Angstrom Dielectric Sputterer Operation Manual

I. System overview

The Angstrom Dielectric Sputterer (ADS) has a similar interface as the Angstrom metal sputterer. It has two screens, the process screen and the chamber screen. The process screen is used for starting and stopping the sputtering process and the chamber screen is used to control and monitor which valves are open and the chamber pressure readings. The main parts of the ADS are shown below:

1. Main chamber
2. Load lock
3. Transfer arm
4. Stage height controller
5. Temperature control (currently not for use)
6. Stage rotation speed control
7. Emergency Off button
8. Throttle valve controller
9. RF tuning circuits
10. Power supply units
11. PC interface
12. Stage alignment marks

Angstrom Dielectric Sputterer
II. Loading samples for deposition

1. Log in the ADS via the MNFL system. Specify the targets at each gun when making reservation. Note: photoresist and Indium are not permitted in the chamber!

2. The chamber screen is shown below. Click on “Source detail and Shutter Control” to see what targets are in the chamber and at which source.

3. Click on “Load Lock Vent Sequence” and then “Start Selected Sequence” to vent the load lock. Since the deposition can be processed at high temperatures, a warming message will pop out to remind that the chamber temperature should be less than 250°C at this step. Load lock cannot be vented without logging into the tool via the MNFL system.

Chamber screen for ADS

4. Open the load lock and take out the circular platinum sample holder. Be careful, this holder is heavy.

5. Mount samples on the holder and fill holes with screws. Plasma would penetrate open holes and deposit upon thermal couple.

6. Put the sample holder back into the load lock on the transfer arm. There is no pin and notch to align, just put the circular sample holder in the circular notch.

7. Close load lock, then click “Load Lock Pump Down Sequence” and then “Start Selected Sequence” to start pumping.
8. When load lock pumping is finished, a message will pop out as in the picture above. Also the indicator of load lock gate valve will turn green. The system is now ready for sample transfer

III. Loadlock transfer

1. The transfer process is different from the Metal sputterer. The sample holder has notch around its edge. The sample stage consists of two semi-circular brackets with pin upon which sample holder can slide in. Schematic of cross section is shown below:

![Sample stage and sample holder](image1)

2. In order to transfer, make sure the stage is at the right height (by checking the mark on height meter) and right angle (by checking the mark on the rotation knob). See figures below.

![Alignment marks](image2)
3. Slide gently the holder into the stage. You can view it from the view port. The sample holder should slide smoothly onto the stage. If you feel a lot of friction, then check the angle and height again. Slightly move the stage up and down using the switch next to the chamber to find the right height.

Be extremely careful: moving the stage too far down will bend the transfer arm!!

Unfortunately it is hard to tell the relative angle between sample holder and stage when seeing from view port, so feeling the friction is a better indicator. The schematic figure of sliding holder onto stage is depicted below.

4. After the transfer arm is moved completely out (as far as possible into the main chamber), the sample holder should be hooked by the sample stage completely. You may now raise the sample stage and lift the sample holder from transfer arm. When you see it from the view port, you can see the weight of sample holder is released from transfer arm. Raise the stage and then retract transfer arm all the way to the right. Make sure the stage is high enough so that transfer arm does not collide with the stage. When transfer arm is completely retracted, then the indicator of “Transfer Arm Retracted” will turn green.

IV. Running a deposition

1. Lower the stage to the lowest point. The transfer arm must be fully withdrawn.

2. Switch to process screen, and select a process. Process name include the source, gas recipe, material and thickness. For example, S2G1 Al2O3 0_250 means Al2O3 target is on source 2 (gun 2), gas recipe 1, with final thickness 250A. Don’t change the gas recipe from the chamber screen

3. If you plan to run the process at high temperatures, click on “Source details and shutter control” on chamber screen, and then turn on the substrate heater. You can then set the temperature from temperature control panel on the sputterer. Only increase 50°C per time, wait for equilibrium and then raise it again. The maximum process temperature is 600°C
4. Click on “Start Process” to start deposition
5. A process consists of 3 steps: Preconditioning, Deposition, and Cooldown. Preconditioning allows the source power to be slowly ramped up to avoid thermal stress on the target. After ramping, the tool will adjust the power to achieve the correct deposition rate. When the correct rate is achieved, deposition begins and runs until the set film thickness is reached. During cooldown the tool ramps down the source power to limit thermal stress on the target.
6. There are two types of shutters, source shutter and sample shutter. The source shutter is on the top vicinity of the target, and opens as soon as a process starts and power is delivered to a source. There is a shutter for each source in the chamber, and the unused source shutters will remain closed. The sample shutter is bigger and is located below the sample holder. The sample shutter is only open during deposition. Once deposition starts, wait for 10 min to check if it runs stably. After that, you can come back every hour to check if the sputterer runs normally.

V. Unloading Samples

1. After deposition, raise the stage well above the mark ( >50 is recommended) on height meter and align the mark on the rotation knob.
2. If you run a process using the substrate heater, you need decrease the temperature setpoint back to 0°C, turn off the substrate heater, and wait until temperature is lower than 250°C before you pump down the load lock. It is recommended to wait until temperature is below 100°C, otherwise the sample holder is too hot to be taken out from load lock.
3. Once temperature is low enough, click on “Load lock pump down sequence” to open the valve between load lock and main chamber.
4. Move transfer arm into the chamber. Be careful not to collide transfer arm with sample stage.
5. Carefully, lower the stage to the height indicated by the mark and let it gently sit on transfer arm. You should see the weight of the sample holder slowly shift to the transfer arm. Again, do not move the stage too low, as this can bend the transfer arm!
6. Make sure the stage is at the right angle by checking the mark on the knob.
7. Gently retract the transfer arm. If you feel too much friction, it means the stage is not at the right height. Slightly move the stage up and down until you can retract transfer arm easily. Sometimes it is easy to retract at first place but it gets
stuck later and rotation knob rotates as well. This also means the height needs to be further adjusted.

8. After retraction, click on “Load Lock Vent Sequence” and then “Start Selected Sequence” to vent the load lock.

9. Unload the samples and put sample holder back into load lock. Close load lock, then click “Load Lock Pump Down Sequence” and then “Start Selected Sequence” to pump load lock.