

Varian Thermal Bell Jar Evaporator

You may use the evaporator after receiving training. Fill out a log sheet each time you perform an evaporation. When you finish, the system should be left in the cryo-pumped state.

Tungsten or molybdenum boats (with or without alumina coating) are typically used depending on your evaporation material. We recommend that you purchase boats (some available from CCMR) to take with you. Boats should be labeled with boat material and evaporation material, and may be kept in the desiccator if desired. Common evaporation materials are available in the blue cabinet next to the evaporator.

A diagram of the vacuum system is provided on the front of the system body. The system can achieve a base pressure $\sim 10^{-6}$ torr.

To load or unload a sample:

- 1) Make sure the TDK-Lambda power supply power switch is off.
- 2) Close the gate valve (toggle switch down). You should hear it clang closed
- 3) If the ionization gauge is on, press **FILAMENT** on the Terranova controller to turn it off.
- 4) Open the vent valve and allow the system several minutes to come to atmosphere. Gauge A shows the chamber pressure in Torr.
- 5) The bell jar can be lifted by holding the brace that connects it to the bracket on the right; lift it all the way up.
- 6) Load or unload the substrate and/or source material. Do not touch anything inside the bell jar without wearing gloves. Notes:
 - a. The stage may move slightly due to pump vibration or when opening/closing the shutter, so make sure your substrate is seated firmly on (or attached to) the shelf.
 - b. To change the boat, use the small hex driver to loosen and tighten the blocks which hold the boat down. Do not over-tighten them, because this can cause a boat to fracture. There are three slots for boats, and they correspond to the numbers 1-3 on the evaporation power supply from left to right.
 - c. Check to see that the quartz crystal microbalance is working. Change crystal if necessary. Holding down XTAL on the controller will tell how much % is used, replace if failed or around 10% or greater.
 - d. When loading the substrate, make sure that it is not blocking the path from the source material to the quartz crystal monitor. The shutter should be blocking the substrate, but not the quartz crystal.
- 7) Pull the bell jar back down.
- 8) Close the vent valve.
- 9) Open the roughing valve (toggle switch up). Pull the bell jar down with even pressure to insure a good seal between the jar and the flange. You should see the pressure dropping when a good seal is achieved.
- 10) Wait for the pressure to drop to 1 torr. This should take about 3 minutes.
- 11) Close the roughing valve.
- 12) Open the gate valve.
- 13) Turn on the ion gauge by pressing the FILAMENT button on the Terranova controller.
- 14) If done, leave the system in this state for the next user.

Evaporation can be performed with chamber pressures below 10^{-5} torr. See instructions on reverse.

To deposit a film:

- 1) Set up quartz crystal microbalance using the program (PG) function on the Inficon XTC controller, enter or verify the appropriate density, Z ratio, and tooling factor for your material and boat location.
- 2) Verify that the switch is in the appropriate position for the material to be deposited.
- 3) Turn the TDK-Lambda power supply using the large power switch on the left side. After a brief initialization, the left display will read "OFF".
- 4) Click the OUT button to turn the output on.
- 5) The left display indicates the output voltage and the right display indicates the output current. Each side has a dial and a green LED. One LED will turn on, depending on the active control mode. Per the manual:
The power supply has two basic operating modes: Constant Voltage Mode and Constant Current Mode. The mode in which the power supply operates at any given time depends on the Output Voltage setting, Output Current setting and the load resistance.
Slowly turn up the output power to the desired current level for your deposition rate. Notes:
 - a. Turn up the dial corresponding to the active control mode, noting that this may change during operation.
 - b. Slowly ramping up the current is necessary to avoid thermally shocking the boat into fracture.
 - c. Typical current levels for common materials are listed on the front panel or in past logsheets. The necessary current level depends on the material's melting point and will be much lower for organic materials.
 - d. Watch the deposition rate on the XTC and try to stabilize it at your desired rate. When trying to set an exact current/deposition rate, the FINE button can be used to activate fine control mode.
- 6) When the rate is stable at the desired level, open the shutter by moving the lever on the right side of the system, just below the top panel. Simultaneously press the **ZERO** button (not the numeric 0) on the XTC to reset the total thickness reading.
- 7) As the deposition proceeds, adjust the current level if necessary to maintain a steady rate. [This will not be necessary if the power supply is operating in Constant Current Mode.]
- 8) When the desired thickness is reached, close the shutter.
- 9) Slowly decrease the current level back to zero by reversing the process in 4a. Cooling too rapidly may crack the boat/filament.
- 10) Turn the output off by pressing OUT, then turn the power supply off.
- 11) If depositing a stack of multiple materials, repeat steps 1-10 for each material.
- 12) Allow sufficient time for cooling before sample removal (10-15 minutes).

Remove your samples and evaporation material(s).