FC 1800 #2 User Instructions

University of Notre Dame

Department of Electrical Engineering

Prepared by Mark Richmond

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FC 1800 #2 Electron Beam Evaporator

General Precautions

Contacts

For problems, clarifications of procedures, or general information pertaining to this machine, please contact one of the following personnel.

Mark Richmond,	**631-6478**	**mrichmon@nd.edu**
Dave Heemstra	**631-6733**	**dheemstr@nd.edu**
Fei Cheng	**631-3268**	**fcheng2@nd.edu**

This User Manual will not be moved away from the FC 1800.

High voltages are exposed when doors are open.

Sweeping of the electron beam is mandatory. Failure to sweep the beam can damage the machine or loss of your privileges on this machine.

If any step does not respond as expect, return the machine to standby mode or at least turn beam off before attempting to contact help.

Always verify sample holders are for the correct machine.

A good vacuum practice is to have everything assembled, clean, and at hand when ever you open the vacuum chamber.

This system uses a cryo-pump. This pump should not be turned off or exposed to air when operating. If this pump is turned off for any longer than a couple of minutes, please allow time for the pump to cool down and operate normally before use. If the Cryo-pump is allowed to warm up it will take 2-4 hours to operate properly again.

This machine is used by many of the lab's personnel. When done with this machine please clean up your materials after yourself and leave the machine in a standby condition.

Use chamber light as needed by rotating on/off and for brightness. Always turn off chamber light after use.

Standby Conditions:

1. Main Chamber Lid should be closed and under high vacuum.
2. Valves that should be lit, open, or on in standby mode on the Auto pump down controller.
    i. "Hi Vac" Valve light illuminated.
    ii. "Hi Vac Iso" valve light illuminated.
    iii. Gate should be "away" from the lid and the light illuminated.
3. Valves that should not be lit, open, or on in standby mode on the Auto pump down controller.
    i. "Roughing" valve Light off.
    ii. "Fore line" valve Light off.
    iii. "Mechanical Pump" light off.
    iv. "Vent" valve light off.
4. Shutter should be closed and Light on Shutter control should not be lit.
5. HV & Gun Controllers should be off.
6. On the Motor Speed Control, the "Local/Off/Remote" switch should be in the "Off" Position (Center) with the "Run" light dark and the motor on the Lid should not be rotating.
7. Film thickness Monitor is always on.
8. Sample Holders should be clean and returned to the proper purge box location.

Depositing a material from Standby Conditions:

1. Log into Coral and enable the machine.
2. Follow the procedure to "To change a sample" on Page # 7 or "To change a sample using the Planetary" on Page #9.
3. Follow the procedure to setup "Rate/Thickness monitor" on Page # 11.
4. Wait for System vacuum to be below 2.0X10^-6 to continue.
5. Switch the CV-8 main power supply breaker up to "On"; it is on the front of the CV8 power supply. The CV-8 is located to the left of the FC-1800.
6. Verify emission current on the high voltage controller is set to ZERO {Fully CCW (Counter Clockwise)}.
7. Verify the following on the High voltage controller
    a. "Power ON" indicator is lit.
    b. "Air" indicator is lit.
    c. "Doors" indicator is lit.
    d. "VAC tank" indicator is lit.
    e. "VAC gauge" indicator is lit.
    f. "PC cards and key lock" indicator is lit.
    g. "HV off" indicator is lit.
8. Verify on the gun control panel:
    a. "Auxiliary" indicator is lit
    b. All other indicators should not be lit.
    c. "Gun water" indicator should light on the gun controller.
    d. "Focus" indicator should light on the gun controller.
    e. "GJN 1 FIL OFF" indicator should light on the gun controller.
9. Set turret to required material by selecting the appropriate metal from the list and pressing the corresponding button on the turret controller. The button indicator will light when it has reached the desired position.
10. Switch on HV by pressing the "HV ON" button on the high voltage controller.
11. If using the Planetary, Verify the motor on the lid is rotating and the samples are moving.
12. Open the shutter by pushing the shutter switch up on the shutter controller.
13. Switch on Filament by pressing the "GJN 1FIl ON" button on the gun controller.
14. Verify filament is on by looking thru the view ports and making sure a white light is coming from the filament area.
15. Advance Emission Current very slowly on the gun controller until you are just able to see the blue beam spot on the crucible when looking into the top view port. This should be done in increments of 1-2 fine marks on the adjustment knob.
16. Position the beam on the metal inside the crucible by adjusting the lat and long beam position on the XY controller for the frequency settings you are using.
17. Verify sweeping of beam by increasing the Long and Lat Freq. switches on the XY controller if necessary. **Warning:** Failure to sweep the beam can cause damage to the crucible, turret, FC 1800 system, your wafers, and/or

your privileges to use this machine. The beam spot should never come into contact with the crucible walls or turret at any time or location.

18. Close the shutter by pushing down on “shutter” switch on the shutter controller. Use lower viewport to see the source now.
19. Slowly ramp current over a couple of minutes to 1-2 angstroms per second on the film thickness Monitor. Monitor this closely so the deposition rate does not go higher than required. **NOTE:** When using the Planetary sample holder, the exposure on the Film Thickness Monitor will also allow a small deposition on the Planetary.
20. Allow the crucible to heat for 5-10 seconds. This allows the crucible to fully melt and reach a stable condition for the best evaporations.
21. Slowly increase emission current by turning the “emission current” control pot on the gun controller until you have reached your desired deposition rate.
22. Zero Film thickness meter by pressing “zero” and open shutter by pressing up on the “shutter” toggle switch on the shutter controller at the same time.
23. Wait until desired thickness is achieved keeping an eye on the source to make sure the beam is in the correct location and the source is not evaporated away.
24. Close shutter by pressing down on the “shutter” toggle switch on the shutter controller and log your results.
25. Set emission current to ZERO by slowly rotating the “emission current” control pot fully CCW on the gun controller.
26. Switch off Filament by pressing the “GJN 1 FIL OFF” on the gun controller.
27. Switch off HV by pressing HV OFF, located on the High Voltage controller.
28. Wait 10 minutes for turret and source to cool down from last deposition before continuing to the next step.
29. Repeat steps 3 to 29 for as many metal depositions as needed or continue when your last deposition is completed and the machine is cool.
30. Switch off the breaker of the CV 8, which is located on the front of the CV 8 High Voltage Power Supply.
31. To remove your sample, follow “To change a sample” procedure on Page #7 or “To change a sample using the Planetary” on Page #9.
32. Verify the machine is in standby conditions, located on page # 4.
33. Log in and disable the machine in Coral, logging all material usage.

To change a sample from Standby conditions:

1. Log in and enable the machine in Coral.
2. Fix samples onto the sample holder and be ready to insert into the machine.
3. Close the gate valve by pushing down on the "gate" toggle switch on the automatic pump down controller and wait for indicators to switch.
4. Verify that the light switches from "away" position to the "home" light.
5. Close Hi Vac Valve by pushing down on the toggle switch labeled "Hi VAC".
6. Verify that the "Hi Vac" light illuminates and the "home" light turns off.
7. Open N2 "Vent" valve by pushing up on the toggle switch labeled "Vent".
8. Verify the "Vent" light illuminates.
9. Allow approx. 2 minutes for venting to atmosphere pressure with N2.
10. After the lid chamber has been released from vacuum, the lid will pop up slightly. Pull up to open Lid chamber.
11. Make sure a clear plastic window cover is in place for your deposition and replace after your deposition. Replacement covers are slightly behind the lid.
12. Install or remove sample holders, sample holders are located in the orange N2 purge box beside the FC 1800.
13. IF installing a sample please verify that the sample is not obstructing the Rate/thickness monitor sensor or your view of crucible thru the viewing ports. (Note: Center your sample is over the "dimple" in the center of the gate valve) Refer to Figures 1-3 on pages #9-10.
14. Pull down on the lid chamber to close the lid.
15. Start "Mechanical pump" by flipping the "mechanical pump" switch up on the auto pump down controller and verify the proper light illuminates.
16. Close N2 "vent" valve by pushing down on the toggle switch labeled "vent" on the automatic pump down controller.
17. Verify the "vent" indicator turns off.
18. Open the roughing valve by pushing up on the "Roughing" toggle switch on the automatic pump down controller. Lid should "pull down" with the vacuum system almost immediately, if it doesn't then close "roughing valve" and check o-ring for obstacles.
19. Close roughing valve when Thermocouple Vacuum gauge "A" reads less than 9.9 to the -2 (the set point light will illuminate) by pushing down on the "roughing" toggle switch on the automatic pump down controller.
20. Verify the "Roughing" Indicator turns off.
21. Open Hi Vac Valve by pushing the toggle switch, labeled "Hi VAC", up on the automatic pump down controller.
22. Verify the "Hi Vac" indicator turns off and the Gate "Home" indicator lights.
23. Shut off Mechanical pump by flipping down the switch and verify the indicator goes dark on the auto pump down controller.
24. Open "Gate" by pushing up on the "Gate" toggle switch on the automatic pump down controller. Verify the Indicators switch from the "Home" position to the "away" position.
25. If installing a sample, return to step 3 on Page #5. If removing a sample return to step 32 on page #6.

Rate/Thickness Monitor:

This monitor is capable of retaining the characteristics of 9 different films. However due to the many different films and sample holders we use here at NDNF, the number of users this machine has, and the amount of use it sees I recommend that you verify your information every time you use this machine.

1. If you start using this monitor and it is displaying CRYSTAL 1, press "Xtal life" button to bring it back to its normal view. This reading shows the amount of life the Crystal has left.
2. Press "Zero" button to zero the monitor readings.
3. On the film thickness monitor. Press the "program" button.
4. Pick your film by rotating the knob to "Film 1".
5. Press "Next" button. "Density" should be displayed. Density and Z-Factor charts will be available in Appendix A on page #10 and posted on side of the control rack as well.
6. Rotate the knob until the density you want is displayed.
7. Press "Next" button. "Tooling" should be displayed.
8. Rotate the knob until the tooling for your sample holder is displayed. Appendix A contains a list of tooling factors for the different sample holders and will be posted on side of control cabinet as well. **NOTE:** There will be specific sample holders for this machine and will be labeled FC 1800 #2". **WARNING**: Do not use the numbers from FC 1800 #1 or #3, these numbers will be wrong for the setup in the FC1800 #2.
9. Press "Next" button. "Z-Factor" should be displayed.
10. Rotate knob until the Z-Factor you desire is displayed. Density and Z-Factor charts will be available in Appendix B and posted on side of control rack as well.
11. Press "Next" button. "Finl Thk" should be displayed. This step saves the last setting of "Z-factor" into the program.
12. Press "Program" button to exit program mode. It is now ready for the deposition.
13. Go to step 4 on page #5.

NOTE: The Film thickness monitor does not stop sampling the deposition when you close the shutter. You will need to watch the monitor and log the thickness when you close the shutter.

NOTE1: The Film Thickness Monitor should be on at all times.

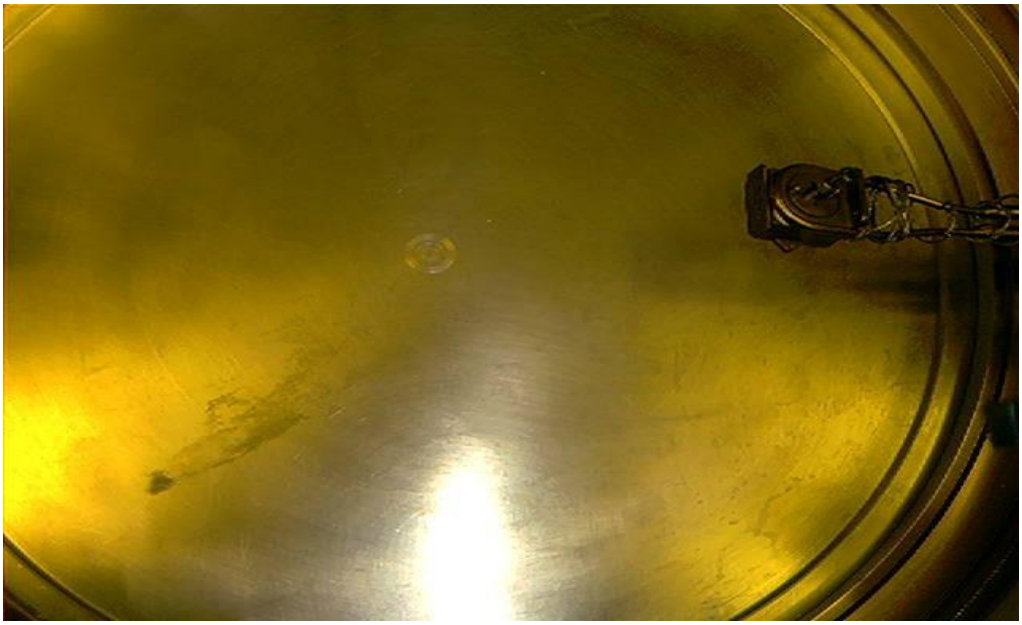

Figure 1: Gate Dimple.
This is the gate valve. In the center of the picture you will notice the “dimple” that is referred to in the procedures.

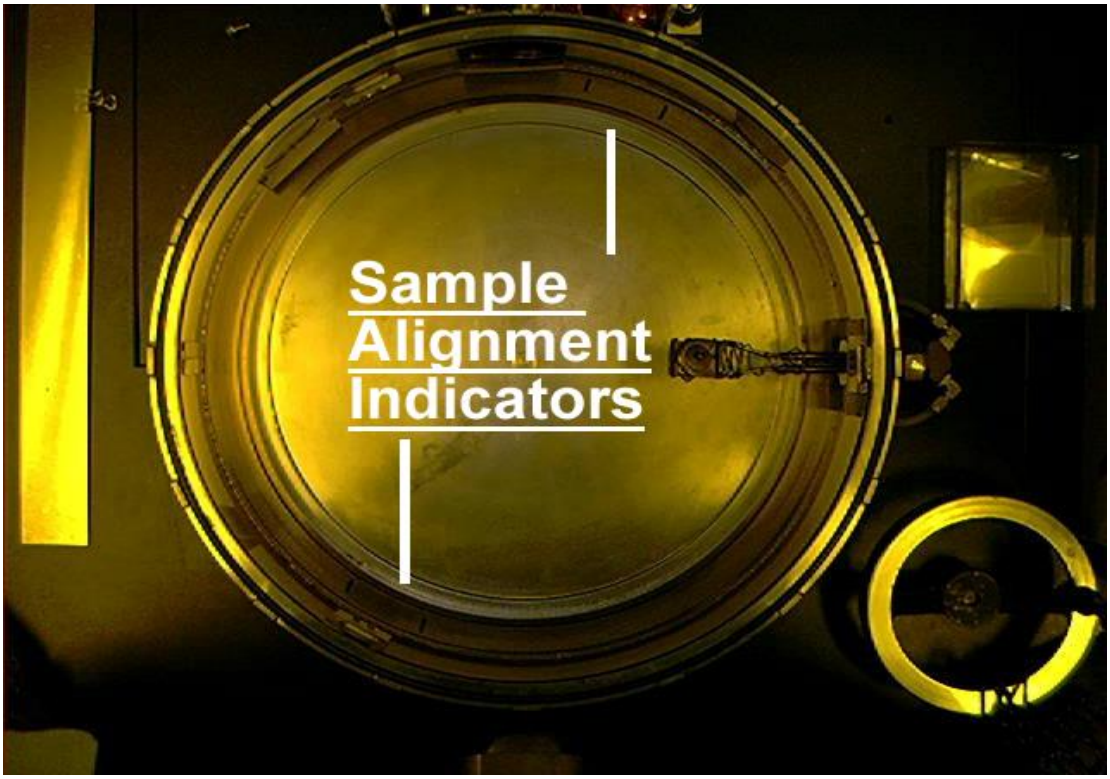

Figure 2: Gate Sample Holder Indicators.
This figure shows the location of the indicators to line up the sample holder.

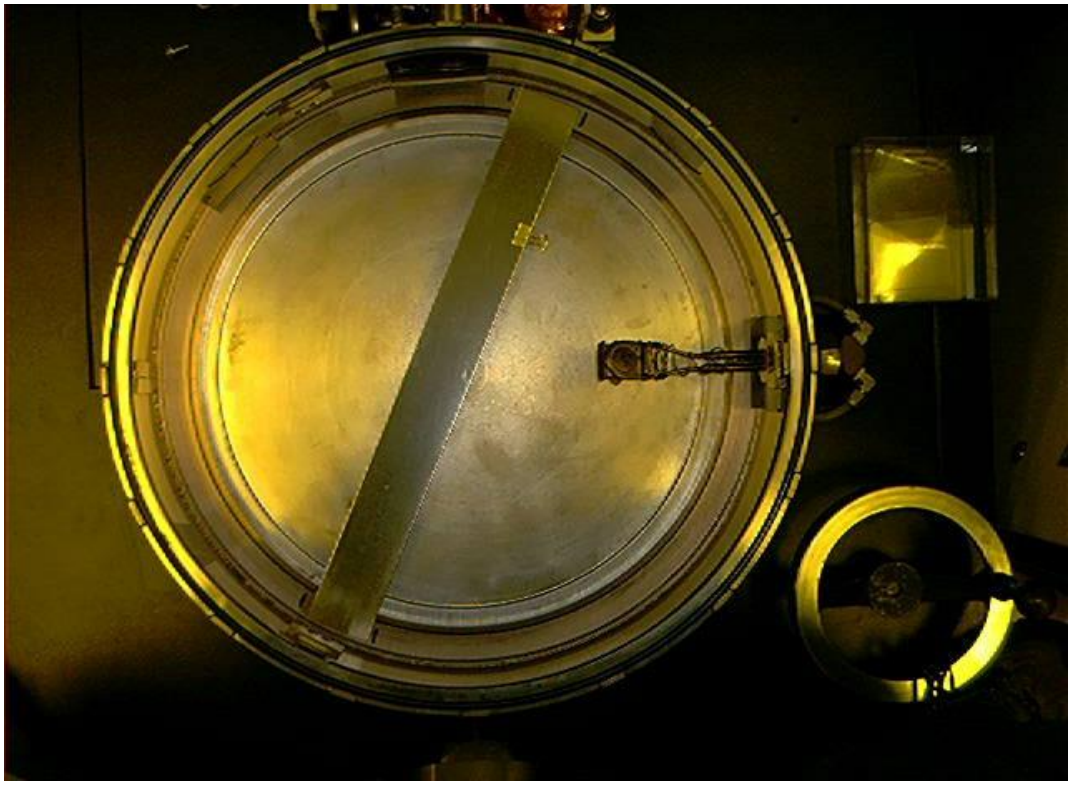

Figure 3: Installed Sample Holder.
This shows how the properly installed sample holder should look.

Appendix A – Tooling Factors:

Sample holders are stored in the orange N2 purge box beside the machine.

15mm/20 sample holder = 203
Chemical Engineering

Flat Bar = 180

Dual Ring = 120

U Bar = 75