Standard Operating Procedure

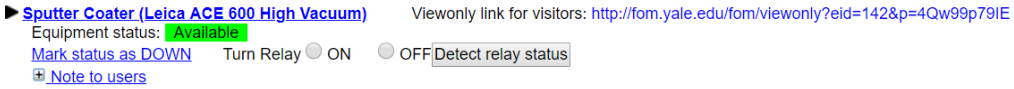
Leica ACE 600 Sputter Coater

Yale West Campus
Materials Characterization Core
ywcmatsci.yale.edu

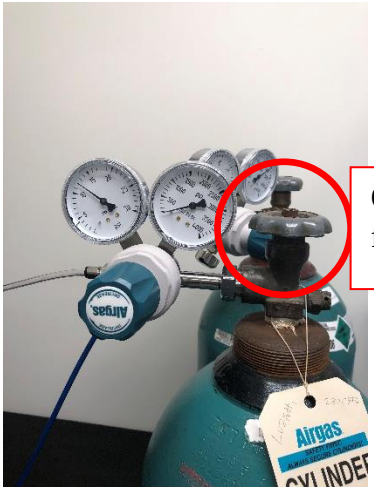
ESI II, Room A119
810 West Campus Drive
West Haven, CT 06516

Leica ACE 600 Sputter Coater
SOP

1. Log FOM to turn on Sputter Coater (Leica ACE 600 High Vacuum).

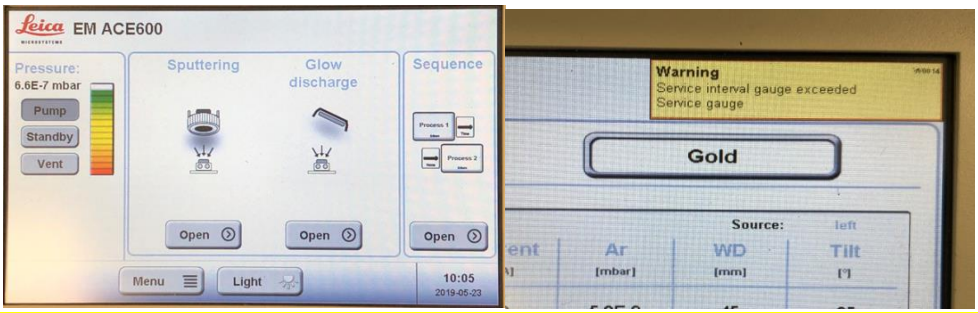


2. Open N_2 valve, make sure the pressure is around 7.5 ~ 12 psi. If possible, do not tune the flow rate knob.



Only open this valve. Avoid tuning flow rate.

3. Click **Vent** to vent the chamber. Wait until the pressure reaches at least **8E+2 mbar** to open the chamber window.



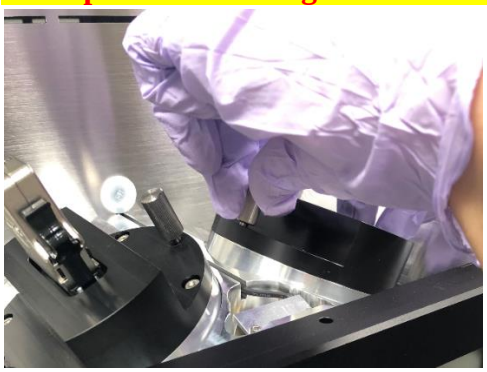
Please ignore the warning message "Service interval gauge exceeded Service gauge".

4. Mount your sample on the sample stage using double side scotch tape.
   - Each small stage can self-rotate. If you want to rotate samples, make sure your sample is not touching nearby stage.
   - For large sample, like glass slide, you can put your sample on more than one small stage, **but make sure the stage is not rotating** (Rotation speed is 0, shown in Stage setup).
   - Check and make sure each small stage sits in the large stage properly. (Otherwise Stage Motor Error may happen.)
5. Clean the chamber using N2 gun in fume hood if the chamber is dirty.

Version 1.0, March 2021

6. Lock the door/window.
   Note: please use N2 spray gun or Vacuum to clean the chamber if it is dirty. The small flakes in chamber may contaminate your samples.
7. Check and Change target if needed.
   Note: Target change must be done in Vent chamber state.
   Please check 'Comments' of logbook for target information.
   1) Open the sputter head cover, disconnect the power cable shown below.

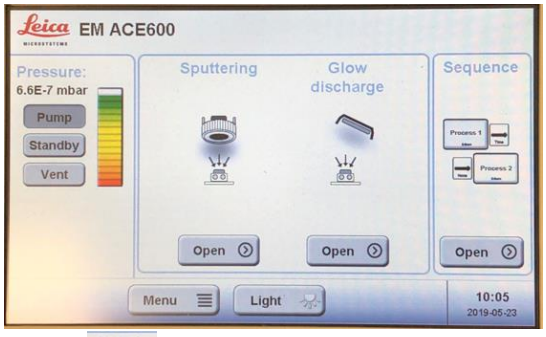

   2) Loose the two screws to release the Sputter Head.
   3) Take off the head, flip it and put on a clean paper.
   4) Rotate the standard ring and take off the target foil using tweezers.
   5) Please put the target into the **Correct** bag.
      Note: please wear the gloves to avoid the contamination of target.



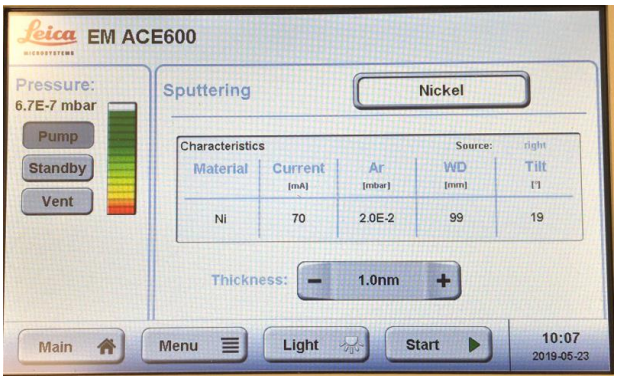

   6) Put the new meal target and lock using standard ring.
   7) Put the sputter head back, make sure the target orientation is correct because the cable has different pins.
      Note: Never ever force push if you feel any resistance. The pin is easily bent.


8) Tight screws (finger-tight is enough) and connect the power cable.
9) Close the sputter head cover.

8. Click **Pump** to vacate the chamber.
9. Turn on the small fan to cool the sputter head if you are coating more than 50nm thick film.
10. Set up program.



1) Click the **Sputtering Open** , you will reach the sputter program shown below.

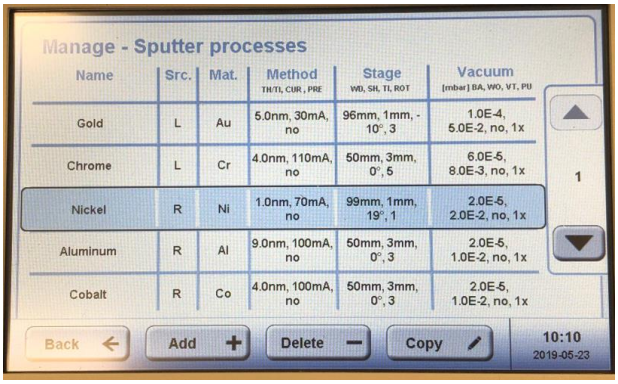


2) Click the top-right block 

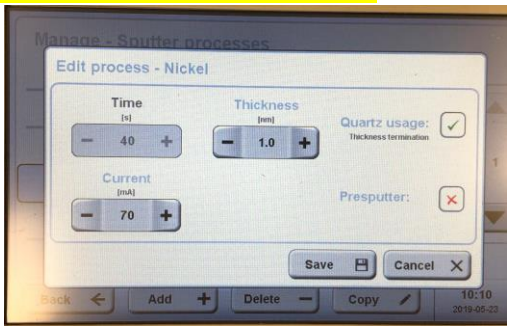
to choose the material you want to coat. Here we take Ni as an example.

3) Click on **Characteristics** window 

to modify program.



4) **Src.** Click R (or L) to set sputter head you are going to use (R: right sputter head, L: left sputter head).
5) **Mat.** Double check the Material.
6) **Method.** Highlight Method column, set up the deposition **Thickness** and **Current**; check the following table for the best Current value. Click **Save** when done.



Parameter Suggestions for ACE 600

Material	Current (mA)	Presputtering (Sec)	WD (mm)	Rotation (rpm)	Sputter Vacuum (mbar)	Base vacuum (mbar)
Au	30	-	99	1	5x10-2	5x10-5
Au/Pd	30	-	99	1	5x10-2	5x10-5
Pt	35	-	99	1	5x10-2	5x10-5
Pt/Pd	35	-	99	1	5x10-2	5x10-5
Ag	35	30	99	1	4x10-2	5x10-5
Cr	110	120	99	1	8x10-3	5x10-5
W	90	60	99	1	8x10-3	5x10-5
Ir	15~30	-	99	1	8x10-3	5x10-5
Al	100	60	99	1	1x10-2	5x10-5
Ti	100	60	99	1	1x10-3	5x10-5
Md	90	60	99	1	8x10-3	5x10-5
Ni	100	60	99	1	2x10-2	5x10-5
Cu	60	30	99	1	2x10-2	5x10-5
Co	100	60	99	1	2x10-2	5x10-5

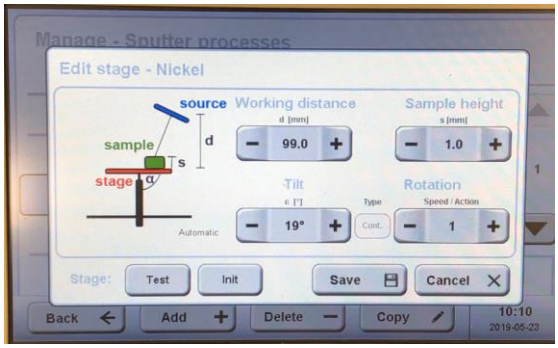
	Recipe of Ir or Au for SEM Imaging							
Material	**Current (mA)**	**Thickness (nm)**	**Pre sputtering (Sec)**	**WD (mm)**	**Rotation (rpm)**	**Tilt**	**Sputter Vacuum (mbar)**	**Base vacuum (mbar)**
Ir	15	2~3	-	99	1	25	8x10-3	5x10-5
Au	30	2~3	-	99	1	-25	5x10-2	5x10-5

	Recipe of Au or other metals for more than 50nm thickness sputtering							
Material	**Current (mA)**	**Thickness (nm)**	**Pre sputtering (Sec)**	**WD (mm)**	**Rotation (rpm)**	**Tilt**	**Sputter Vacuum (mbar)**	**Base vacuum (mbar)**
Au	30~50	> 50	-	50~65	1	-25	5x10-2	5x10-5
Ni	100	> 50	60	50~65	1	25	2x10-2	5x10-5

Please use small working distance (50 ~65mm) if sputtering more than 50 nm.

7) **Stage.** Click Stage column.
   - The Maximum **Working distance** could be 99 mm (the largest value when sample height is 1 mm);
     If you sputter more than 50nm, please set **Working distance** to around 60mm. Otherwise, your sputtering process will be terminated due to sputter head over temperature.
   - **Tilt** angle for Right sputter head is 25º if directly facing target is needed;
   - **Tilt** angle for Left sputter head is -25º if directly facing target is needed;
   - **Rotation** speed usually is 1. If you have large samples, put 0 as rotation speed.

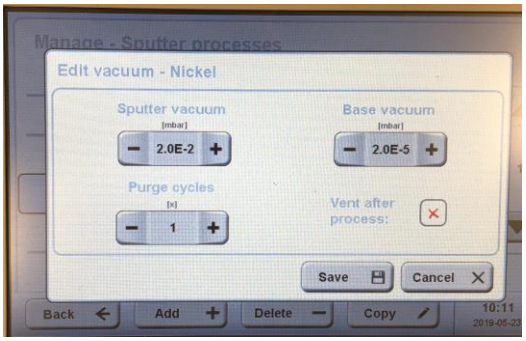
   Click **Test** to check your parameter and then click **Init** to recover. Save if you satisfy.



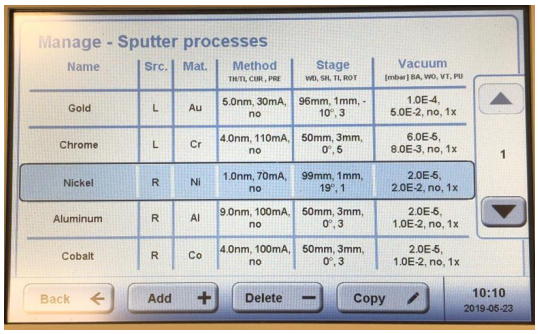
8) **Vacuum**. Set up vacuum by clicking Vacuum.

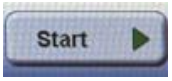
   Check the above table for the best **Sputter vacuum** and **Base vacuum**. For Base vacuum, 1.0E-5 to 5.0E-5 is good.

Note: The better vacuum, the longer waiting time.
Click **Save**.

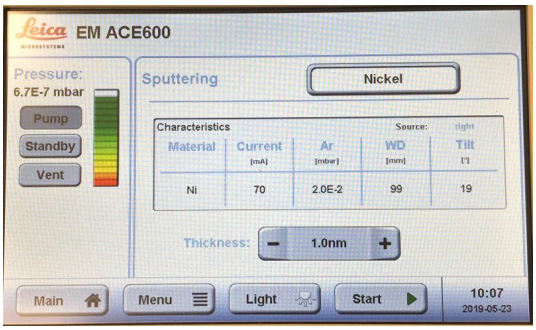


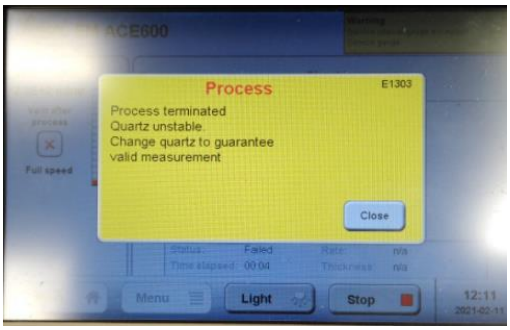
9) Click **Back** when all parameters are set up.



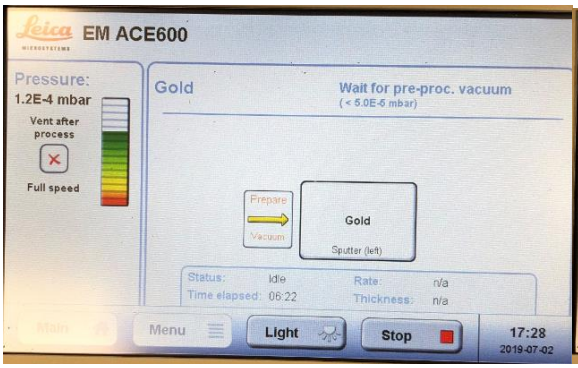
11. Click 

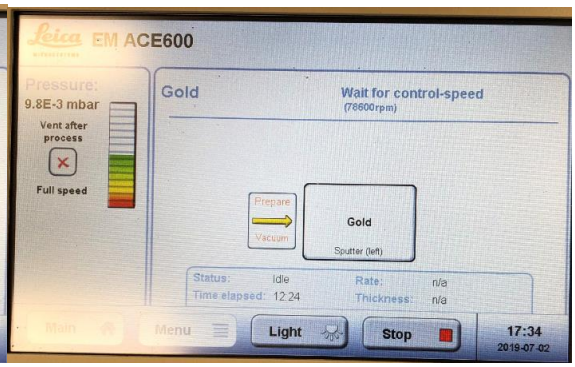
only after the Pressure reaches to 5E-5 mbar.
Warning: You have to wait until the desired vacuum level, otherwise the error message "Quartz unstable" may show.
Please see trouble shoot if you see any error.





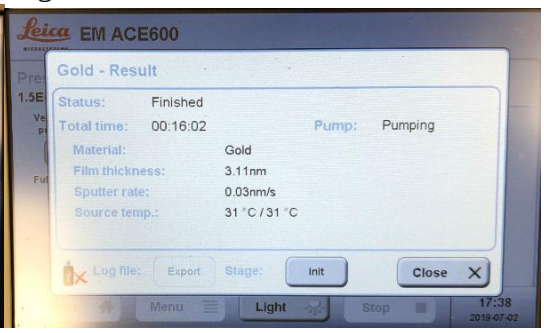
12. Watch for sputtering. Make sure the Ar gas flow is around **7.5 psi.**
    - There are several steps before sputtering, including **Wait for pre-proc. Vacuum**, **Wait for control-speed**.





13. **Sputtering**. You can check the rate and thickness.
    - The final thickness will be shown when it is done, as shown in the following figure.
    - If the thickness is less than your expectation and sputtering is terminated, the sputtering rate may be small, increase **Current** and change thickness to sputter again.

14. Click **Init** when it is done to recover the stage. Then click **Close**.



15. Click **Vent.**
16. Open the chamber until the pressure reaches **8E+2** mbar.
17. Take your samples out. Clean the stages.
18. Lock the window and Click **Pump.**
    The chamber must be left in vacuum state when you are done.
19. Close N2 valve.
20. Logout FOM.
21. **Sign in Log book.**
    Please write down the final target information of each head in logbook **Comments**. This is very important, because a lot of targets have similar color.

    Contact Lei Wang at (203) 745 8460 if needed.

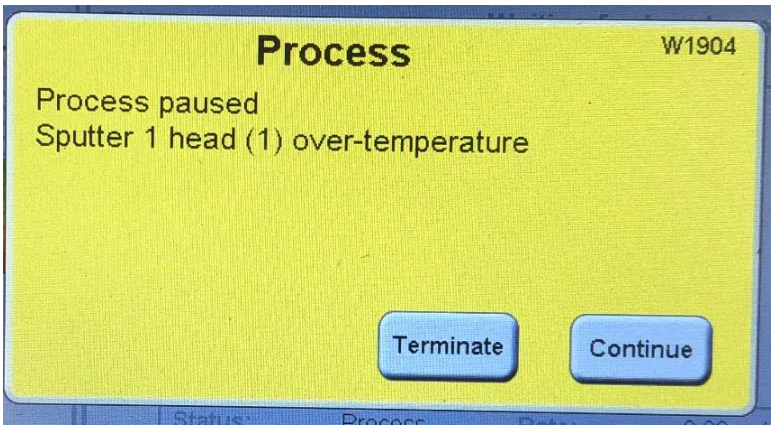
Trouble shoot:

1. If you see the **motor error**, please click the error to remove it.

2. Sputter head **over-temperature**. Please wait 30 min to cool down the head. If you are working on thick sputtering (> 50nm), please

(1) Turn on the small fan to cool the head.

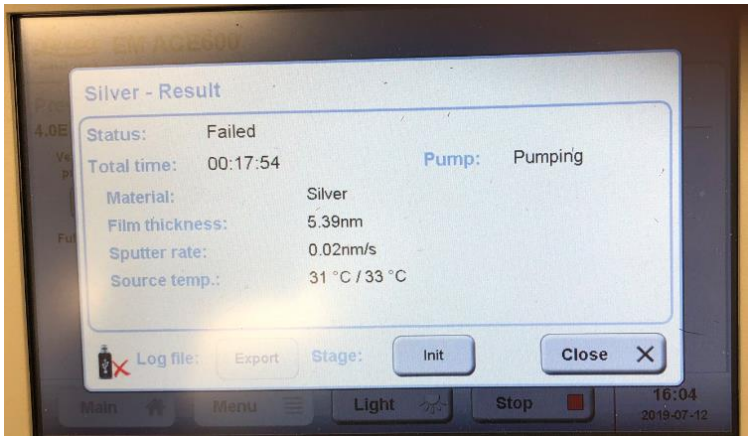
(2) Change **Working distance** to 80 ~ 50 mm to increase the sputtering rate.



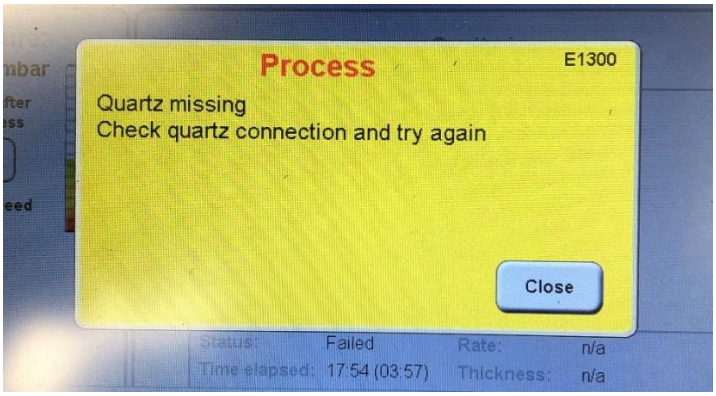
3. **Failed**. The film thickness is less than setup.

(1) Check the **sputtering rate**, if sputtering rate is too low, ~0.01 A/Sec or 0, the quartz may not detect the metal sputtering and will stop after a while.

(2) Increase the **Current** and sputter again.



4. **Quartz missing** error.



(1) Click **Menu**.

(2) Click **Quartz.**

(3) Click **Start.**

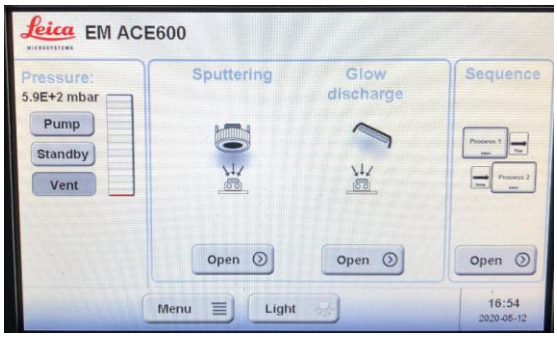
(4) Check whether showing **Status: OK.**

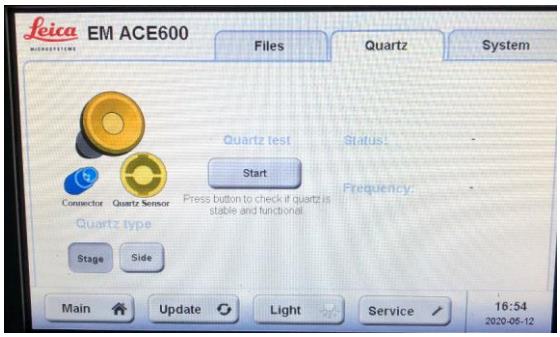
(5) If it shows **Status: Change**, Click **Stop** and then **Start** to test again.

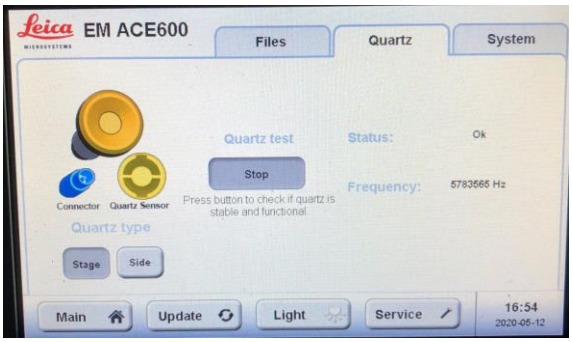
Note: if test results have several **Status: Change**, it may need new quartz replacement, please let manager know. Sometime the quartz shows

(6) Click **Stop**.

(7) Start sputtering again.







5. **Process terminated. Ignition fault.**

(1) Check agron flow **pressure**, it should be ~7.5 psi.

(2) Check the sputter head and connection cable. The pin must be straight. Never force push cable when reconecting the cable.