

Sputtering System Vacuum Operation
Thayer School of Engineering
Microelectronics Cleanroom

Pump down:

1. **Sign the Logbook** (ex. 6/9/99 KDC)
2. Make sure the foreline vent valve inside the Cooke Vacuum system door is closed – the valve is located above the diffusion pump on the short tube leading out of the side panel
3. Turn on/Plug in mechanical pump – make sure it is functioning properly. Oil level should be about half way in the port window *when running*
4. Turn on glycol flow - turn outake valve to open, turn supply valve to open (two RED valves in the back alley of cleanroom)
5. Turn on re-circulating cooler (be sure to fill with non-deionized water - periodically check the water level)
6. Turn mechanical pump to "Foreline" position to begin pumping on the foreline
7. Turn on diffusion pump to get it warming up – this will take about 20 minutes
8. Turn on thermocouple vacuum gauge (to read chamber and foreline pressures)
9. Turn power on on the mass flow controller: MKS model 247C
10. Pump on foreline with mechanical pump to between 50 and 100mTorr
- * At this point, it is safe to vent and open the chamber and load targets and substrates for sputtering
11. Turn mechanical pump to "Roughing" position – be sure to watch the foreline pressure as you don't want it to shoot up above about 200mTorr at any time

12. The capacitance manometer light will come on on the vacuum panel display. Turn on the power on the capacitance manometer on the rack
13. Pump on chamber to 100mTorr (this will take at least 5 minutes - you may need to periodically switch to foreline momentarily to keep the pressure there below 200mTorr)
14. Switch back to mechanically pumping on the foreline - keep this position for as long as the diffusion pump is on
15. Add liquid nitrogen to the Meissner cold trap through the copper pipe/Folgers® (mountain grown) coffee can
16. When the diffusion pump is good and hot (about 20 minutes) and the chamber and foreline are pumped down mechanically, open High-Vacuum valve - watch the foreline as you do this. You don't want the pressure to go above 200mTorr
Note: When the High-Vacuum valve is opened about 1/2 way ($\sim 45^\circ$), it can be toggled to slightly opened/closed. Do this to slowly bring down the chamber pressure and not allow the foreline pressure to exceed 200 mTorr
17. When the thermocouple gauge is below 1mTorr, turn on ion gauge (10^{-4} range)
Note: To set emission current on the ion gauge: i.) 10^{-4} Torr range, it should read 1 mA when "Emission Current" is pressed; ii.) 10^{-5} Torr range, it should read 10 mA when "Emission Current" is pressed
18. Pump on chamber with diffusion pump this way for a few hours to get to a low base pressure (10^{-6} range)

Gas flow control:

1. Zero capacitance manometer if it is off by more than 1/2 mTorr from ion gauge reading
2. Turn off ion gauge
3. Turn on Argon gas flow (in back alley of cleanroom) - 3 green knobs and throttle
4. Purge the gas isolation valve line by momentarily switching the Gas Isolation switch on the system schematic box. Watch foreline pressure while doing this to make sure it does not go above 200mTorr
5. Continue to momentarily switch the Gas Isolation valve on the system schematic box until it is safe to fully open without allowing the foreline pressure to skyrocket
6. Turn on Argon (gas 1)[or other ambient gas] mass flow control switch on the MKS model 247C
7. Select a flow rate (10.0 sccm typical - change using screwdriver adjust) – allow it to reach set-point
8. Turn on exhaust valve controller
9. Make sure the exhaust valve is fully OPEN (red light should be on) on the Type 252A Exhaust Valve Controller
10. Close the Exhaust Valve some by throwing the white switch to CLOSE for a short time - the pressure on the capacitance manometer should start to rise
11. When the pressure on the capacitance manometer starts getting close to your desired working pressure, zero the set-point between LO and HI using the set-point knob
12. Turn controller to AUTO - it should now maintain the set pressure and flow rate - you are now ready to sputter

Sputter depositing:

1. Make sure the substrate and shutter are both located under the target you would like to sputter from at this point

DC Sputtering

2. Select "DC" and "GND" on the Sputtering Medium and the Substrate Bias switches respectively
3. Turn on the Advanced Energy Lo Power MDX 1-K DC Magnetron and Glow Discharge power source
4. Select Power(W), Voltage(V), or Current(A) for sputtering
5. Open the shutter to begin sputtering onto the substrate

RF Sputtering

2. Select "RF" on the Sputtering Medium Select switch and "GND" on the Substrate Bias switch
3. Choose the desired target to sputter from with the Target Select Switch
4. Turn on the AC power on the ENI Power Supply
5. Turn on the Main power
6. Turn up the Forward Power using the knob to desired sputtering power in Watts
7. Switch to Reflected Power and tune to its lowest point using the Target Load (0 - 200) and Target Load Capacitor - note this position - alternately until minimum reflected power is achieved
8. Open the shutter to begin sputtering onto the substrate

Shut down:

1. Turn off the Gas Isolation Valve

2. Fully OPEN the Exhaust Valve controller
3. Turn off Mass Flow Controller
4. Turn off working gas flow (probably Argon) in back alley of the cleanroom
5. Turn off capacitance manometer
6. Turn off ion gauge (and set back to 10^{-4} range)
7. Close High Vacuum valve
8. Turn off diffusion pump - keep pumping on foreline
9. When the diffusion pump is good and cool (about 40 minutes), turn off
thermocouple vacuum gauge
10. Turn mechanical pump valve to "off"
11. Turn off mechanical pump

AND

12. Vent foreline valve!!!
13. Turn off glycol flow (two valves) and turn off re-circulating cooler (back alley of
cleanroom)
14. Complete logbook entry – be sure to come back after alpha-stepping to write down
the film thickness sputtered as this is VERY useful for future reference