MN Nano Center -- University of Minnesota
Standard Operating Procedure

Equipment Name: Thermal Evaporator

Coral Name:	Thermal-Evap	**Revision Number:**	11
Model:	Various	**Revisionist**:	Bob Amundson
Location:	Bay 3	**Date:**	03/30/2020

1 Description

The Thermal Evaporator evaporates & deposits metal onto substrates. Under vacuum, current is passed through a filament boat, which heats up the metal contained on the boat. When the evaporation current is reached, the melted metal evaporates onto the substrate.

2 Safety

a. The Main Power Supply circuit breaker should be in the OFF position prior to loading the system or switching power to the boats.

3 Restrictions/Requirements

a. Must be a qualified user on the Thermal Evaporator.
b. Wear poly glove when handling the metal or loading samples to prevent contamination.
c. Fill out the log book completely.
d. MNC will supply the following materials:
Ti pellets, Al pellets, Cr sticks, molly boats, Tungsten boats & aluminum oxide boats. Please contact staff if you need to evaporate any other material.

4 Definitions

a. Ion gauge -- measures the pressure of the chamber while under high vacuum (i.e. while using the cryo pump)

5 Setup

a. Check to ensure that the Main Power Supply circuit breaker is in the OFF position.

b. Press IG1 to turn off the ION gauge.

c. Move the High Vacuum valve toggle switch to the CLOSED position.

d. Move the three position selector switch from the CLOSE position to the VENT position. In 8-10 minutes the bell jar will be vented to atmosphere (760 Torr).

6 Operating Instructions

a. Move the three position selector switch from the VENT position to CLOSE position.

b. Raise the Bell Jar by pushing the CABLE IN button on the Hoist control. Only raise the Bell Jar enough to load sample.

c. Turn on the Inficon deposition controller by pushing the ON/STBY switch. If the words CRYSTAL FAIL appear on the LEDt he crystal needs to be replaced, XTAL-1 means the cryatal is good.

d. There are two positions to load 2 separate metals to evaporate. They are labeled 1 and 2 (Nitrile gloves need to be worn). To place the boat between the clamps, loosen the bolt grip with an Allen wrench. Place the boat between the clamps and tighten. With the current source OFF check the cable socket location in the back of the tool it should match the boat post location number.

e. Load the sample onto the stage with the side to receive the depositing facing the boat.

f. CLOSE the Bell Jar by pressing the CABLE OUT button the HOIST control aligning the bell to the base evenly.

g. Move the three position selector switch from CLOSE to ROUGH.

h. When the pressure gauge is reading below 100 mTorr, move the three position selector switch from ROUGH to CLOSE.

i. Perform LEAK UP CHECK by watching the pressure gauge. If it rises more than 10 mTorr in 1 minute, there is a leak.

j. Move the High Vacuum valve toggle switch to the OPEN position.

k. Wait 5 minutes then push the IG1 button then the green LED light will come on.

l. A sufficient vacuum can be reached after 40-60 minutes (6.0 x 10^-6).

m. Turn on the Inficon deposition controller if not still on by pushing the ON/STBY switch. The green LED will light.

n. On the Inficon deposition controller, push the button labeled PROG to toggle the display between PROGRAM and OPERATION modes.

o. Enter the Z-RATIO and DENSITY for the metal by using the up and down arrows and noting where the solid black dot is located. This indicates the parameter that will be updated. Enter the updated value. If you need to change a value, press C (clear).

p. Press Program.

q. Return to the OPERATION screen. Press the RESET: (C button) and the ZERO button to clear the previous deposition thickness.

r. Push START to start monitoring the deposition. Pushing the 2 or the ZERO at any time resets the display thickness to 0. Push STOP to stop measuring and START to restart again.

s. Make sure that the remote current controller is off and the dial is set on 0. This is how you control the power to the boats.

t. Turn the circuit breaker on the power supply unit ON.

u. Turn the remote controller ON.

v. Slowly begin to turn the remote current controller clockwise. Watch the deposition monitor as you turn up the current. Increase the amps by 20 then wait, and let it soak for 2 minutes. Keep increasing by 20 amps and waiting for 2 minutes until you reach your evaporation current/amp. Try to keep the deposition under 10 Å/second. Usually, the lower the deposition rate, the better the film quality. Return to the OPERATION screen. Press the RESET: (C button) and the ZERO button to clear the previous deposition thickness. Use toggle switch to open shutter. When the deposition is complete, close the shutter and turn off the remote current controller

w. If you are depositing another metal, check to ensure that the Main Power Supply circuit breaker is in the OFF position prior to switching the cable to the other position – 1 or 2. Follow the procedure starting at step n. if you are done, go to step x.

x. Once you have completed the deposition, turn off the power supply, the Inficon deposition monitor and the ION Gauge tube.

y. Cool Down: Wait 30 minutes prior to venting.

z. Move the Hi Vacuum valve toggle switch to the CLOSE position.

aa. Move the tree position selector switch from CLOSE to VENT. In 8-10 minutes the bell jar will be vented to atmosphere (760 Torr).

bb. Move the three position switch from VENT to OFF and remove the substrate.

cc. CLOSE the bell jar by pressing the CABLE OUT button on the HOIST control, aligning the bell to the base evenly.

dd. Move the three position switch from OFF to ROUGH.

ee. When the Teledyne pressure gauge located on top of the Inficon deposition controller is reading below 100 mTorr move the three position selector switch from ROUGH to OFF.

ff. Move the High Vacuum valve toggle switch to the OPEN position. Wait 5 minutes then push IG1 button to turn on ION guage.

8 Problems/Troubleshooting

a. if the current is not increasing when turning up the current controller, the boat might not be placed properly between the clamps and the system needs to be vented and the boats repositioned.