Veeco Thermal Evaporator
Operation Manual
University of Notre Dame

a. Allowed materials:

- Aluminum (shots/pellets)
- Chromium (rods)

b. Standby Conditions

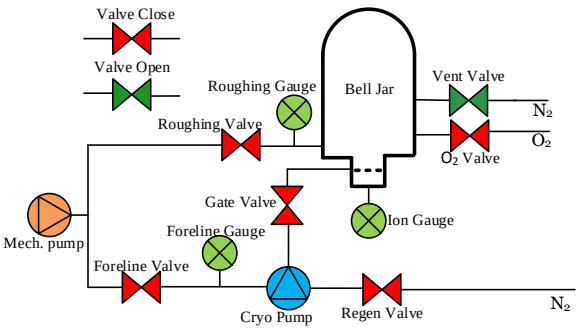
(These conditions allow for the safest and best conditions for the machine, your safety, and the best results for your research)

1. The Bell Jar should be closed and under High Vacuum.
2. Check if the ion gauge is on or not. If the ion gauge is not on then turn on the ion gauge from the gauge controller and ion gauge should read less than 1×10^{-6} Torr.
3. Switches/ Valves that should be illuminated, open, or on in Standby conditions –
    a. Cryo Compressor Breaker On and compressor LED on.
    b. Main switch will be on and LED illuminated.
    c. Gate/Roughing-Foreline-Vent switch is in Gate position and Gate LED on (means gate valve is open).
4. Switches/Valves that should closed or not be illuminated in Standby Mode –
    a. Rough-Foreline/Vent Switch in Vent position
    b. Vent
    c. O_2
    d. Regen.
    e. Mech. Pump
    f. Rough/Foreline switch in Rough position

c. Venting the Bell Jar & sample & source load/unload:

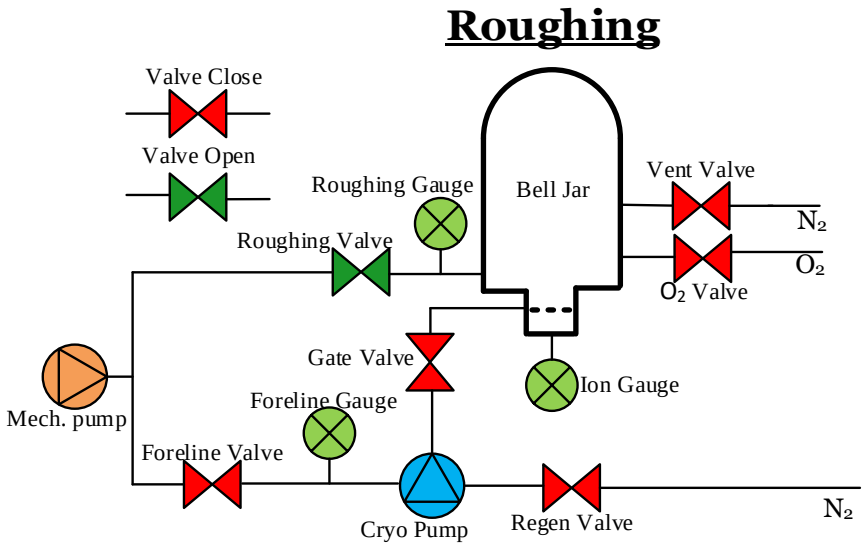
1. Turn the Gate/Roughing-Foreline-Vent switch is in Roughing-Foreline-Vent position. Wait for the Gate LED to go out.
2. Turn the Vent switch on. Vent LED will be illuminated and bell jar would be vented within 2 min. After the bell jar is vented it will pop out and turn off the Vent valve.
3. Make sure a new and clean plastic shield is in place for your deposition.
4. Load/unload the sample and source. If sample is loaded, then follow steps c through g. If sample is unloaded the follow steps c and d. In both the cases make sure the standby conditions are met before leaving the machine.

Venting



d. Roughing the bell Jar:

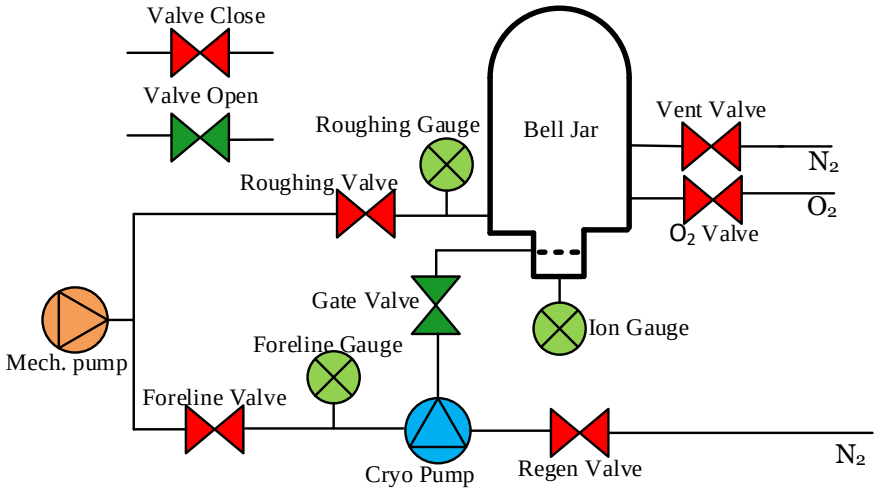
1. Turn the mechanical pump on. LED will be illuminated and wait for 10-20s.
2. The Gate/Roughing-Foreline-Vent switch should be in Roughing-Foreline-Vent position.
3. Switch the Rough-Foreline/Vent Switch in Rough/Foreline position.
4. Switch the Rough/Foreline switch in rough position. The rough LED will be illuminated.
5. Wait until the bell jar pressure in gauge controller come down to ~.5×10^{-2} Torr.
6. Switch the Rough-Foreline/Vent Switch in Vent position. The rough LED will go out.
7. Switch the Rough/Foreline switch in foreline position.
8. Turn the mechanical pump off. Wait for the mechanical pump LED to go out.



e. HiVac/Pump position:

1. Switch the Gate/Roughing-Foreline-Vent switch in Gate position.
2. The Gate LED will be illuminated (means gate valve is open).
3. Wait till the pressure of ion gauge in gauge controller comes ~4×10^{-6} Torr.
4. Turn off the ion gauge.
5. Turn on the O_2 valve switch. Wait for ~5min to pump the residual O_2 of the line.
6. Turn off the O_2 valve switch.
7. Turn on the ion gauge and wait till ion gauge in gauge controller comes ~4×10^{-6} Torr.

HiVac/Pump



f. 1st Evaporation:

1. Program the FTM for desired metal paraments and use a tooling factor of 65.
2. Make sure the sample is tilted at the correct angle for the first evaporation.
3. Turn on the basket power.
4. Slowly ramp up the power to 35-40%. Allow the aluminum/other source to melt and wait to observe the surface oxide/impurities to begin spinning.
5. Evaporate desired thickness of aluminum at > 10A°/s. Slower rates allow the aluminum enough time to significantly alloy with the tungsten basket.
6. Turn off the basket power. Let source cool for 1.5 minutes.

g. Oxidation:

1. Turn on the O_2 switch on board and also open the black O_2 stop valve.
2. The pressure should be ~7.5×10^{-6} Torr.
3. Begin timing. Typical oxidation time is 9-9.5 minutes for junction resistances between 26 kΩ and 1 MΩ, depending on the design.
4. Close O_2 switch and stop valves.

h. 2nd Evaporation:

1. Rotate sample to second evaporation angle. Let system pump for 5 minutes. Make sure the sample is tilted at the correct angle for the first evaporation.
2. Turn on the basket power. Slowly ramp up the power to 35-40%. Allow the aluminum to melt and wait to observe the surface oxide/impurities to begin spinning.
3. Evaporate desired amount of aluminum at > 10A°/s. Turn off the basket power.
4. Let source cool for 5 minutes.

5. Go to Step b.

Regeneration (only after a cryo crash):

1. Wait for the cryo pump to come up to room temperature.
2. Close the gate valve by switching the Gate/Roughing-Foreline-Vent switch in Roughing-Foreline-Vent position.
3. Turn the mechanical pump on.
4. Switch Gate/Roughing-Foreline-Vent in Roughing-Foreline-Vent position. Rough-Foreline/Vent in rough-foreline position. Switch the rough/foreline in foreline position.
5. Keep the system like that for 30min until the foreline pressure gauge shows <30mTorr
6. Turn off the Mechanical pump.
7. Perform a rate of rise test (ROR).
8. If the rate of rise is >10 mTorr/min then do steps 3 through 6.
9. If ROR < 10mTorr/min, Switch the Rough-Foreline/Vent in vent position.
10. Turn on the cryo compressor.
11. Wait for 24 hours to complete the cryo pump regeneration process.