

## Dielectric Sputter (SOP)

April 29, 2016

### **Process Capabilities:**

1. Dielectric targets: Hafnium oxide, Silicon dioxide, Zinc oxide, Zinc Magnesium Oxide
2. Gases Involved: Argon, Oxygen, Nitrogen
3. Base Pressure:  $5 \times 10^{-5}$  mbar
4. Wafer Size: 2inch
5. Operating Pressure:  $2 \times 10^{-2}$  mbar
6. Target Size: 125mm dia. Circular disc, 5mm thick with copper backing plate
7. Sputtering Distance: 14 cm
8. 2 RF power supplies with matching networks
9. RF matching can be manual or auto

### **Checklist before turning ON the system:**

1. Make sure from the logbook that your required target is in the process chamber of the system. If your required target is not in the chamber, you can ask the system owner or the operator of the system to change the target. Do not switch ON the system without confirming the same.
2. Make sure about the planned electrical shutdown. If it is within 2hrs, don't plan your process.
3. Wear Hairnet, facemask and gloves while handling your sample.
4. Check for water flow from micro-1 chiller.
5. Check the nitrogen cylinder pressure for your process.
6. Check for the RF power connection to required target: HfO<sub>2</sub> & SiO<sub>2</sub> use the same RF connection (matching unit and RF source marked 2), ZnO has separate connection (matching unit and RF source marked 1)

### **Gases used in the system:**

1. Nitrogen is used for operating pneumatic solenoid valves so it can be commercial or 5N pure.
2. Argon & Oxygen is used as sputtering gas in the process chamber (5N pure)

## **Switching ON the tool**

1. Switch ON the main power supply.
2. Switch ON the MCB on the control panel.
3. Switch ON the 24 DC volts supply.
4. Switch ON the turbo, rotary, gauge.

To load sample for processing:

1. The substrate holder of process chamber must be in position 1 and must be in down position.
2. Open the load lock chamber. Place the sample on the substrate holder.
3. Place the substrate holder on the substrate arm.
4. Close the load lock chamber.
5. Switch ON the load lock chamber rough valve. (wait for 10 mins)
6. Open the slit valve.
7. Push the substrate arm into the process chamber.
8. When the substrate arm is above the substrate holder in process chamber, take the substrate holder to UP position. (Make sure it is properly aligned)
9. Pull back the substrate arm to load lock chamber.
10. Close the slit valve.
11. Switch OFF the load lock rough valve.
12. Bring the substrate holder to DOWN position. Rotate the substrate holder to the desired target (Position 1, 2 or 3).
13. Bring the substrate holder to UP position.
14. Start the rough valve of the process chamber. Check the process chamber pressure in the pirani gauge. Do not keep it open for a long time. (wait for vacuum to reach  $3.9 \times 10^{-2}$  mbar)
15. Now close the rough valve of process chamber and switch ON the foreline valve.
16. Switch ON the turbo pump. Wait for the speed of the turbo to reach 37krpm. As the turbo reaches 37krpm, it would show Normal Operation.
17. Open the gate valve to 100%. (Please do not open the gate valve beyond the arrow mark)
18. Check the pressure in Penning Gauge. Wait for the vacuum to reach  $5 \times 10^{-5}$  mbar. Do not keep it ON for long time.

19. Now close the gate valve to 70%.
20. Open the Argon cylinder and set the gas flow to 2bars. (Switch ON the pirani gauge)
21. Switch ON the process gas valve. Set MFC to get required pressure in the chamber.
22. Switch ON the RF generator and set the required RF power. Switch OFF the pirani gauge.
23. Do the deposition as per your process requirement. The plasma should be ON for 10 minutes and then it should be OFF for 10 minutes for the sample to cool (If the total deposition time is more than 10 minutes).
24. Switch OFF the RF generator.
25. Wait till your sample gets cooled. Keep the Argon gas flow ON.
26. Now switch OFF the process gas valve. Close the Argon cylinder.
27. Open the gate valve to 100%. Wait till 5e-5 mbar is achieved.
28. Close the gate valve 100%.
29. Switch OFF the turbo pump.
30. Switch OFF the foreline valve.
31. Switch ON the rough valve of the load lock chamber. Wait for 10 mins.
32. Bring the substrate holder to DOWN position.
33. Bring the substrate holder in position 1.
34. Bring the substrate holder to UP position.
35. Open the slit valve.
36. Push the substrate arm in the process chamber. Align the substrate holder with the substrate arm.
37. Bring the substrate holder Down.
38. Pull the substrate arm out of the process chamber and back to the load lock chamber.
39. Close the slit valve.
40. Switch OFF the rough valve of the load lock chamber.
41. Switch ON the process chamber rough valve.
42. Switch ON the vent valve of the load lock chamber. Wait for the load lock to be fully vented.

43. Unload the sample from the holder.
44. Wait till the vacuum drops to  $1 \times 10^{-2}$  mbar in the process chamber.
45. Switch OFF the rough valve of process chamber.
46. Switch OFF the load lock vent valve.
47. Switch OFF the rotary pump.
48. Switch OFF Turbo power, gauge & MFC, DC power.
49. Switch OFF the MCB from the control panel.
50. Switch OFF the main MCB.
51. Close the Nitrogen cylinder.
52. Make entry in the online log book.

**Caution:**

- 1. While operating the system, make sure that only one of the rough valve or foreline valve is open. Both should never be ON at the same time.**
- 2. In case of power failure, CLOSE the gate valve manually and turn OFF all the switches, the gas cylinders, main supply.**
- 3. Make sure the chiller is ON before turning ON the system and if the chiller goes OFF during process, turn OFF the system immediately.**
- 4. The substrate holder must always be in DOWN position while changing the target position.**
- 5. While depositing, RF power (plasma) should not be ON for more than 10 minutes. There should be a break of 10 minutes with RF power (plasma) OFF.**
- 6. ZnO should never be deposited at RF power more than 100 W.**
- 7. The RF power cable for target position 1(ZnO) is fixed and should never be disturbed. RF power cable 2 is to be interchanged among positions 2(SiO<sub>2</sub>) and 3(HfO<sub>2</sub>).**
- 8. If a sample is fallen in the chamber accidentally, entire chamber must be cleaned using a vacuum cleaner with the help of operator or system owner.**
- 9. The load lock chamber should also be cleaned frequently with a vacuum pump by the operator.**
- 10. The maximum allowed thickness for deposition is 250nm.**