



Angstrom EvoVac Deposition System

Standard Operating Procedure



These instructions are intended for reference only, and will *not* replace the thorough training required for proper system operation. Contact a clean room staff member with questions or to report a system problem.

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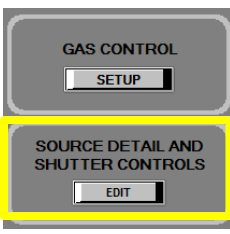
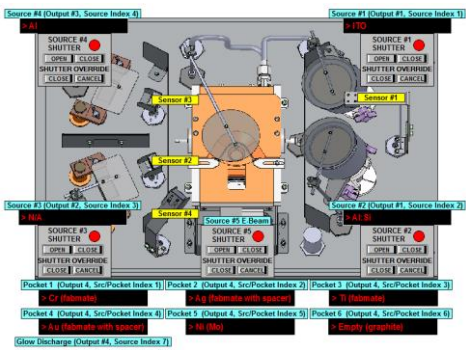
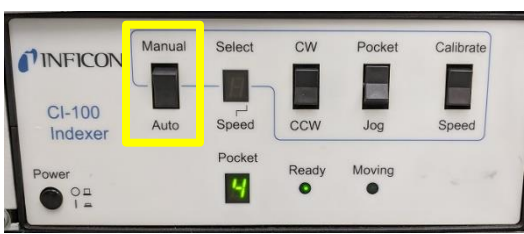

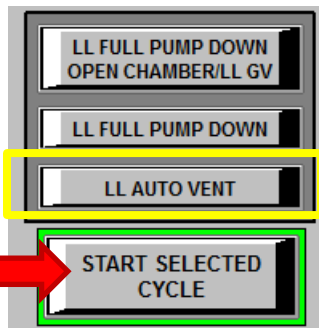
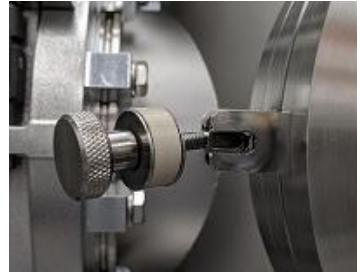
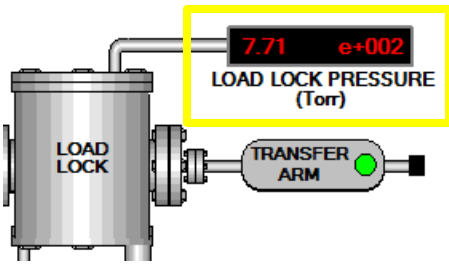
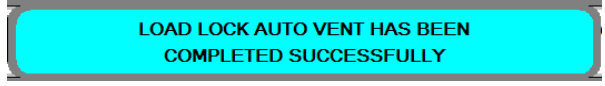




<p>1.</p>	<p>GENERAL INSTRUCTIONS:</p> <ul style="list-style-type: none"> You should not leave the tool unattended while the tool is running. Fill out all the items in the logbook. Inform cleanroom staff with any abnormal performance of the tool and report in Badger as well. 	
<p>2.</p>	<p>BADGER: Enable the tool in badger.</p>	
<p>3.</p>	<p>VERIFY SYSTEM STATUS: The main chamber pressure should be in the range of 10^{-8} to 10^{-7} Torr.</p> <p>Check the CRYO TEMP. It should be around 15-16K.</p> <p>Check the logbook and read the comments from the previous user.</p>	







<p>The most updated materials information is available on the Badger comment. You can also view the source information on the software.</p> <p>Check the INFICON Indexer. E-beam crucible indexing should be on "Auto".</p> <p>The stage rotation should be on. If you wish to cancel the rotation, turn it off. Make sure to bring it back on when you finish the deposition.</p>	   
<p>4. VENT:</p> <p>Click "LL Auto Vent" (Load Lock Auto Vent), then click "Start selected cycle" to initiate the sequence.</p> <p>As soon as the venting starts, you should un-tight the screw of the load lock door. When LL chamber is fully vented, a blue message pops up. Click on the blue pop-up message to continue.</p>	   





<p>5. SAMPLE LOADING: Open the LL door, then use the fork to take out the plate/holder.</p> <p>After clipping of the samples, you need to make sure that there are no open holes on the plate and the sample thickness is not thicker than the thickness of a “wafer + glass slide”. If you have high profile samples, please talk to super users or clean room staff, as you may need to load your samples directly from the main chamber.</p> <p>Also, make sure all the screws with the clips are tight. The loose clips might make the plate loading process difficult as the clips touch the chamber frame.</p> <p>After samples are mounted, put the plate back in the LL frames with the two pins matching the holes, close the LL door and finger-tight the screw set.</p>	 
<p>6. PUMP LOAD LOCK: Click “LL Full Pump Down Open</p>	





<p>Chamber/LL GV” (Load Lock Full Pump Down and Open Chamber/Load Lock Gate Valve).</p> <p>Then, click “Start Selected Cycle” to initiate the sequence.</p> <p>The GV should be open when the LL pressure reaches 5E-2 Torr. Click on the blue pop-up message.</p>	
<p>7. LOADING THE PLATE:</p> <p>The LL frame should be at the pick-up position (photo on the right). Insert the fork using the positioning knob on the transfer arm. Move the transfer arm slowly.</p> <p>Then, lower the LL frame to ~60 (indicated by the two black lines), then rotate the knob to bring the plate into the main chamber until reaching the black line marked on the rail.</p> <p>Switch over to the positioning knob next to the chamber. Note that you should turn the knob the opposite direction.</p>	





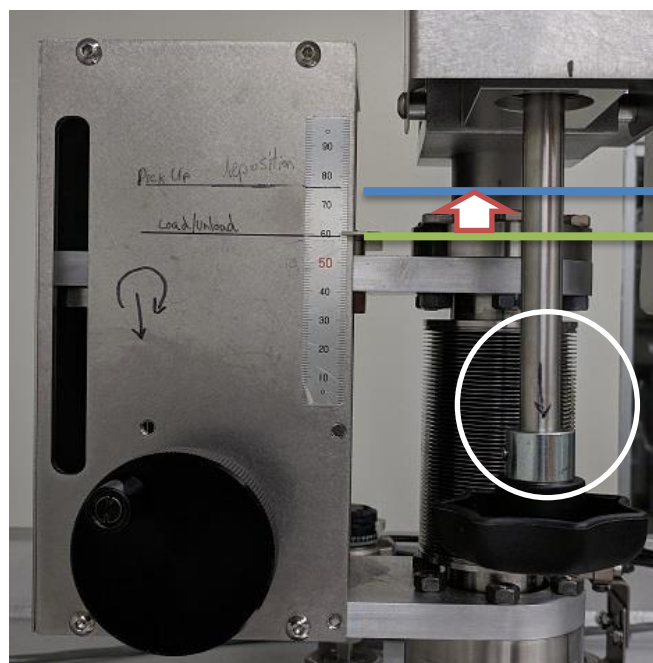
Check the arrow on the rotation knob is facing to the front, and the chamber frame is at the “Load/Unload” position.

Continue to extend the plate all the way to the front end of the rail. Watch closely from the viewport and be careful with any potential collision.

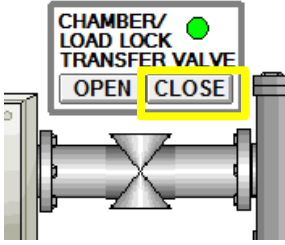
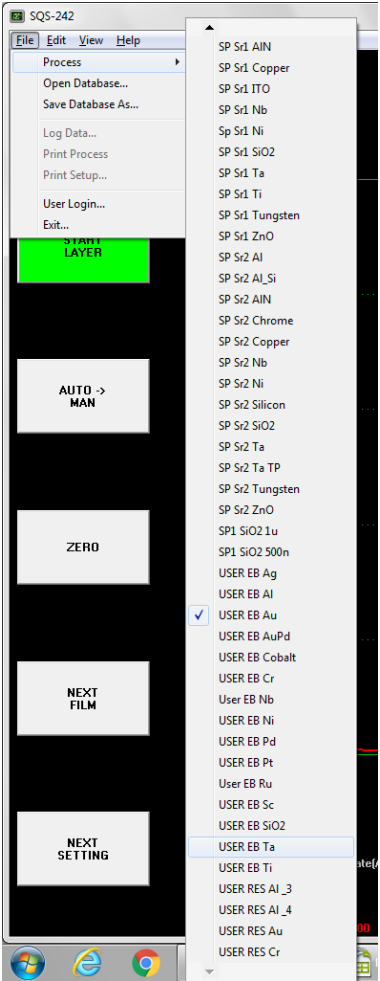
Now raise the main chamber frame to match the holes of the frame with the two pins of the plate, stop at the position of “deposition”. It can be the most difficult step for new users; please be patient. You may need a little tweak on left or right using the rotation knob.

Once the plate completely fits into the main chamber frame at the position of “deposition”, bring the transfer arm out from the plate. Move the positioning knob slowly and watch through the viewport to make sure the plate stays on the frame.

Bring the transfer arm all the way back to the end of the rail. You should not feel great





<p>friction force during the entire process, do not force in at any time.</p> <p>Close the GV between the chamber and LL.</p>	
<p>8. CHOOSE A RECIPE: Switch to the “SQS-242” window. Choose the recipe from File>Process>.</p> <p>Scroll all the way down from the list, as the recipe you need may appear at the bottom.</p> <p>The e-beam recipes are labeled as “USER EB XX”.</p> <p>Al is the only available material for thermal evaporation. Choose “USER RES Al_4”.</p> <p>The sputtering recipes are labeled as “SP Sr1 XX” for the source #1 and as “SP Sr2 XX” for the source #2.</p>	
<p>9. RECIPE SETTINGS: Usually, the setting parameters from the previous runs should be very close to the ones you want to use. Check out the logbook first!</p> <ul style="list-style-type: none"> - Ramp1 Pwr: increase power from 0 to “Power1” - Ramp1 Time: amount of time needed to reach “Power1” from 0% 	





- Soak1 Time: amount of time to stay at “Power1”
- Ramp2 Pwr: increase power from “Power1” to “Power2”
- Ramp2 Time: amount of time needed to reach “Power2” from “Power1”
- Soak2 Time: amount of time to stay at “Power 2”; “Power 2” should be set to be close to the power required to achieve the setting “rate”. Do not oversoak Au.
- Shtr Acc (Shutter Acceptance): usually set to be 30% range of the setting rate; after soak2, the software will automatically adjust the “Power2” to reach the actual power needed to maintain the setting rate within 30% range with pre-set PID control
- Shtr Wait (Shutter Wait): the maximum amount of time allowed to reach 30% “Shtr Acc”. If failed, the shutter won’t open, and the process will be aborted.
- Shtr Hold (Shutter Hold): amount of consecutive seconds needed for the rate to be within 30% as the criteria (usually 10 sec is enough).

Example: “Shtr Acc” is set to be 30%, “Shtr Wait” is 60 sec, “Shtr Hold” is 10 sec, and the “rate” is 1 Å/s. Then, after passing phase “soak2”, the tool starts to automatically adjust the power to reach 0.7-1.3 Å/s with pre-set PID control within 60 sec. If the rate stays within 0.7-1.3 Å/s for consecutive 10 sec, then “Shtr Acc” criteria is met, the rest of 60 sec of “Shtr Wait” will be skipped. Then the tool will move to the next step – open shutter and start to deposit (thickness displayed by the crystal sensor will be cleared and start to recount from zero.)

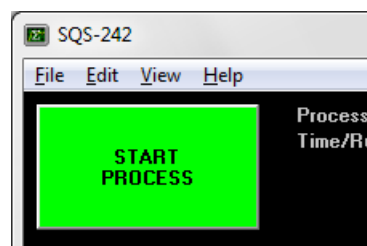
- Final Thickness: the thickness of the material you intend to deposit
- Rate: deposition rate, usually can be set from 0.5 Å/s to 1 Å/s.

Do not change any other parameters in the recipe.

10. START DEPOSITION:

Click “Start Process” with the parameters you set.

Note that if you do thermal evaporation or sputter

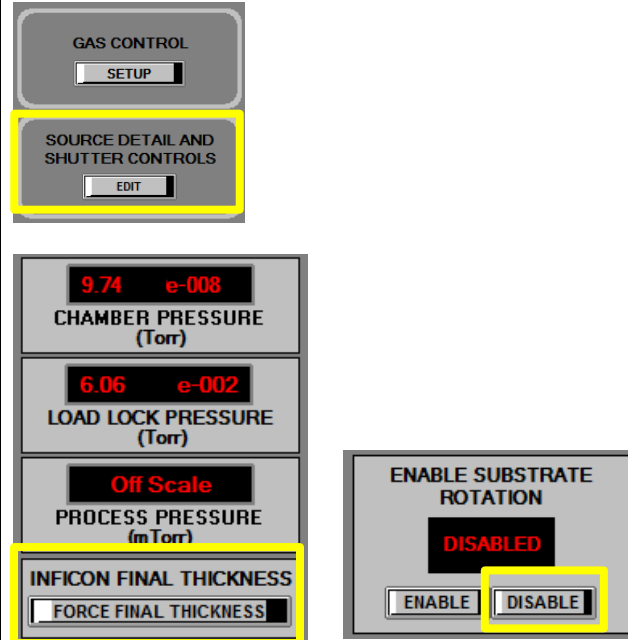




deposition, make sure you manually move the indexer to the empty pocket. Don't forget to switch it back to "Auto".

You can abort the process at any time by using "Force Final Thickness" in "Edit" of the main control software.

You can also turn off the stage rotation using the software. The rotation is disabled only at the current deposition.



11. DURING DEPOSITION:

From phase "Ramp1" to "Soak2", you are advised to change the position of beam spot if you are experiencing unusually low rate with high power. Monitor the beam spot position from the viewport, while moving the beam position in X and Y direction in the touchscreen. "Double arrows" means moving by 10, "single arrow" means moving by 1.

Fill out all the items in the logbook.

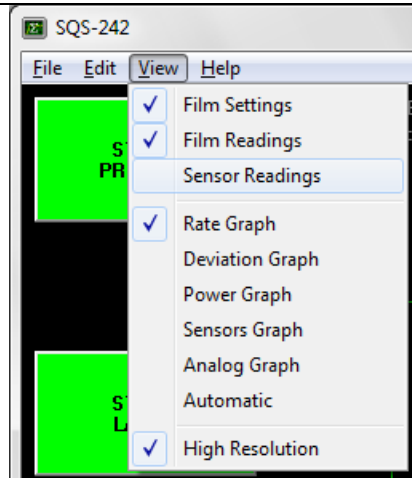




12. POST DEPOSITION:

Record the crystal sensor life after each metal layer. You can find this information in **View>Sensor Readings**.

“Sensor5” is assigned to e-beam deposition. Please remember that the sensor is only calibrated and accurate at the “deposition” position.



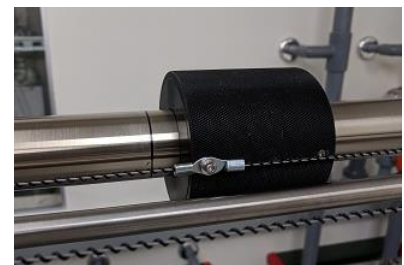
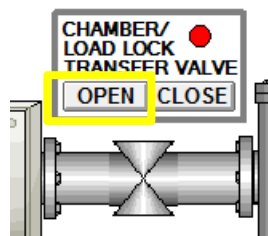
	Rate (A/s)	Thick (kÅ)	Freq. (Hz)	Life (%)	Source
Sensor 1	Not	Used	5804506.12	80.5	Output 1
Sensor 2	Not	Used	5660973.01	66.1	Output 2
Sensor 3	Not	Used	5904147.51	90.4	Output 3
Sensor 4	Not	Used	Fail	0	None
Sensor 5	.00	0.5014	5930281.80	93.0	Output 4(P)
Sensor 6	.00	-0.0004	5612224.86	61.2	Output 4(S)
Sensor 7	Not	Used	Fail	0	None
Sensor 8	Not	Used	Fail	0	None

13. UNLOADING THE PLATE:

Open the GV between the main chamber and LL. Bring the transfer arm until the black line marked on the rail.

You need to have the black arrow facing you. Bring the transfer arm all the way to the plate. Again, this step could be difficult for new users. Be patient, and do not force in.

Once the fork is inserted into the plate, lower the main chamber frame from





<p>“deposition” to “load/unload” to disengage the plate from the frame.</p> <p>Bring the plate to the LL. Raise the LL frame to engage the plate by raising the position from “60” to “pick-up” position.</p> <p>Then, release the fork from the plate and bring the fork all the way to the back end of the rail.</p>	
<p>14. VENT:</p> <p>Make sure the transfer arm is fully retracted. Close the GV.</p> <p>Then, click the “LL Auto Vent” and “Start selected cycle”.</p> <p>Loose the screw of the load lock door.</p>	





<p>15. UNLOAD SAMPLES AND PUMP LOAD LOCK: Unload your samples from the plate. Place all the screws back if you removed any to mount your sample.</p> <p>Put the plate back to the LL frame, and leave the fork in the LL as well.</p> <p>Close the LL door, finger tight the screw set and click “LL Full Pump Down”. Wait for the blue pop-up message says the LL chamber is completed pump down.</p>	
<p>16. BADGER LOGOUT: Disable the tool in Badger when you’re done.</p>	

