SOP-Sputter Orion

Faculty In-charge

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Sample Holders:

There are **3** different Sample Holders for substrates.

1. One Sample Holder is dedicated for photo resist samples marked at back with letter "R".
2. Second one is dedicated for without photo resist samples marked at back with letter "W"..
3. One is used for samples which are placed on chuck using thermal tape marked at back with letter "T".

Training and Authorization Policy:

- Interested students should fill up the new user request form available on CEN website.
- Based on the request one Authorized User(AU) will be assigned to the student. Multiple trainee students can be allowed for a training session.
- One theory + demo session (complete system is demonstrated along with the facilities)
- 1demo session: Student observes the User handling the system
- 3 hands on session: Student handles the system under authorized user's guidance
- 1 practice session: Student handles the system under authorized user's supervision
- Test + viva: Depending on the performance of the student, it will be decided whether he/she needs more practice sessions or can be authorized to use the system independently.

Re-Authorization policy:

If there has been a gap of two month or more for system usage, the user needs to give a demo to the Assigned AU/SO. As per the user's performance, SO decides, if the User needs to undergo any practice sessions and whether he needs give 1) or 2)

1. Viva
2. Practical test + viva

Violation Policy:

1. User should not violate any of the steps mentioned in the SOP.
2. Don't forget to make a log book entry for process.
3. Don't try new material and do not make any hardware changes in the system without system owner's permission.
4. User should activate and then use the slot that he/she has booked.
5. If you measure the thickness, resistivity or other characterization parameters of the metal deposited, you have to report it to the operator and in the log book. Please measure the thickness at the center, right and left.

If it is found that user is not following the above rules and regulations, then his/her authorization may be canceled or any other punishable measure can be taken after discussion with faculty in charge of this tool.

Cleaning Protocol:

1. Use lint free cloth and IPA only.
2. Clean the instrument body, working table with IPA soaked cloth.
3. Clean the tweezer and Substrate holders.
4. Please take care of the cables while cleaning the system and the area nearby.

If any problem arises in the system while you are working: Please make a note of it in the logbook Call the system owner and inform him. Place a note near the system. Inform the users who have booked the next slots (mail/phone) Please do not try anything to rectify the problem unless you are with an experienced AU or SO or you have been instructed by the SO to do so.

Specifications:

1. Target Size: 2”
2. Gases used in the system: O2, Ar, PN2
3. Substrates used: Si, Ge, Quartz
4. Substrate size: Small samples, 2” and 4” diameter wafer.
5. Substrate temperature: Room temperature to 850 C

Materials that can be deposited:

Cr,Au,Ti,Pt,Fe,Co,Ag,W,Ta,Ni,NiFe,SiO2,MgO,Nb,Gd ,SnGe and Cu.

Check the following facilities before using the system:

1. After coming inside the Nano lab–
   (a) Check the “Mains Power” of the Main
   (b) Chamber from the front panel on the tool.
   (c) Check the 4 water chiller valves at backside of panel.
   (d) Check the water chiller valves for the tool and bypass .
   (e) Check the 4 green LEDs at the backside of the tool. If any LED is not glowing, slightly close the bypass valve and make sure all LEDs are glowing.
2. Turn ON the required process gases. Set the pressure of gases to -10 psi.
3. The Gate valve between the Main chamber and Load lock chamber should be closed.
4. Turn on the N2 valve for venting .

Loading process:

1. Turn OFF the load lock chamber vacuum pump. Wait for the load lock chamber to come to atm. pressure (760 Torr).
2. Take the lid off and keep it on the 3 rest points.
3. Place the sample on the sample holder.
4. Place the holder in the load lock chamber, taking care of the screws provided on the transfer arm to place the holder correctly (in "Y" position toward main chamber).
5. Place the lid properly and turn on the load lock vacuum pump.
6. Wait for the pressure to reach 5e-5 Torr.(On load lock gauge)
7. Open the gate valve between main chamber and load lock chamber.
8. Check if the position of the substrate height adjustment knob is below the bottom mark (position "Ch"=24 on the substrate height adjustment knob). If not, then rotate the knob in anti-clockwise direction until it reaches below the bottom mark.
9. Rotate the rotator to L position (on substrate rotator).
10. Move the transfer arm into the main chamber.
11. Rotate the substrate height adjustment knob in clockwise direction until it reaches below the upper mark ((position "Lh"=35).
12. Rotate the rotator to E position (on substrate rotator). If it does not rotate then adjust the height adjustment knob a bit and then again rotate the rotator to E position.
13. Rotate the substrate height adjustment knob in anti-clockwise direction until it reaches below the bottom mark (position "Ch").
14. Check if the substrate holder is placed properly on the substrate carrier .
15. Move the transfer arm into the load lock chamber.
16. Close the gate valve between main chamber and load lock chamber.
17. Fix the substrate height adjustment knob to desired position (according to your deposition).

Sputtering Process:

1. Turn on the CEN sputter (orion) Laptop and press Remote controller on front panel of sputter system.
2. Start the Phase2j software and enter the password. You will see the SYSTEM

   CONFIGURATION page as shown in fig(1).

   (a) Set STPT value to 10 and turn on the Ar gas flow shown by arrow (b) in fig (2).
   (b) Set the pressure to 30 m Torr using the "pressure" button (a) show in fig(2) for Plasma generation.

(c) Select the gun according to your desired target. (e.g. Ru target shown by arrow (d) in fig(2))

(d) Set the forward power in the STPT shown by arrow (c) in fig(2) with the Ramp time=(forward power/10) sec.

(e) Turn on the "OUT PUT" button.

(f) After the plasma strikes, set the process vacuum to desired value using "pressure" button.

(g) Start the deposition by pressing "closed" button.

(h) If you want to rotate the substrate during the deposition for uniformity, you can turn on the substrate rotator using the "rotation" button as shown by arrow (r) in fig(2)

(i) Do the deposition as per your thickness requirement.

(j) After deposition, close the shutter. Set the forward power to 0 with the same ramp time.

(k) Turn off the "OUTPUT" button.

(l) If you want to deposit another material just after this, repeat the steps 2-10.

Automatic operation method:

(a) Press the " create layer" button on "computer control" interface shown in fig(2) .

(b) Select the respective parameters according to your recipe .(eg.- Bias strike has been shown in fig(3).)If the load lock chamber vacuum pump is off, turn it ON and wait for the pressure to reach 2e-6 Torr and ensure that the PN2 valve near the system is OFF.

(c) Open the gate valve between the main chamber and the load lock chamber.

(d) Check if the position of the substrate height adjustment knob is below the bottom mark (position "24"). If not, then rotate the knob in the anti-clockwise direction until it reaches below the bottom mark (position "24").

(e) Check if the rotator is in L position, if not, then rotate the rotator to L position.

(f) Move the transfer arm into the main chamber.

(g) Rotate the substrate height adjustment knob to upper position (position "37" the substrate height adjustment knob).

(h) Rotate the rotator to E position (on substrate rotator). If it does not rotate then adjust the height adjustment knob a bit and then again rotate the rotator to E position.

(i) Rotate the substrate height adjustment knob to upper position (position "24").

(j) Check if the substrate holder is placed on the arm properly.

(k) Move the transfer arm into the load lock chamber.

(l) Close the gate valve between the main chamber and the load lock chamber.

(m) Turn off the load lock chamber vacuum pump. Wait for the load lock chamber to come to atm. pressure.

(n) Take the lid off and keep it on the 3 rest points.

(o) Unload the sample holder and remove the samples.

(p) Place the lid and turn on the load lock chamber vacuum pump.

The turbo pump of the system is always on and is shut down only during maintenance/ any emergency / servicing. So the steps given below should be followed only when any such situation arises and in consultation with the SO.

System Turning ON procedure:

1. Vent the main chamber and load lock chamber using vent valve of the main chamber. (ensure that the PN2 valve is open)
2. After venting the chambers, close the vent valve.
3. Open the gate valve between the load lock chamber and the main chamber and the main chamber and turbo.
4. Turn on the load lock vacuum pump using load lock chamber “main power” and “vacuum pump” switch.
5. Start the turbo using the main chamber “main power” and “vacuum pump” switches when the vacuum reaches 5e-2 Torr (on load lock gauge)
6. Close the gate valve between the main chamber and the load lock chamber.

System Turning OFF procedure

1. Close the gate valve between the load lock chamber and the main chamber.
2. Close the gate valve between the main chamber and the turbo pump.
3. Turn OFF the load lock chamber vacuum pump and the main power switch of the load lock chamber.
4. Turn OFF the main chamber vacuum pump and the main power switch of the main

Target changing Process:

1. Close the gate valve between turbo and main chamber.
2. Close the gate valve between load lock and main chamber.
3. Vent the main chamber using vent valve.
4. Switch off load lock vacuum pump, if it is on (ensure that PN2 knob is open)
5. Open the lid of main chamber.
6. Take 2 bigger screws from required gun.
7. Take the insulator out.
8. Remove the 4 smaller screws from the target ring.
9. Put the copper mesh below target. (Copper mesh is not required in ferromagnetic targets.)
10. Change the target with appropriate spacer .
11. Fix 4 smaller screws with target ring.
12. Put the insulator properly.
13. Fix the two bigger screws .
14. Put the lid of main chamber properly.
15. Open the gate valve between load lock and main chamber.
16. Switch on the load lock chamber vacuum pump.
17. Wait till the vacuum reaches to 5e-3 Torr .(on load lock gauge)
18. Close the gate valve between load lock chamber and main chamber .
19. Open the gate valve between main chamber and turbo.
20. Wait till the vacuum reaches to 5e-7 Torr (Ion .....gauge)
21. Now you can load your sample according to loading procedure as mentioned abover