

Typical Operating Procedure

Procedure assumes rotary and diffusion pumps are already ON. [Fig 2]

1. Remove Plexiglas cover and place in safe location.
2. Ensure valve lever is set to backing. [Fig 1]
3. Ensure vacuum gauges are OFF.
4. Depress Air Admit button. [Fig 2]
5. Vent with slow source of N₂ gas on south wall of lab. [Fig 3]
6. When fully vented press Air Admit valve. [Fig 2]
7. Carefully place bell jar on "bell jar cradle for Edwards".
8. Close N₂ valve on wall. [Fig 3]
9. Check crystal monitor health (TC/CHK) [Fig 4] (Note: failure ~50%)
10. Open cooling water for crystal half-turn (lower right side) [Fig 5]
11. Remove platen from chamber and attach samples.
12. Add source material(s) as necessary.
13. Rotate boat/rod to contact pad [Fig 6] with source knob. [Fig 7]

Note: Rotation may be difficult. Only turn counter-clockwise.

14. Insert new glass slide in window.
15. Close shutter.
16. Remove debris from sample platen using compressed N₂.
17. Return platen to chamber, aligning shadow on platen to crystal monitor in chamber.
18. Carefully return bell jar to baseplate, press down and twist to seal.
19. Push valve lever [Fig 1] in; turn counterclockwise to roughing.
20. Allow a few minutes to pump to 10⁻¹ on Pirani gauge.
21. Turn valve lever clockwise to backing. [Fig 1]
22. Slowly turn valve lever [Fig 1] further clockwise to roughing to lift plate in bottom of chamber.

Note: System may be left pumping overnight at this stage

23. Ensure penning gauge is on Range 1. Turn gauge ON.
24. When pressure is < 2×10⁻⁵ mbar, switch to Range 2, 3 as needed.
 - Range 1: P = 10⁻² - 10⁻⁵ mbar
 - Range 2: P = 2×10⁻⁵ - 10⁻⁶ mbar
 - Range 3: P = 2×10⁻⁶ - 10⁻⁷ mbar
25. Add liquid nitrogen (LN2) to cold trap (insert metal funnel on left side of system) [Fig 8]
26. Allow pressure to drop to ~1.5×10⁻⁶ using (Range 3).
27. Perform deposition sequence of first material.

Note: See Material-Specific Deposition Notes section.

28. Rotate source knob to second material.
29. Perform deposition of second material, and others as necessary.
30. When deposition is complete, turn pressure gauges off.
31. Turn valve lever [Fig 1] counterclockwise to backing.
32. Turn water off (lower right side of machine) [Fig 5]
33. Allow system to cool for at least 15-30 min.
34. Open N₂ valve on wall. [Fig 3]
35. Depress Air Admit button. [Fig 2]
36. When chamber is vented close N₂ valve on wall. [Fig 3]
37. Press Air Admit button. [Fig 2]
38. Remove bell jar and samples.

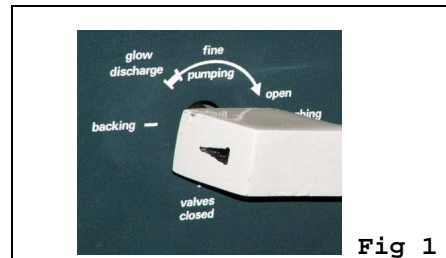


Fig 1

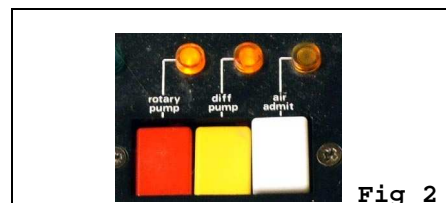


Fig 2



Fig 3



Fig 4



Fig 5

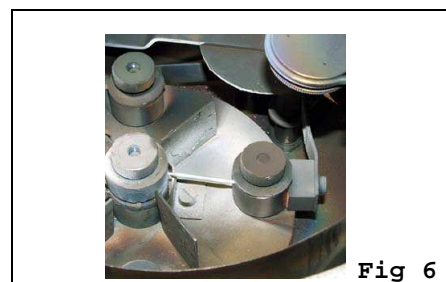


Fig 6

39. Return platen to chamber.
40. Carefully return bell jar to baseplate, press down and twist to seal.
41. Push valve lever in; [Fig 1] turn *counterclockwise* to roughing.
42. Wait 2 min.
43. Rotate valve lever clockwise [Fig 1] to backing.
Note: It is always best to leave vacuum systems under vacuum when not in use for extended periods of time.

Material-Specific Deposition Notes

Chromium

1. Push Thickness 1 [Fig 10] on growth control panel.
2. When program light is on, enter parameters using keypad:
 Density: 720, press E. **Note:** chromium (7.20 g/cm^3)
 z-Ratio: 0305, press E. **Note:** chromium (0.305 z-ratio)
 Tooling: 50, press E. (**50%**)
3. Switch penning gauge to Range 2.
4. Push LT button. [Fig 9]
5. Preheat sequence: [Fig 9]
 - a. Increase power slowly to 50%; remain for 3 min.
 - b. Increase power slowly to 70%; remain for 1 min.
 - c. Increase power slowly to 90%.
6. Press Zero button [Fig 4] and open shutter.
7. Increase power [Fig 9] slowly as needed to maintain rate.
Note: Deposition rate for chromium $\sim 1.5\text{-}2.5 \text{ \AA/s}$.
8. When final thickness obtained, close shutter. [Fig 8]
9. Reduce power slowly to 0%. [Fig 9]
10. Press LT button. [Fig 9]

Indium

1. Push Thickness 1 [Fig 10] on growth control panel
2. When program light is on, enter parameters using keypad:
 Density: 730, press E. **Note:** Indium (7.30 g/cm^3)
 z-Ratio: 0841, press E. **Note:** Indium (0.841 z-ratio)
 Tooling: 50, press E. (**50%**)
3. Turn penning gauge to Range 2.
4. Press LT button. [Fig 9]
5. Preheat sequence: [Fig 9]
 - a. Increase power slowly to 50%, remain for 3 min
 - b. Increase power slowly to 70%, remain for 1 min
 - c. Increase power slowly to 90%
6. Press Zero button [Fig 4] and open shutter.
7. Increase power [Fig 9] slowly as needed to maintain rate.
Note: Deposition rate for indium $\sim 15\text{-}20 \text{ \AA/s}$.
8. When final thickness is obtained, close shutter. [Fig 8]
9. Reduce power slowly to 0%. [Fig 9]
10. Press LT button. [Fig 9]

Note: See Technical Data for Depositing Thin Films Under Vacuum table for additional material information.



Fig 7



Fig 8



Fig 9



Fig 10