

## Thermal 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.

A diagram of the vacuum system is provided on the front of the system body. The system can achieve a base pressure  $<10^{-7}$  torr.

### To load or unload a sample:

- 1) Make sure the Variac is turned down to zero and toggle 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. Fix the substrate as the stage may move slightly due to pump vibration or when opening/closing the shutter.
  - 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.
  - c. Check to see that the quartz crystal microbalance is working. If you breathe on the microbalance, humidity should cause the thickness reading to go up, then back down quickly. Change crystal if necessary. Holding down XTAL on the controller will tell how much % is used, replace if failed or around 12%.
  - 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.
  - e. There are three slots for boats, and they correspond to the numbers 1-3 on the evaporation power supply from left to right.
- 7) Pull the bell jar back down.
- 8) 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 will hear air hissing through the vent valve
- 9) Close the Vent Valve
- 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) Turn the knob on the far left of the power supply to point to the appropriate boat location.
- 3) Turn the Voltmeter on to measure the current through the boat. Normally the clampmeter is set to convert 1 Amp of current = 1mV AC. High currents should correspond to the black ammeter on front panel.
- 4) With Variac at zero, turn power ON to activate the power supply.
- 5) Slowly turn the large black knob up to the desired current level for your deposition rate. Notes:
  - a. Slowly ramping up the current is necessary to avoid thermally shocking the boat into fracture.
  - b. Typical current levels for common materials are listed on the front panel or in past logsheets
  - c. The necessary current level depends on the material's melting point and will be much lower for organic materials; in this case, it is advisable to use the clamp meter around the appropriate cable going into the chamber in order to read lower current levels.
  - d. It should be possible to see the boat glowing through the side viewport once the current is at some reasonably high level.
  - e. Watch the deposition rate on the XTC and try to stabilize it at your desired rate. Press **START** if you want to know the elapsed time
- 6) When the rate is stable, open the shutter by turning the knob 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.
- 8) When the desired thickness is reached, close the shutter.
- 9) **Slowly decrease the current level back to zero, then shut the power supply off. Cooling too rapidly may crack the boat/filament.**
- 10) Allow sufficient time for cooling before sample removal, particularly if you will be changing the boat.

Remove your samples, leave the work area cleaner than you found it.