

**Tool Name: EVO 18** <sup>Version 1</sup>

**Authorized Users:** Gayatri, Vishnu kant

**Materials Used:**

Sample holder has facility to mount 9 stubs: Si, Glass,

**Materials allowed :** [needs to be discussed with faculty if any new material to be done]

Powdered samples on case by case basis, Copper, Sample preparation having Na<sup>+</sup>, K<sup>+</sup> ion content

At present we have maintained GPS- general purpose stubs for such samples.

**Sample Size:**

(2 mm x 2 mm x Z ) to (10 mm x 10 mm x Z) [ for surface imaging]

(4 mm x 4 mm x Z ) to (8 mm x 8 mm x Z) [ for cross-sectional imaging]

where Z is the variable substrate thickness (it can vary from 200 microns to 2 mm, depending on the substrate type like: Si / glass substrates. But it should not be more than this range; if it is, consult with SO before loading the samples.

**Training Procedure:**

1. Please send a mail for training as per the format mentioned on the CEN website
2. Please bring the Training log sheet along with you for each session and get it filled from the AU training you.
3. One theory + demo session (complete system is demonstrated along with the facilities)

1 demo sessions –  
1. Student observes the User handling the system  
2. User gives instruction of handling the system practically

1 hands on sessions -Student handles the system under AUser's guidance

1 practice sessions – Student handles the system under AUser's supervision

1 Written test- Depending on the performance of written test it will be decided whether to take another written test or to proceed to next level.

1 Practical test + viva-Depending on the performance it will be decided whether the student needs more practice sessions or can be authorized to use the system independently or not eligible for independent handling (authorization)

**Please submit the training log sheet to the SO conducting your Test**

1-2 days - to complete all the tests.

### **Violation policy:**

1. If there is any mishandling of the system by the AU and it is not reported to the SO on time by the user : he/she will be barred from using the system for 3 weeks and he/she has to attend 2 consecutive cleaning sessions plus one day to assist the facility team in their work.
2. If one fails to attend 2-3 cleaning sessions consecutively that too without informing your cleaning partner or SO, one has to attend back to back cleaning sessions for the next two weeks
3. If the logbook entry is missed, it will be reported to CENIITB as violation.

**Re-Authorization policy:** If there has been a gap of one month or more for system usage, re-authorization needs to be done. The user needs to give a demo to the SO. As per the user's performance, SO decides, if the User needs to undergo any practice sessions and then conduct a Practical test + viva.

### **Cleaning Protocol EVO 18**

1. Use lint free cloth and IPA only.
2. Clean the instrument body, working table with IPA soaked cloth. (To be done carefully)
3. Top cover of the tool should be cleaned by the cleaner with a lint free cloth under authorised user's supervision. Once he is done with the top cleaning please ask him to keep the stool out of the lab.
4. Clean all the tweezers, holder and stubs..
  - Please take help of cleaners wherever necessary.
  - Please take care of the cables and boxes while the cleaner is cleaning the system and the area nearby.

### **N2 Cylinder Change**

- If the pressure is less than 10 kg/cm<sup>2</sup> inform the facility team member to replace it
- After replacement set the line pressure to 4 - 6 kg/cm<sup>2</sup> and 2.5 -5 psi (N2 gas regulator)
- Then start your process.

### **Common Errors observed while using the system:**

#### **Yet to be observed**

### **If any problem arises in the system while you are working:**

- Urgently call either of the system owners and inform them about the same.
- Please Make a note of it in the logbook.
- 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.

- If there is a sudden power cut off, then stop the imaging, switch off the beam and turn off the system as usual.

## SOP

1. To check all the facilities required by the system
  - a. Status of the UPS
  - b. N<sub>2</sub> cylinder: Switch on the N<sub>2</sub> supply to the system using cylinder key and check:
    - i. Cylinder pressure (> 10 kg/cm<sup>2</sup>)
    - ii. Line pressure (4 - 6 kg/cm<sup>2</sup>) and 2.5 -5 psi (N<sub>2</sub> gas regulator)
  - c. AC is on and set at 22 degree C.
2. Check for any notice about the system present for the next user.
3. Switch on the circuit breaker/ main switch on the connection board.
4. Check if the vibration isolator is properly connected.
5. Press the **yellow** standby button - the vacuum pumps turn on.
6. wait for 2 min
7. Press the **green** button- the system turns on.
8. Start the Smart SEM Software by double-clicking on the smart sem logo icon and put your login username /password required.
9. wear gloves, hair net.
10. Take a clean lint free cloth and place it on the working table
11. Take the sample holder from the box and place it on the lint free cloth and load samples on the appropriate stubs of the sample holder as per the observations to be done i.e. surface/cross-section.
12. Sample height/ area should be under **specified range** otherwise it can hit the the beam column and the BSD detector and severely damage the system during z height change/ rotate/tilt operations.
13. After mounting the samples on the stubs, vent the chamber using the software command and wait for some time to have the gap between the door and the chamber wall. Slowly pull out the chamber door and load the sample holder.
14. Place the holder on the stage, taking care of the stopper and orientation of the holder such that numbers 1,9, 8 are facing towards the user.
15. After loading the sample holder close the door and pump the chamber using pump command.
16. Wait for chamber vacuum 'ready' to reach to the **specified vacuum level**.

17. **Chamber vacuum level:**It should be around  $1 \times 10^{-5}$  mbar ( before switching on electron beam)
18. Meanwhile change the Z (stage height) and position of the sample using the sample stage navigator/ software control as per the observations to be done.
19. **Z-height/working distance(WD):**WD ~ 7.5 mm (for surface imaging), for cross-sectional imaging it should be chosen according to the sample height.
20. Check the EHT voltage (kV) and set it to a value required for Imaging.
21. After reaching the proper chamber vacuum level, switch on electron Beam and don't do anything while beam is being switched on.
22. Make the entry of the start time and chamber vacuum in the log book.
23. Go to SEM mode.
24. Adjust the "brightness" to 50% and adjust the "contrast" if the image is too bright/dark
25. Use the stage navigation/joystick for aerial movement across the sample surface.
26. Adjust the **Z-height (WD)** always using the TV mode to prevent the sample hitting the BSD detector.
27. Observe the sample at lower magnification (50X /100X) in 'pixel avg mode' of scanning and locate a particle on the sample, try to focus the particle.
28. Adjust the required scanning speed.
29. Later try to focus the particle at a higher magnification (2kX/5kX/..)
30. On achieving maximum focus possible, do the Astigmatism correction and Aperture alignment using focus wobble.
31. If there is a need to change the EHT voltage (kV), change it in smaller steps (0.5 kV/step) otherwise there is a chance of filament damage.
32. Do the SEM imaging as per the requirement (magnification/ location).
33. While taking an image, scan the image in 'line integration mode' and at the scan speed '6'. After complete scanning, image will automatically freeze. So save the image using 'save as' option to the desired folder with the desired name.
34. If there is a need of tilting the sample, then first go to TV mode and increase/adjust the gap between sample holder and the BSD detector so that it should not collide during the tilt/rotate operation.
35. After completion of the imaging turn off the beam.
36. Wait for at least 5 min after switching off the beam to vent the chamber and unload the samples.
37. Switching off of the beam should be done before venting the chamber. It's a very important point to remember.
38. Meanwhile you can do other works like: data collection, making the stage at its home position (tilt=0, rotation=0), place the lint free cloth on the working table for placing the sample holder etc.
39. After venting the chamber take the sample holder out and place it on lint free cloth.
40. Now immediately close the chamber door and start pumping it.

41. Remove the samples from the sample holder and put the sample holder in its box.
42. Make the entry of the values of remaining parameters in the log book.
43. After reaching the sufficient chamber vacuum level (sufficient to switch on the electron Beam), close the EM server and exit the programme (software)
44. Log off SEM s/w -> Shutdown the system and put the system in the "standby" mode by pressing the **yellow** button on the front of the system panel.
45. Wait for 2 min and "switch off" the system using **red** button on the front of the panel.
46. "Switch off" the circuit breaker/ main switch on the connection board.
47. "Switch off" the N<sub>2</sub> supply to the system using cylinder key.
48. "Switch off" the tube lights and close door of the room.