# **Operation of Unaxis ICP-PECVD Deposition**

- 1. Reference Figure 1 for arrows within this procedure.
- 2. Vent the Load Lock via the "Vent Lock" icon.
- 3. Load your sample(s) and a pre-clean substrate into Cassette 2 (the cassette on the right). Ensure the major flat is parallel to and facing the back of the cassette. The system will automatically map the cassettes when you close the door.
- 4. Pump the Load Lock via the "Pump Lock" icon. The icon will change to "Pump Lock" when the "Vent Lock" process is complete.
- 5. Edit Deposition Time and navigate to the "Operations" screen.
- 6. From the "Lot Operations" screen follow steps a-q for "Pre-Deposition Clean & Seasoning" and then your substrates:
  - a. Select Cassette 2.
  - b. Enter a "Lot Name".
  - c. From the "Material ID/ Port Location" list select the substrate that you wish to process.
  - d. From the "Flow Name" list select the flow file that you wish to run (i.e. "LDR SiO2 100C").
  - e. Select "Execute Lot".
  - f. The selected wafer will now be removed from the "Material ID/ Port Location" menu list.
  - g. Once the chuck temperature has reached process set-point the system will begin running. If the actual temperature is different than your required process temperature it may take a while attain your desired temperature so please be patient.
- 7. When the system has completed processing it will prompt you with an audible indicator and the Signal Tower will flash yellow.
- 8. Repeat steps 5-7 until all of your substrates have finished processing.
- 9. Vent the Load Lock, via the "Vent Lock" icon.
- 10. Remove your substrate(s), insert an AIN cleaning wafer into the cassette and run the "PM3 Post-Dep Clean".



# Load Sample(s):

- 1. Reference **Figure 1** for arrows within this procedure.
- 2. Remove Cassette #2 (the cassette on the right).
- 3. Place your sample(s) onto a carrier wafer at the center.
- 4. Hold the carrier wafer at the edge opposite the major flat using tweezers, and insert the carrier wafer all of the way to the back of the slot (otherwise, the be parallel to the back of the cassette (The side without pins).
- 5. Put the cassette back to the holding position (the pin side of the cassette should be facing the LM chamber).
- 6. Close the door gently and click on the "Pump Lock" icon.

carrier wafer will be broken inside of the process module). The major flat should

Edit Deposition Time:	<u>Category Filter</u> <u>Ste</u>
<ul> <li>From main screen, click on "EDITORS" icon.</li> </ul>	
<ul> <li>Focus on PM3 and select "Fdit Step"</li> </ul>	SiN Process(2%SiH4-No-Ar) 🕥 SiN 50C-12
• Select the appropriate "Category Filter" i.e. "Low-stress SiN Process(100% SiH4)"	"Low Stress No Ar" SiN 100C-1
See list below for other ontions	SiN 250C-
See list below for other options.	
• Select the appropriate step from the Directory of Process Steps .	
i.e. SIN Dep 100C(100% SIH4)".	
• Edit the "process Time" using the deposition rates on the paper posted on the	Medium Stress No Ar - SIN 1000-3
right side of the system for your calculation and select "SAVE STEP". Select	CSIN 250C-
the " <b>Return</b> " icon.	
	SiN 50C-5
	"High Stress No Ar"┤ SiN 100C-5
	LSiN 250C-
Vent         Image: Stop         11/20/2007         11:07:12         UCSB         User: process         R3.5.6.1           PM1         PM3         LOT	
Lock Pressure 0.0 T 1.2e-4 T All Lots ¥	Low-stress SiN Process(100%SiH4) SiN
Stop openations     Overview     Stade     Intel Proparing       11 mT     Sequence     SF6 clean SiN (0-1     0%	SiN
Edit Process Step for PM3 Category Filter Category Name Process Step Name: Input Value: Author:	SiN
Low-stress SiN Process(100%SiH4) ¥ Low-stress SiN Process(1 SiN Dep 100C(100%SiH4) NC	
Directory of Process Steps Name Setpoint Units Max Min Error+ Error- Warn+ Warn-	madium strace SiNI Process(100% SiHA) SiNI
lowstrSiN Cap 100C(100%SiH4)	<u>(illediuli)-Silless Sill Fl 0Cess(100 % SiFi+)</u> <u>Silv</u>
SiN Dep 250C(100%SiH4)         Temperature1Temperature2Etpt         40.0         degC         70.0         0.0         0.0         0.0           SiN Gas Stab. 100C(100%SiH4)         Temperature2Temperature2Etpt         100.0         degC         70.0         0.0         0.0         0.0         0.0	
SiN (gaition 100C/100%SiH4)         Temperature3TemperatureSetpt         40.0         degC         60.0         5.0         0.0         0.0         0.0           SiN lgnition 200C/100%SiH4)	<u>51N</u>
HeliumCoolerPressureSetpoint 5000.0 mTorr 10000.0 0.0 0.0 0.0 0.0	
RF1C0ntrolwode     Power       RF10CBiasSetpoint     0.0       vots     1000.0       0.0     0.0       0.0     vots       0.0     0.0       0.0     0.0       0.0     0.0       0.0     0.0       0.0     0.0       0.0     0.0	
RF1ReflectedPowerSetpoint         0.0         waits         000.0         0.0         0.0         0.0         0.0	<u>SiO2 Process (100%SiH4)</u> <u>SiO2</u>
RF2ControlMode     Power	"Low Dep Rate" $\prec$ <u>SiO2</u>
RF2ForwardPowerSetpoint         800.0         watts         1000.0         0.0         0.0         0.0         0.0           RF2ReflectedPowerSetpoint         0.0         watts         100.0         0.0         0.0         0.0         0.0	L <u>SiO</u> a
AMN1ControlMode Auto	
AMN1TuneSetpoint         0.0         percent         100.0         0.0         0.0         0.0           AMN1LoadSetpoint         0.0         percent         100.0         0.0         0.0         0.0         0.0	⊂ SiO
DELETE SAVE STEP	"High Den Rate" - SiQ
	SiO
	C <u>310</u>
EDIT STEP EDIT SEQUENCE EDIT FLOW CAMERA POSITION SECURITY ADMIN RETURN	

<u>(Figure 2)</u>

#### ep

120W-2%SiH4 No Ar -120W-2%SiH4 No Ar -120W-2%SiH4 No Ar

50W-2%SiH4 No Ar -50W-2%SiH4 No Ar -50W-2%SiH4 No Ar

5W-2%SiH4 No Ar -5W-2%SiH4 No Ar -5W-2%SiH4 No Ar

<u>) Medium Stress 50C (100%SiH4)</u> <u>) Medium Stress 100C (100%SiH4)</u> <u>) Medium Stress 250C (100%SiH4)</u>

02 LDR 50C (100%SiH4) 02 LDR 100C (100%SiH4) 02 LDR 250C (100%SiH4)

02 HDR 50C (100%SiH4) 02 HDR 100C (100%SiH4) 02 HDR 250C (100%SiH4)

# SiNx and SiO2 with Argon Rate Table

### SiNx (Low Stress) 100%SiH4

Flows: SiN Low Stress (50C,100C,250C) (100%SiH4) **Category:** Low-stress SiN Process(100%SiH4) Step: SiN Low Stress (50C,100C,250C) (100%SiH4)

Substrate Temperature	50C	100C	250C
Dep Rate (Å/min)	0	310	344
Seconds/1000Å	0	194	175

#### SiNx (Medium Stress) 100%SiH4

Flows: SiN Medium Stress (50C,100C,250C) (100%SiH4) **Category**: medium-stress SiN Process(100%SiH4) Step: SiN Medium Stress (50C,100C,250C) (100%SiH4)

<u>Substrate Temperature</u>	<u>50C</u>	100 <i>C</i>	250C
<u>Dep Rate (Å/min)</u>	0	412	397
Seconds/1000Å	0	146	151

### SiO2 (LDR) - Low Dep Rate

Flows: SiO2 LDR (50C,100C,250C) (100%SiH4) **Category**: SiO2 Process (100% SiH4) **Step**: SiO2 LDR (50C,100C,250C) (100%SiH4)

<u>Substrate Temperature</u>	<u>50C</u>	100C	<u>250C</u>
<u>Dep Rate (Å/min)</u>	375	382	383
<u>Seconds/1000Å</u>	160	157	157

### SiO2 (HDR) - High Dep Rate

Flows: SiO2 HDR (50C,100C,250C) (100%SiH4) Category: SiO2 Process (100% SiH4) Step: SiO2 HDR (50C,100C,250C) (100%SiH4)

<u>Substrate Temperature</u>	<u>50C</u>	100C	250C
<u>Dep Rate (Å/min)</u>	1145	1137	1044
<u>Seconds/1000Å</u>	53	53	58

# SiNx and SiO2 with He Rate Table

### SiNx (Low Stress 2%SiH4 No Ar)

Flows: SiN (50C,100C,250C)-120W-2%SiH4 No Ar Category: SiN Process (2%SiH4-No-Ar) Step: SiN (100C, 50C, 250C)-120W-2%SiH4 No A

SIN (100C, 50C, 250C)-120V	/-2%5IH4 N0	Ar	
<u>Substrate Temperature</u>	<u>50C</u>	100 <i>C</i>	250C
<u>Dep Rate (Å/min)</u>	249	170	159
Seconds/1000Å	241	353	377

### SiNx (Medium Stress 2%SiH4 No Ar)

Flows: SiN (50C,100C,250C)-50W-2%SiH4 No Ar **Category:** SiN Process (2%SiH4-No-Ar) Steps: SiN (100C, 50C, 250C)-50W-2%SiH4 No Ar

Substrate Temperature	<u>50C</u>	100 <i>C</i>	250C
<u>Dep Rate (Å/min)</u>	289	219	212
Seconds/1000Å	207	274	283

### SiNx (High Stress 2%SiH4 No Ar)

Flows: SiN (50C,100C,250C)-5W-2%SiH4 No Ar **Category:** SiN Process (2%SiH4-No-Ar) **Steps:** SiN (50C,100C,250C)-5W-2%SiH4 No Ar

<u>Substrate Temperature</u>	<u>50C</u>
Dep Rate (Å/min)	300
Seconds/1000Å	200

#### SiO2 (2%SiH4 with He)

Flows: SiO2 (100C,50C, 250C)-5W-2%SiH4-No Ar **Category:** SiO2 Process(No-Ar-2%SiH4) Steps

<b>s:</b> SiO2 (100C,50C, 250C)-5W·	-2%SiH4-No /	٩r	
<u>Substrate Temperature</u>	<u>50C</u>	100 <i>C</i>	250 <i>C</i>
<u>Dep Rate (Å/min)</u>	303	336	319
Seconds/1000Å	198	179	188

100C 237 253	250 <i>C</i>
237	209
253	287

# Pre-Deposition Clean & Seasoning:

- 1. From the "Lot Operations" screen select one of the clean & seasoning flows, and follow steps 6-7 of the "Operation of Unaxis ICP-PECVD Deposition" procedure using one of the following "Flows".
- 2. To prepare for SiNx film at 250 °C, select "SF6 clean & SiN seasoning-250C".
- 3. To prepare for SiNx film at 100 °C, select "SF6 clean & SiN seasoning-100C".
- 4. To prepare for SiO2 film at 250 °C, select "SF6 clean & SiO2 seasoning-250C".
- 5. To prepare for SiO2 film at 100 °C, select "SF6 clean SiNx & SiO2 seasoning-100C".
- 6. Click on "Execute Sequence".



(Figure 3)

## PM3 Post-Dep Clean:

- 1. Reference "Figure 3" and "Figure 4" on the next page for colored arrows within this procedure.
- 2. From the "Edit Flow" screen dit the "PM3 Post-Dep Clean" flow list. **Sequence**" under "View Options" must be selected.
- 3. From the "Edit Step" screen select "Post Dep Clean" from the Category Filter list. Select the step "SF6 Clean Post Dep" (ZZZZ) and edit the
- ICP-PECVD Deposition" procedure using the flow "PM3 Post-Dep Clean".

		11/20/2	000 14-22	40 UC	SB	llea	r. nroco	22	B24
M 🔒 🕇 Vent	CTOD	1 - 1730/2	009 14:52	249 UC DM1	.30	DM3	i. proce	35	LOT
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		Sta	tus	Idle		Idle		% (	 Comp
📲 🚽 🕈 🕈 🕈 🕈		Sequ	ence						0%
	Edit Process Sten	for PM3							
Category Filter	Category Name Pro	ocess Step I	Name:		Input Value	: Auth	or:		
Post Dep Clean 🖌 📕	Post Dep Clean 🛛 🞽 S	F6 Clean Po	st Dep		3000.0	) TB			
Directory of Process Steps	Name	Setpoint	Units	Max	Min	Error+	Error-	Warn+	Warn
SE6 Clean Post Den	Process Time	> 3000.0	s	3.1536e7	0.0	0.0	0.0	0.0	0
SF6 O2 Clean Final Pump	Pressure	15.0	mTorr			0.0	0.0	0.0	0
SF6 O2 Clean Gas Stab									
SF6 O2 Clean Inititial PD	Temperature1	40.0	degC	70.0	0.0	0.0	0.0	0.0	0
SF6 O2 Flush	Temperature2	50.0	degC	350.0	0.0	350.0	40.0	350.0	40
SF6 O2 Light Step	Temperature3	40.0	degC	60.0	5.0	0.0	0.0	0.0	0
SF0 OZ LIGHL Step 2-1	HeliumCoolerPressureSetpoint	5000.0	mTorr	10000.0	0.0	0.0	0.0	0.0	0
	DE1 Mode	Power							
	RE1 DCBias	0.00	volts	1000.0	0.0	0.0	0.0	0.0	0
	RF1 Forward Power	20.0	watts	600.0	0.0	0.0	0.0	0.0	0
	RF1 Reflected Power	0.0	watts	100.0	0.0	0.0	0.0	0.0	0
	RF2 Mode	Power							
×	RF2 DCBias	0.0	volts	2000.0	0.0	0.0	0.0	0.0	0
	RF2 Forward Power	900.0	watts	1000.0	0.0	0.0	0.0	0.0	0
DELETE SAVE STEP	RF2 Reflected Power	0.0	watts	100.0	0.0	0.0	0.0	0.0	0
STEP(S)									
				RR			<	<b>þ</b>	A

(Figure 4)

and verify the Sequence "Post Dep Clean" is loaded into PM3 in the "Current Flow" deposition thickness. SiNx etches at 20nm/min and SiO2 etches at 40nm/min. 4. From the "Lot Operations" screen follow steps 6-7 of the "Operation of Unaxis

## Editing a Flow:

- 1. Navigate to the "Editors" screen.
- 2. Select "Edit Flow" at the bottom of the screen.
- 3. Select the "Flow" to be edited from the flow list.
- 4. Click on "PM3" in the "Current Flow" field.
- 5. Select the appropriate "Category Filter".
- 6. Select the desired "Sequence" from the sequence list.
- 7. If you are saving a custom flow make sure to rename the flow in the "Flow Name" field.
- 8. "Save" the new flow. If you are saving a standard flow like "PM3 Post-Dep Clean" then do not rename it.



# Aborting the run:

- 1. Wait until the wafer has loaded into the p
- 2. Select the "Stop Operations" icon.
- 3. Select the "STOP PM3 PROCESSING" but
- 4. The "ALARMS" button will turn red, when
- 5. Select "Next Step" then click on the "Rec
- 6. Repeat steps 3-5 until the sequence reach
- 7. Click on the "ALARMS" button to close the
- 8. Select the "MODULE STATUS" icon to re



(Figure 6)

process chamber.
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cover" button.
nes the "Final Pump Down" step.
e "ALARMS" screen. <
eturn to the process status screen. <