive Index (n)

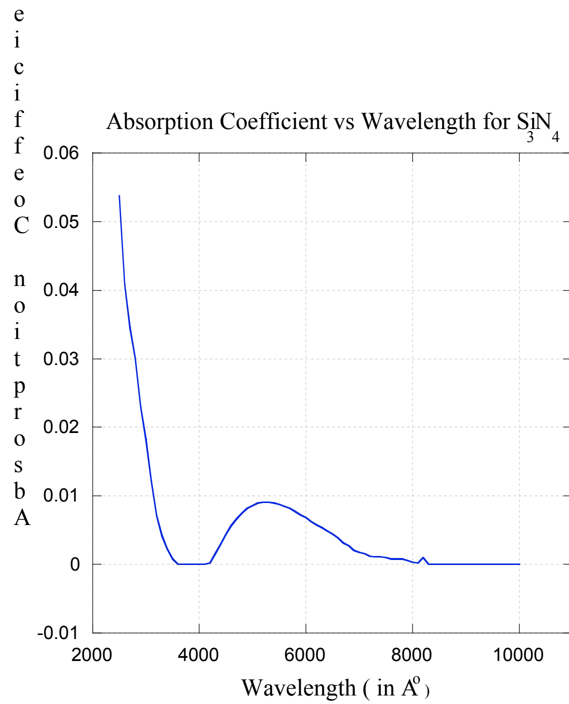

Figure 2. PECVD Silicon Nitride Absorption Coefficient (k)

Silicon dioxide (SiO_2)

Recipe for Oxide Deposition (SiO2dep.prc)

Flow Rates

SiH_4	:	80sccm
N_2O	:	900sccm

Temperature

Heat Exch. : 60º C
Substrate : 250º C

Power : 25W
Pressure : 900mT

Growth Rate : 450Å/minute

When:
Temperature : 120º C

Growth : 360 Å/min

Optical Properties of PECVD Silicon Dioxide
(Measured by WVASE 32)

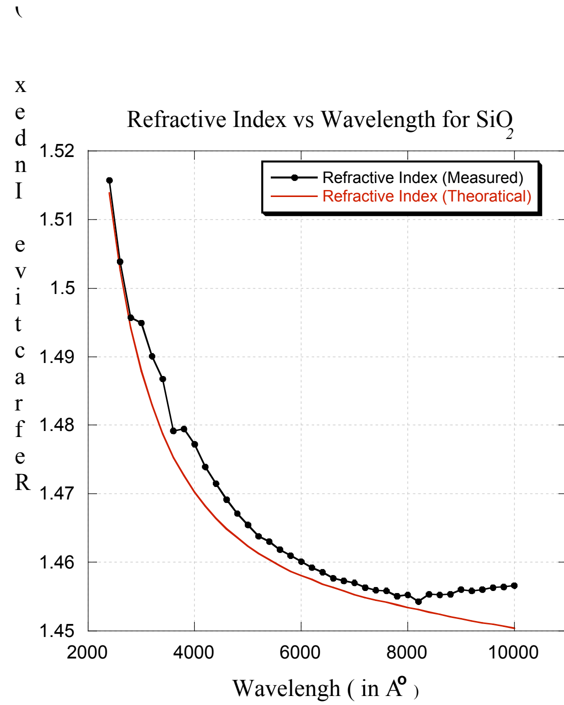

Figure 3. Silicon dioxide refractive index. Comparison of PECVD and thermal oxide values.

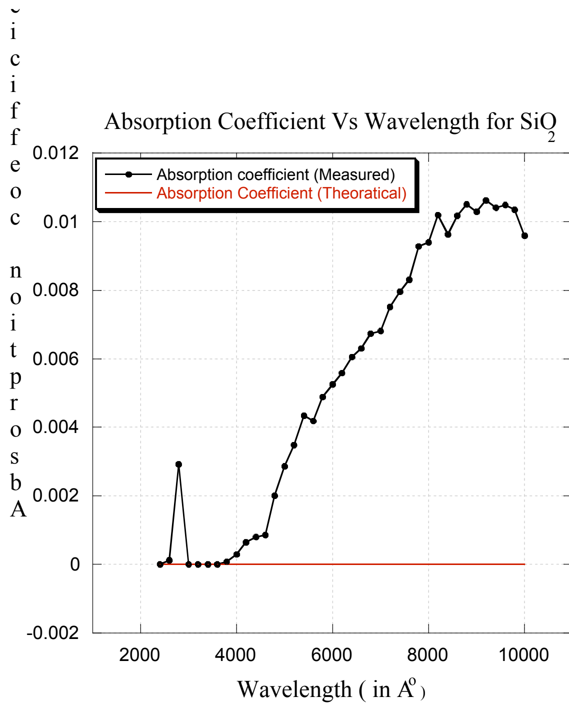

Figure 4. Silicon dioxide absorption coefficient. Comparison of PECVD and thermal oxide values.

Typical PECVD Process Sequence

Step 1: Initial
Setup the process & chamber wall temperature
Pressure = 1.0×10^{-2} Torr
Hold Time = 30 secs
Step 2: N_2 Flush of Chamber
500 sccm Nitrogen Process Gas
Pressure = 200 mTorr
Time = 1 min
Step 3: Process Gas Stabilization
Setup process gas flow rates
Setup process pressure
Time = 30 sec
Step 4: Deposition Step
Same as Step 3 except with RF power and deposition time set
Step 5: N_2 Flush Following Deposition
500 sccm Nitrogen Process Gas
Pressure = 200 mTorr
Time = 1 min
Step 6: Final Pumpdown
Pressure = 1.0×10^{-2} Torr
Hold Time = 1 min

Notes:

1. The typical deposition temperature is 100 to 350 °C.
2. The chamber wall temperature is normally set at 60 °C.