NCMN
Nebraska Center for Materials and Nanoscience
University of Nebraska

AJA E-beam Evaporator Operating Procedure

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1 Introduction

1.1 Key Words

E-beam Evaporation

1.2 Purpose

This document provides instructions for operating the AJA E-beam Evaporator, which can be used for thin film deposition. Use of this tool requires the understanding of physical vapor deposition (PVD).

1.3 Applicability

1.3.1 Locations

The tool is located at **Clean room of Nanoscience Research Center**.

1.3.2 Safety

The only safety concern is the system uses high voltage electricity.

1.3.3 Restrictions and Limitations

- Must be a qualified user of clean room and EBE system.
- The imitation for the sample is that it must not damage the system.

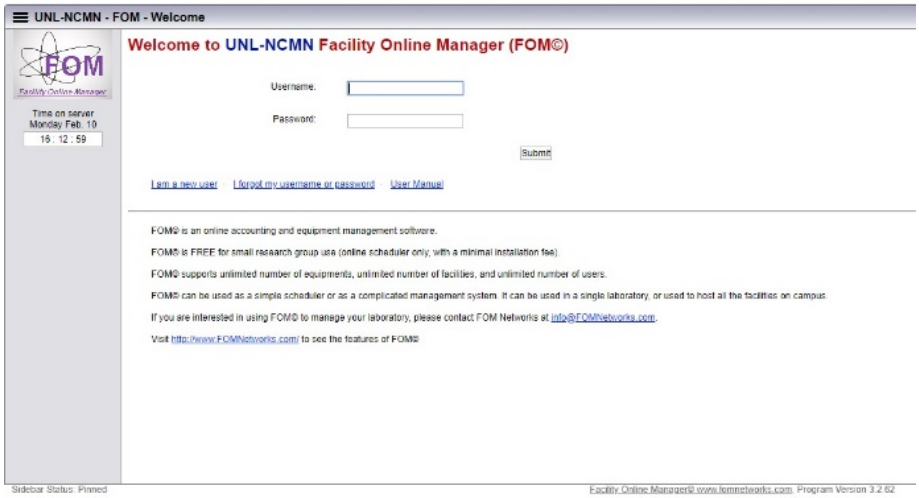
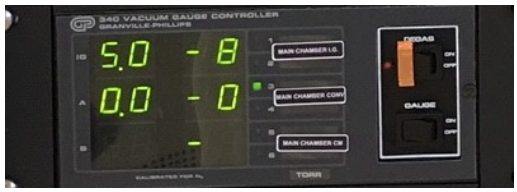
1.4 Restrictions on Working Alone

- Normal working hours are from 8am to 6pm M-F.
- Working alone is permitted with completion of an orientation to this written procedure and hands-on training from the specialist.
- Assistance from the specialist is available during working hours only. If an error occurs during off-hours, record the error in the Logfile and contact the specialist. **Do not try to fix or adjust anything by yourself.** Tool will be checked in the following work day. User will be notified when sample left in chamber is available for pickup.
- Problems with equipment malfunctions, breakage, etc. should be reported to the specialist and recorded in the tool Logfile. **Again do not try to fix or adjust anything by yourself.**
- For any emergency involving injuries, fire, chemical spills, etc., call **911.**

2 Preparations

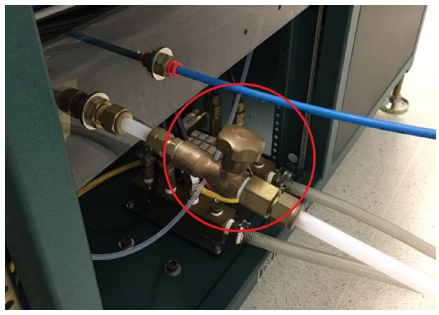
- Receive this procedure from the specialist.

3 Execution (Step-by-step work breakdown)

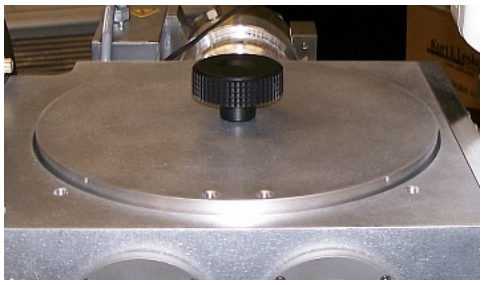
Step #	Action
1.	**Logon equipment through NCMN FOM**: • Use the computer on the table next to the entrance to logon equipment through NCMN FOM. The thickness monitor and beam scanning controller will remain off without logon the equipment. 
2.	**Check the status of the system**: • Check and make sure both load lock (below 10^{-6} Torr) and main chamber (below 10^{-8} Torr) vacuum are in good condition   • Check and make sure the gate valve between load lock and main chamber is closed properly.

3. **Load sample in load lock**:

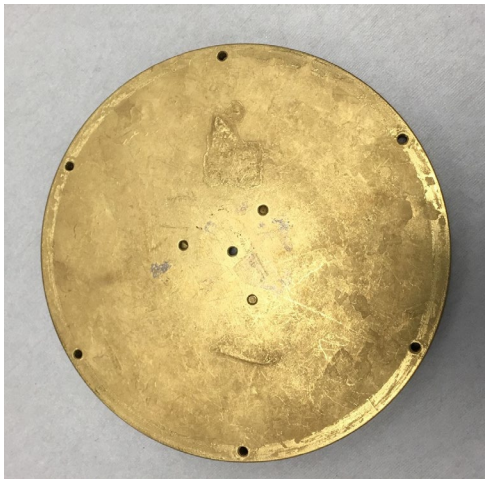
- Using vacuum pump breaker to switch off the load-lock chamber pumps (left one) and open the venting valve behind to vent it.

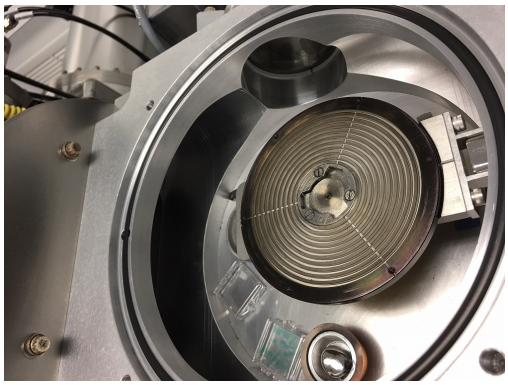


- Remove load-lock lid set it on the rubber stands.



- Put samples on substrate holder, make it face down, and then place substrate holder onto transfer arm. Make sure one of the three lines on the back of the holder sit in the middle of the arm and point directly forward to the chamber.

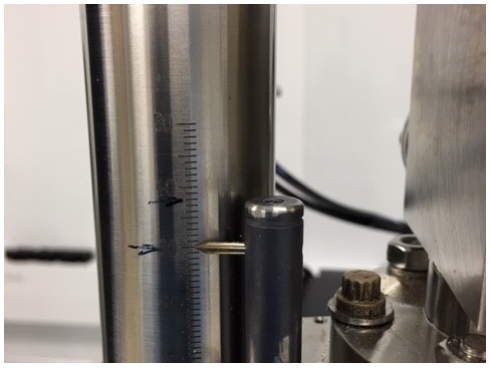


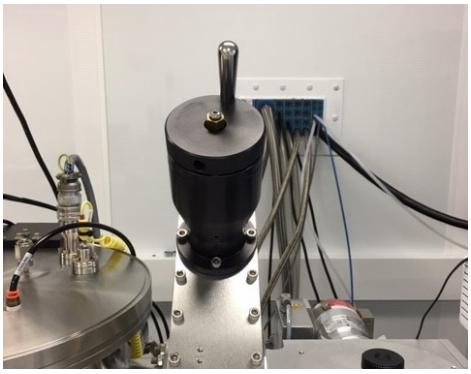


- Place the lid back on the load-lock, turn on load lock pumps and close the venting valve behind.

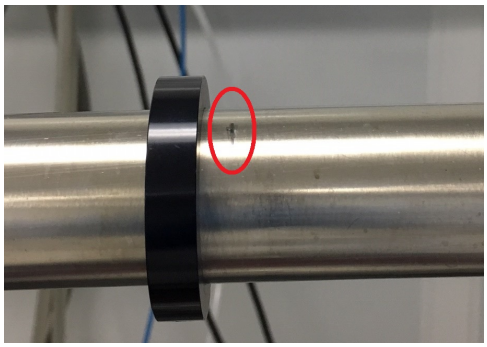
4. **Transfer sample into main chamber**:

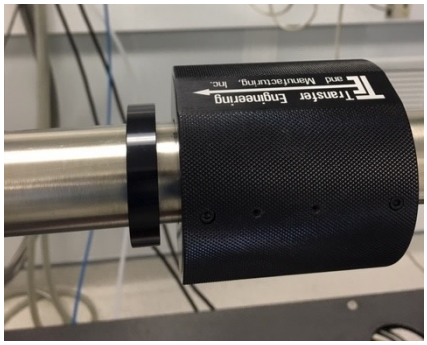
- Wait (~10 min) until the load lock vacuum is below $1x10^{-5}$ Torr
- Check and make sure the rod is at "30". Open the gate valve.



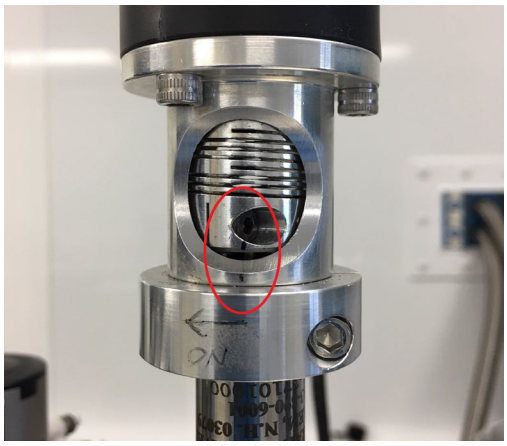


- Slide the transfer arm to the mark.





- Rotate the sample rod and put it in the positon that two marks aligned.



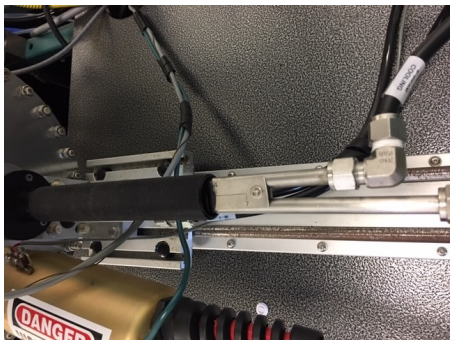
- Lower the rod to "38", which is the limit. **Do NOT go further by force**.
- Rotate the rod clockwise (along "on" direction) with half turn. Check through the view port with flash light. You should see the chuck is "sucked up".
- Lift the rod to "30". The chuck should move up with the rod and separate from the transfer arm.

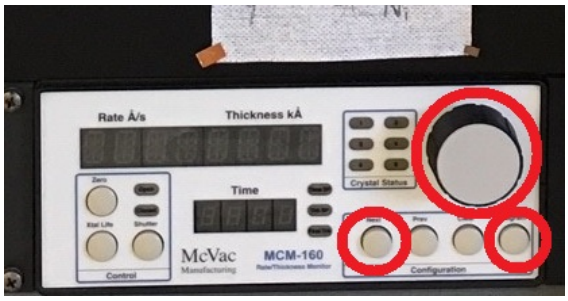
- Turn on the rod rotation motor and set it to “70”.

- Check through view port and make sure the chuck rotates smoothly without too much wiggling. **If it wiggles a lot while rotating, stop and reload the chuck**.
- Extract the transfer arm out and close the gate valve (**make sure a “click” is heard**).

5. **Evaporate thin film**:

- Set the desired target to the right positon for evaporation. (There are four targets); and set the thickness monitor to the proper material. (Press “program” button to enter setting, use big knob to change film number, press “next” button to confirm).





- Turn on controller (first) and High Voltage (second) of the power supply.

- Turn the Key to “ON” and push the POWER “ON” button. Push the “RESET” button. **Wait for 5 min to warm up the system and pass all safety interlocks**.

	• Press High Voltage "ON" button (Check and make sure the controller switches didn't jump off). Use the knob slowly adjusting the high voltage to "7 kV". • Use hand controller for current (do NOT use the front panel). Press "ON" to turn on the current. Use the knob to increase the current to a small number and use the joy stick on the hand held controller to center the electron beam in crucible.  • Open the thickness monitor shutter and increase the current to desired number (**NO higher than 0.09A**). Wait until there are readings on the rate.  • Open substrate shutter and press "zero" button on thickness monitor. Wait until desired film thickness reaches. Close substrate shutter. Decrease current to zero and press "OFF" button on the hand held controller. Decrease Voltage back to zero and press "OFF" button. • Push the POWER "OFF" button and turn the Key to "OFF".
6.	**Unloading the sample:** • Open the gate valve. Slide the transfer arm to the mark. • Lower the rod to "38" and rotate the rod counter clockwise (opposite to "on" direction) with half turn. • Lift the rod to "30". The chuck should stay on the transfer arm. • Extract the transfer arm out and close the gate valve (**make sure a "click" is heard**). • Vent load lock, take out the sample and pump load lock back to vacuum. (**make sure the venting gas valve is closed; wait until load lock vacuum is below $1x10^{-5}$ Torr**)

9.	**Logfile entries and Log off NCMN FOM:** • Fill out the log file with the corresponding parameters on the registration computer. • Log off the equipment through NCMN FOM.
10.	**Clean up all samples, pens, and notebooks from the area.**
End	**End of Procedure**

4 Post-Performance

4.1 Recordkeeping

Completely fill out the logfile.

4.2 Feedback

Report any unusual or problematic behavior of the setup by contacting the specialist.

5 References

5.1 Technical References

6 User Access Level

Normal User – Requires specialist to be present

Expert User – Does not require specialist to be present