

# Lesker Sputtering System

## Operation Instructions

### *Sign In*

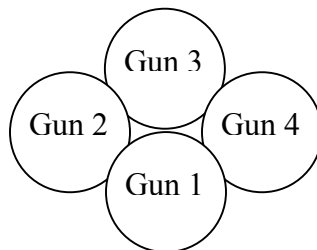
- Fill out a log sheet, which is located in the thick white folder on top of the Lesker system. Make sure to include: Date, Name, Account Number.
- Change the sign in front of the system from the green “SYSTEM FREE” to the yellow “SYSTEM IN USE” sign

### *Venting System*

- You must be wearing clean gloves and the long-sleeve lab coat before performing any action involving the inside of the chamber (sample loading/unloading, target mounting, etc.)
  - The system is normally in a high vacuum state, it needs to be vented in order to bring the chamber up to atmosphere, so it can be opened.
1. Make sure ion gauge is OFF. This gauge is made for measuring pressures in the  $10^{-5}$  Torr region only, therefore it can be seriously damaged if its not turned off. You can tell if its off by looking at the Vacuum Gauge Controller and seeing that the IG1 light is off.
  2. Turn the main key on the upper right to the MANUAL indicator. The key will go from the horizontal position to the vertical position.
  3. Wait for the cryopump gate valve to close. This valve makes a recognizable popping noise. Do NOT proceed if this does not occur!
  4. Flip the Chamber Vent Valve toggle to the ON position. To switch this toggle, it must be pulled out before its moved.
  5. Go to the nitrogen tanks, which are located in the change room, and flip the valve on the 2<sup>nd</sup> tank to the on position. If you don't hear gas flowing, then perhaps the main large valve on the top of the nitrogen tank is closed. If this is the case, turn the valve in a counter-clockwise fashion to open.
  6. The light on the system schematic indicates that the valve is now open. It takes approximately ~2 minutes to vent.
  7. Wait for the green Chamber ATM light on the system schematic drawing to go on. This indicates that the chamber is now at atmosphere.
  8. Flip the Chamber Vent Valve toggle to the OFF position.
  9. Go to the nitrogen tanks and flip the tank valve (located on the 2<sup>nd</sup> tank) to the OFF state.
  10. Use the hoist button located on the upper left of the system to raise the chamber lid to its maximum height. Push this toggle up to lift. The lid can also be swung to the left for easier manipulation inside the chamber.

### *Changing Targets*

1. Open the shutter that blocks the sputtering guns by flipping the toggle located on middle right of the system. These switches are labeled 1-4, corresponding to one of the four sputtering targets, and are arranged in a vertical fashion with the labels “Open”, “Closed”, and “Timed” specifying the three positions. Flip the toggle to OPEN for the desired gun. If you were looking down form the top of the system, the gun orientation would be the following pattern:



2. After this shutter is open, remove the glow discharge shield which is placed over the sputtering gun.
3. Then remove the target shield, this is held by three screws along the circumference of the target shield. This usually can be removed by hand, not requiring an allen wrench.
4. Then remove the target cap, which is held by two screws. These screws will need an allen wrench to be removed. A small petri dish on top of the system has various allen wrenches.
5. Now the sputtering target, which is a round 2-inch disk made of a certain material, can be removed. Other targets are located in the bottom back of the chamber, covered with a metal cylinder to protect them from any deposition. These are kept in the chamber for cleanliness reasons.
6. After the desired target is chosen, place the target onto the sputtering gun. Making sure that the flat side of the target is facing down (the circular racetrack feature on the target should be facing up).
7. Now perform everything in reverse. Place the target cap on the sputtering gun, tighten the two screws. Place the target shield on the sputtering gun, tighten the three screws by hand, place the glow discharge shield over the sputtering gun, and finally flip the shutter toggle to CLOSED.

### ***Sample Loading***

1. The sample holder tray, attached to the chamber lid and located above the sputtering guns, is made for 3-inch round substrates. Additional accessories allow 2-inch round substrates to be placed in this holder tray. There are 4 sample holder positions on this tray.
2. The tray can be rotated by pressing any one of the 4 push buttons located on the middle right panel of the system labeled with "Table Position". This will rotate the sample to any one of the 4 sputtering guns.
3. Kapton tape can be used to attach delicate samples or larger size wafers to the sample holder tray.

### ***Pumpdown Procedure***

1. Before pumping the system down, make sure to note the location of the sputtering gun(s) that will be used and the location of your samples. If gun 2 will be used, record this in the log sheet along with the tray positions that will be used.
2. Record the target used and the type of substrate placed in the system. In addition, record the substrate size and mounting performed (none, taped, glass slide, etc).
3. Its good to check that there is no short in the sputtering gun. This can be checked by using the multimeter located on the Lesker system. Use the resistance or continuity setting to check that the coax input into the sputtering gun is open (i.e. no short).
4. After the targets have been changed and the samples loaded, use the hoist button located on the upper left of the system to lower the chamber lid until it is shut. Make sure that the lid closes around the chamber (there is small black line that marks the approximate spot where the lid should match up with the chamber).
5. Turn the main key to the AUTO mode. The key will now be horizontal.
6. Start the pumpdown process by pushing the toggle to the START position. This toggle is located in the upper rightside and is labeled Auto Mode. This is a momentary switch so it will snap back down after the toggle is released.
7. The pumpdown process can take from 2 to 8 hours depending on the purity of the film deposited desired.

### ***System Ready Check***

- Before any deposition can begin, the system parameters must be recorded in the log sheet.
1. Begin by checking the inlet/outlet water cooling lines. Record the inlet temperature and pressure as well as the outlet temperature and pressure.
  2. Record the cryopump temperature. This gauge is located on the bottom right panel and is labeled Temperature Indicator. It should be around 15 Kelvin.

3. The base pressure of the system must be low enough to ensure a high quality sputtered film. Turn on the ion gauge by pressing the IG1 button located on the Vacuum Gauge Controller.
4. Degas the ion gauge by pressing the DEGAS button, also on the Vacuum Gauge Controller. Wait for 1-2 minutes. Turn OFF the degas by pressing the DEGAS button again.
5. The pressure should be less than  $4 \times 10^{-7}$  Torr. Enter the pressure value in the log sheet in the location marked "Base Pressure"
6. Turn the throttle valve to ON by flipping the toggle up. This toggle button is located on the center panel and is labeled Throttle. Flip the toggle from AUTO to OPEN. This will open the throttle valve.
7. The pressure in the throttle position should be less than  $2 \times 10^{-6}$  Torr. Enter this pressure in the log sheet in the location marked "Base Pressure w/Throttle"
8. Return the toggle to the AUTO position.
9. Turn off the ion gauge by pressing the IG1 button (this turns off the light and pressure reading).

### ***Deposition Process***

- Make sure the ion gauge is OFF.
1. Find the DC power cable and attach it to the appropriate sputtering gun. This DC power cable is located below the chamber and sputtering guns, it is a black coax cable. Screw this cable onto the desired sputtering gun, make sure not to do this tightly.
  2. Press the Main and Ar button to begin the argon flow into the chamber. When ON, these two buttons will glow green.
  3. Turn ON the 4 Channel Readout module by flipping the toggle to the Power ON state. This toggle requires that it be pulled out before it can be toggled.
  4. Flip the 1<sup>st</sup> channel on the 4 Channel Readout module to the ON position. The 1<sup>st</sup> channel is labeled with the number 1. Channel 1 controls the argon flow into the chamber.
  5. The Flow Controller should be already on (this is labeled the Type 250 Controller). On this controller, turn the bottom right knob from the Close to the Auto position. The Auto position is set to regulate the flow and produce a 5 mTorr chamber pressure.
  6. The DC Power can be turned on now. On the upper left side of the panel you will find the DC Power Supply (it has the Kurt Lesker Co. label on it). Flip the Power toggle to ON.
  7. Turn the rightmost knob from the STANDBY to the WATT position and slowly turn the middle knob to the desired power.
  8. The plasma should of sparked by now and might be visible through the chamber window.
  9. Some targets have a thin oxide film on them, so its best to wait 5 minutes or so to remove any contaminants on the surface of the target.
  10. Set the SHUTTER TIMER located on the rightside of the panel. This timer can be set in minutes, seconds, as well as tenths of seconds.
  11. Flip the shutter toggle (which is next to the SHUTTER TIMER) to the TIMED position corresponding to the sputtering gun that will be used (1, 2, or 3).
  12. When you are ready, check that the correct table position is highlighted and that the correct sputtering gun is connected and ready to be timed.
  13. Press the green START button to begin the deposition. The shutter will now automatically open, exposing your substrate to the plasma, and the timer will begin a countdown.
  14. Record your sputter parameters in the log sheet. This includes: power wattage, target voltage (this number can be determined by turning the rightmost knob on the Power Supply to Voltage), Pressure (this is read off of the Flow Controller), Flow Ar (this is read off of the 4 Channel Readout).
  15. After the deposition is completely, the shutter will automatically close. You can now change the table position by pressing any one of the 4 push buttons, and then again press the START button to begin again.
  16. If another sputtering gun needs to be used for deposition, the DC Power Supply must be turned off.
  17. If the deposition is complete (or you need to switch the power supply), turn the rightmost knob on the Power Supply to STANDBY position, and then turn down the wattage on the middle knob to zero. Turn the Power toggle to OFF. If another gun will be used, unscrew the cable from the gun and rescrew it onto the second gun that will be used. Proceed to number 6 to begin the process again.
  18. Turn the knob on the Flow Controller (Type 250) from the AUTO position to the CLOSE position.

19. Turn the toggle on the 4 Channel Readout to the middle OFF position. Then turn the Power OFF on the Readout by pulling the toggle out and then down to the OFF position.
20. Turn the Argon valve off by pressing the MAIN and Ar push buttons. In the OFF state, these buttons will not be lit up.

***Venting and Pumpdown Procedure***

1. The system may now be vented. Follow the “Venting System” procedure described above.
2. After you removed your sample(s) from the chamber, bring the chamber lid down and close the chamber.
3. Turn the main key to the AUTO mode. The key will now be horizontal.
4. Start the pumpdown process by pushing the toggle to the START position. This toggle is located in the upper rightside and is labeled Auto Mode. This is a momentary switch so it will snap back down after the toggle is released.
5. Change the sign from the “SYSTEM IN USE” sign to the “SYSTEM FREE” sign.