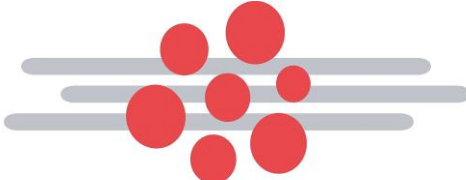


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 <p style="text-align: center;"><b>Center for Functional Nanomaterials</b> Brookhaven National Laboratory</p>	<b>NUMBER</b>
	<b>REVISION</b>  <b>1.0</b>
<b>Subject: Kurt J Lesker PVD-75 Evaporator for contacts -- operating procedure</b>	<b>DATE 3/03/2013</b>
	<b>PAGE            1 OF 5</b>

#### 1. Important reminders before you get started:

- a. This document is not a substitute for system training. No one should use the instrument without proper training and authorization from Aaron Stein.
- b. Remember to work safe.
- c. Do not attempt to make any changes to any other systems or touch the tool in any way unless authorized to do so by a CFN Staff member.

#### 2. Tool booking rules

- a. We will use the Google Calendar for sign-ups.
- b. At this time, there are no limitations on how often and how long your session can be.

#### 3. Basics

- a. The evaporator has two modes: thermal and e-beam.
- b. The system also has an ion gun and backsputtering capabilities for surface cleaning or some milling. The procedures for these capabilities will be added in the near future.
- c. E-beam evaporation is limited to the following metals: titanium, chromium, gold, platinum.
- d. Thermal evaporation is limited to: gold, chromium, aluminum, copper, gold-palladium, silver.
- e. All other materials should be deposited in the e-beam evaporator.
- f. If there are other metals you would like to deposit in this system please ask a staff member. **DO NOT** take it upon yourself to deposit unauthorized materials into the system.

#### 4. Loading sample(s)

- a. At the start of your session, the system should be under vacuum. To vent the chamber, press the "VENT PC chamber" button on the software. The system should vent in ~2-3 minutes.
- b. When the chamber is vented, you can open the door to load your sample.

- c. If the chamber is dirty with flakes of metal, use the nearby vacuum cleaner to clean up as much as possible.
- d. Open the substrate shutter by switching to the “Deposition” screen and hitting the “substrate shutter” button.
- e. You should be able to loosen the screws on the platen with your fingers. If not, find the proper Allen wrench. Remove the platen and bring to the table.
- f. Mount your sample(s) using the clips. You can feel free to move, add or remove clips to best accommodate your samples. In some cases, tape is better for mounting your sample – please use the vacuum-compatible Kapton tape for this.
- g. Before loading the platen back into the chamber, make sure your samples are secured by holding upside down.
- h. Replace the platen and tighten the screws. *Finger tighten only!*

## 5. Loading metal

- a. E-beam
  - i. If you are doing an e-beam evaporation, the metals should already be in their specified position in the crucible carousel.
  - ii. Always check to make sure there is enough metal in the crucible liner to do your deposition.
  - iii. To move the carousel
    - 1. open the door to reveal the e-beam control panel
    - 2. there are two main screens to the panel, you can toggle between them by hitting the orange MENU/QUIT button.
    - 3. Make sure you are on the position select screen (the list of 4 metals will be shown on the right)
    - 4. Move the right-hand joystick to the metal you want.
    - 5. After it is selected, push the joystick to the right and hold it. The carousel will move until it gets to the selected position and then stop.
  - iv. Add an appropriate amount of pellets to the crucible. If you need to add a precious metal (e.g. gold or platinum), you will need to ask a staff member to get the metal for you.
  - v. It may be easier to add the metal with the e-beam shutter open. You can do this via the software. Occasionally the shutter will stick – if this happens, you can give it a light push with your finger. You can leave the shutter open.
- b. Thermal
  - i. Check the back of the paper log book located near the system to see what metals are currently in the chamber.
  - ii. If you need to add or change metals, first open the “evaporator shutter” using the software interface.
  - iii. There is a large Allen wrench with a piece of red tape which can be used to loosen the screws that hold the boat in place.
  - iv. Get the metal you want out of the appropriate drawer. Depending on the metal, there may already be a boat or basket with some metal in it. If not, you will need to get a new boat out of the drawer.
  - v. Put the boat between the posts and make sure there is good contact between the washer and the metal of the boat. Tighten the screws and make sure the boat is held firmly in place.
  - vi. Note: the source nearest the front of the chamber is #1 and the source in the back is #2.

## 6. Pump down

- a. After your sample and the source metals are loaded into the chamber, you are almost ready to pump.
- b. Check the mylar window to make sure it does not need replacing. You should be able to see clearly through the window. On this system, the window does not need to be changed very regularly.
- c. One last thing is to check the life on the crystals in the monitors to make sure that they are sufficient.
  - i. Open the sigma software and check the lifetime on the crystals you will use.
  - ii. If it is above 80%, you are good to go.
  - iii. If any of the crystals you need to use are below 80%, you should probably change it.
  - iv. If you do not know how to change the crystal, or are uncomfortable doing so, ask a staff member to show you/do it for you.
- d. Now you can close the door to the chamber and hit the PC Pump button on the software.
- e. The pump-down will start automatically. The rough pump will pull the chamber down to  $1.5e-1$ . Then the gate valve will open (you will hear a “clunk” noise) and the pressure should drop quickly into the low  $10^{-5}$ 's. After 5-10 minutes it will be in the  $10^{-6}$  range and within an hour should be below  $1x10^{-7}$ .

## 7. Deposition

- a. After the system is pumped down sufficiently, you are ready to start the deposition.
- b. Open up the Sigma software and load the settings for the metal you will deposit.
  - i. File>OPEN and find the metal.
  - ii. Then you must hit VIEW>Setup and then OK in the window that pops up.
  - iii. Make sure the numbers have changed.
  - iv. Please note that the tooling factors have been calibrated, but may not be entirely accurate. You may want to calibrate the thickness if you are concerned about deposition accuracy.
- c. On the Lesker software, switch to the “Deposition” screen.
- d. E-beam evaporation
  - i. If the crucible is not in the correct position, move it (see 5.a.iii above – when the system is pumped down, you do not have to hold the joystick, push it to the right and it will move around until it reaches the correct position).
  - ii. Also choose the crucible position on the deposition screen on the software. This does not actually move the crucible but is necessary to satisfy an interlock.
  - iii. Open the e-beam shutter and the xtal #2 shutter by hitting the buttons on the touchscreen.
  - iv. Hit the EB ON button so it is ON. The EB HV should light up green.
  - v. Now open the door to the chamber to access the e-beam power supply control panel again.
  - vi. Hit the MENU/QUIT button if necessary to toggle to the control screen which should now display a current of 0.0 mA on the right side.
  - vii. You should have some idea on the approximate current you will need either from past depositions or from other people’s notes in the log book.
  - viii. Slowly turn up the current in 5-10mA steps.
  - ix. While increasing the current, always check through the window that everything is going fine – i.e. the beam is hitting the metal and no spitting is occurring. As

the current turns up, the metal may get very bright – *use the provided welder's glasses to protect your eyes.*

- x. Check the rate on the monitor in the Sigma software display.
- xi. Once the desired rate is reached, close the shutter to xtal #2 and open the shutter to xtal #3 and wait a moment until you read the correct rate.
- xii. When you are satisfied with the rate, you are now ready to deposit. Zero the sensor on the software and then open the sample shutter quickly after that.
- xiii. Continue to keep an eye on the rate, the metal, etc. while the metal is depositing. You may need to tweak (up or down) the current over time to maintain the rate.
- xiv. Once you have reached the desired thickness, close the sample shutter, the xtal shutter and the e-beam shutter.
- xv. *Slowly* turn the current back down to zero so the metal solidifies evenly.
- xvi. On the software hit the EB OFF button to ON.
- xvii. If you are depositing a second metal, start this process again from step i.
- xviii. After the beam is off and you are done with your deposition, wait at least 5 minutes for the metal to cool before venting.

e. Thermal evaporation

- i. Select the metal source you want from the top right of the software screen on the deposition page.
- ii. Open up the evaporation shutter and the shutter for xtal #1.
- iii. You should have some idea on the approximate % power you will need either from past depositions or from other people's notes in the log book.
- iv. Turn on the evaporator source. Set the ramp rate to 1%/second (middle column).
- v. Then set the % power you want.
- vi. Keep an eye on the metal to see when it melts as well as on the sigma screen to monitor the rate.
- vii. Tweak the power until you get the rate you want.
- viii. Once the desired rate is reached, close the shutter to xtal #2 and open the shutter to xtal #3 and wait a moment until you read the correct rate.
- ix. When you are satisfied with the rate, you are now ready to deposit. Zero the sensor on the software and then open the sample shutter quickly after that.
- x. Continue to keep an eye on the rate, the metal, etc. while the metal is depositing. You may need to tweak (up or down) the power over time to maintain the rate.
- xi. Once you have reached the desired thickness, close the sample shutter, the xtal shutter and the evap shutter.
- xii. *Slowly* turn the power back down to zero by once again entering a 1% ramp rate and setting the power to zero.
- xiii. If you are depositing a second metal, start this process again from step i.

**8. Finishing up**

- a. Vent the system after evaporation.
- b. Remove your samples.
- c. Pump the system back down.
- d. Be sure you mark down all pertinent information in the log book, including:
  - i. Name & proposal number
  - ii. Metal(s) deposited

- iii.** Current/power used and what rate achieved.
- iv.** Pressure
- v.** Any other relevant notes, issues, anomalies, etc.