

# AJA Sputter Deposition SOP

NOTE: Latest revisions are in Blue.

## Table of Contents

- 1.0 Safety**
- 2.0 Quality Control and Calibrations**
- 3.0 Sample Load**
- 4.0 Sputter Types and Materials**
- 5.0 Running a Deposition**
- 6.0 Sample Unload**

## 1.0 Safety

- 1.1 **High Voltage** - High Voltage Radio Frequency and High Voltage DC is used throughout the system. System maintenance may only be performed NRF Staff. Do not remove any tool covers or defeat any interlock on this system.
- 1.2 **Moving Components** - The User should be aware *at all times* of the moving components associated with this tool. For instance, the turret unit does rotate and does present a potential hazard. The User must exert caution *at all times* such that a limb, finger, or article of clothing does not become trapped or entangled (or worse, violently detached) when components of the machine are in motion.
- 1.3 **Heat** – The sample platen is heated and should never be touched.
- 1.4 **Buddy System** – the Buddy System is not needed for after hours usage of this equipment

## 2.0 Quality Control and Calibrations

### 2.1 Sputter Rates

- 2.1.1. The Sputter rates contained in the spreadsheet on the web site “docs” were accurate at the time of calibration and should only be used as an estimate. Rate calibrations are not performed on a periodic schedule. Due to the complexity of the sputter process, these rates may change slightly over time. If you need a very specific film thickness you must run a test sample.

Use the following method: Use clean polished silicon or glass for the test. Run recipe long enough to obtain a film thickness of at least 1500 angstroms. Do not cover your sample with a shadow mask or tape. Dip a swab into a bottle of AZ1512 and touch a small area of photoresist onto the test sample. You don't want the PR to be too thick or it will be hard to bake. Bake the sample for 5 mins. at 112C.. Small bottles of photoresist are located on the bottom shelf of the Litho Bay chrome rack. Etch the film using the appropriate wet etchant or plasma etch. Remove the photoresist using acetone after etch and measure the film etch step using the Dektak 150 Profiler. Once you have the calibrated rate, email the results to NRF Staff. You may request that your target be loaded into the same sputter gun in the future for consistency.

## 2.2 Film Quality

2.2.1. For non-reactive materials, you should wait for the main chamber pressure of  $<2.0 \text{ e-}6$  Torr range per the Ion Gauge.

2.2.2. For ultra-sensitive oxide targets such as Indium Zinc Oxide, InGaZnO, the main chamber base pressure must be  $<5.0 \text{ e-}7$  Torr. This is also true for reactive oxide recipes.

## 2.3 Heater Box Temperature

2.3.1. The temperature of the heater box is controlled by 2 thermocouple sensors located several inches from the sample holder. **There is a substantial temperature offset between the system readout and actual sample temperature.** See "AJA Sputter Temp" graph located in the "docs" for the tool on the web site.

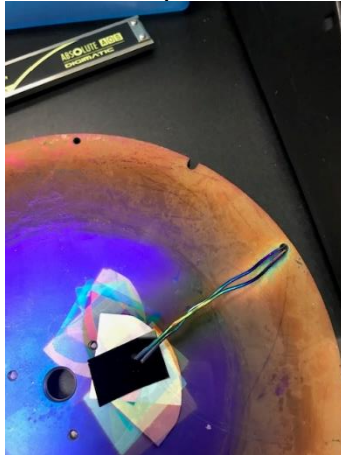
## 3.0 Operation

### 3.1 Power Up - Chamber Evacuation from atmosphere

- 3.1.1. Turn Main Power ON. Black momentary switch, left upper side.
- 3.1.2. On the VAT controller, press the "open" button.
- 3.1.3. Power up the process chamber roughing pump by pressing the big Green Power Button, left rack. The turbo pump powers up and starts automatically when crossover pressure is made. The chamber press can be read by the "main chamber conv.." gauge on the Granville Phillips controller.
- 3.1.4. The turbo is operational at 42 KRPM.
- 3.1.5. The ion gauge may be turn on with IG1 button on the Granville Phillips controller to check for proper base pressure before sputter.  $2 \text{ e-}6$  for standard metals,  $<5 \text{ e-}7$  for reactive or sensitive oxides, ZnO, InGaZnO,
- 3.1.6. Turn off the ion gauge before sputtering.

### 3.2 Sample Load

- 3.2.1. Mount sample to holder using wire as shown



- 3.2.2. Attach to loading fixture and place face down on load arm fork.



- 3.2.3. Align one of the three radial lines machined into the back of the holder with the mark on the fork, see pic.
- 3.2.4. Install lid and press the power on button for the loadlock, left rack.
- 3.2.5. The LL is ready when the turbo is at 75 KRPM. The pressure is read on the Pfeiffer gauge controller near the LL turbo controller. Continue when the LL is in the 5 range,

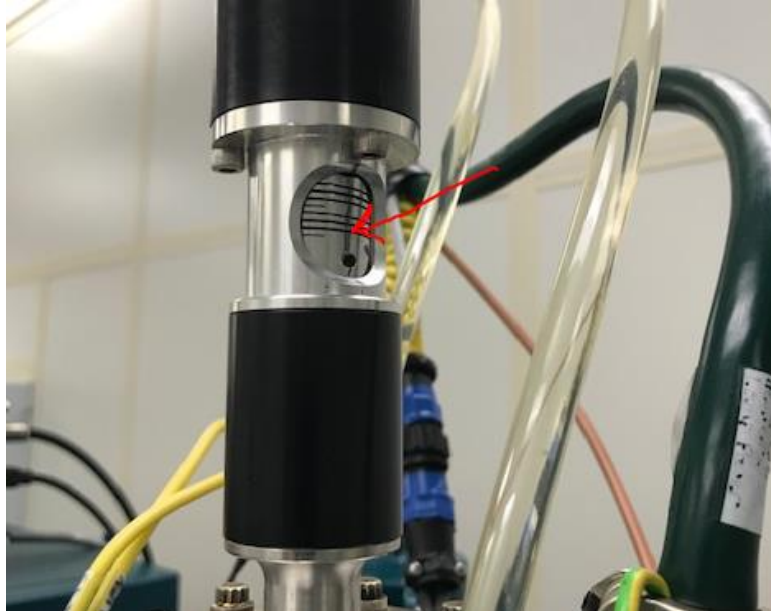


3.2.6. Close the process chamber to turbo VAT valve by pressing close on the controller. Open the manual LL iso valve.

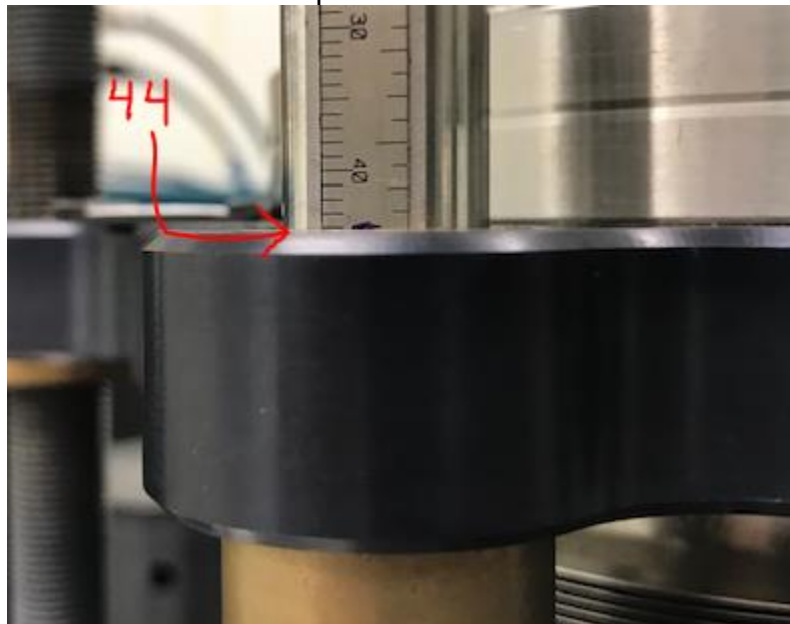
3.2.7. Open the manual LL iso valve. Counter-CC.



- 3.2.8. Align the black sharpie mark on the platen rotation motor coupling with the window as shown.



- 3.2.9. Press the “Jog” up joystick until the platen is at <30mm position or to the top.
- 3.2.10. Move the load arm all the way inside the chamber.
- 3.2.11. Bring the platen down by moving the joystick on the motor controller down until the top of the bushing is at 44mm as shown in the pic.



- 3.2.12. Rotate the coupling by hand clockwise (looking top-down at the machine). You should feel it rotate easily almost 1/4 turn and then stop.
- 3.2.13. Open the viewport window (loosen the locknut). Position “0” is closed.

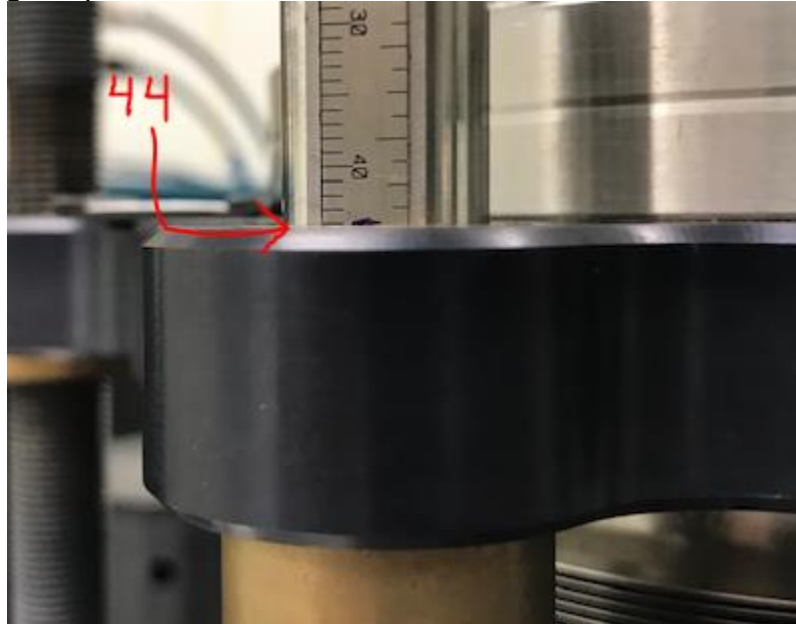
- 3.2.14. Raise the platen while watching the sample holder, it should lift-up. If not, move the vertical position slightly using the joystick until it's engaged properly.
- 3.2.15. Raise platen to top, it will stop when the limit switch is made. Move load arm home and close the LL iso valve.
- 3.2.16. Open the process chamber iso valve by pressing "open" on the VAT controller.

### 3.3 Run Process

- 3.3.1. Set the motor control switch to "Run" mode.
- 3.3.2. Turn on the ion gauge and wait for 5e-7. Turn gauge off.
- 3.3.3. If doing reactive sputter, refer to the recipe spreadsheet in the "docs" section for tool on web site for gas flow settings.
- 3.3.4. Press the Ar "ON" green switch on the pneumatic panel. Turn on the Ar MFC. The setpoint can be changed using a flathead screwdriver while pressing up on the "read" toggle switch. Use the black selector knob to display Chanel 1, Argon.
- 3.3.5. Set the VAT controller to pressure control mode. Preset 1=15mt.
- 3.3.6. Set power using the arrow keys on the RF Power Supply and turn on the RF power.
- 3.3.7. Verify forward power nominal and reflective low. May need to open and close the shutter using the SH x switch on the pneumatic panel.
- 3.3.8. Change VAT controller to desired pressure SP.
- 3.3.9. For standard target sputter skip the Reactive Recipe Steps that follow.
- 3.3.10. **For Reactive Recipe**
  - 3.3.10.1.1. With shutter closed, run the RF for >6 mins to clean the target surface.
  - 3.3.10.1.2. Switch to display channel 2 on the MFC controller. Open the O2 pneumatic valve. Turn on Chan 2 MFC.
  - 3.3.10.1.3. Set the flow rate for channel 2 if needed using the flathead SP potentiometer. You must push up on the "read" toggle switch while changing the setting.
  - 3.3.10.1.4. Gas Correction Factors are already dialed in on the back of the MRF controller for each gas type.
- 3.3.10.2. Open the shutter and sputter desired time. When done, close the shutter, turn RF off, turn off the MFC(s). Press "Open" on the VAT controller.

### 3.4 Sample Unload

- 3.4.1. Open the manual LL/Proc chamber ISO valve. Move the load arm all the way into the chamber.
- 3.4.2. Jog the platen down to the 44mm mark.



- 3.4.3. Rotate the coupling by hand counter-clockwise (looking top-down at the machine). You should feel it rotate about 1/16<sup>th</sup> of a turn easily which means it's disengaged with the sample holder plate.
- 3.4.4. Open the viewport window.
- 3.4.5. Raise the platen while watching the sample holder. The 3-finger platen mechanism should come out of the sample holder plate. If not, move the vertical position slightly using the joystick until it can be disengaged.
- 3.4.6. Raise the platen high enough to clear holder. Move load arm home and close the LL iso valve.
- 3.4.7. Open the process chamber iso valve by pressing "open" on the VAT controller.
- 3.4.8. Vent the Loadlock by pressing "Load-Lock Vacuum" off (red button). The LL will automatically vent to ATM. The lid may be removed when the Pfeiffer "Single-Gauge" reads approx 300 torr.