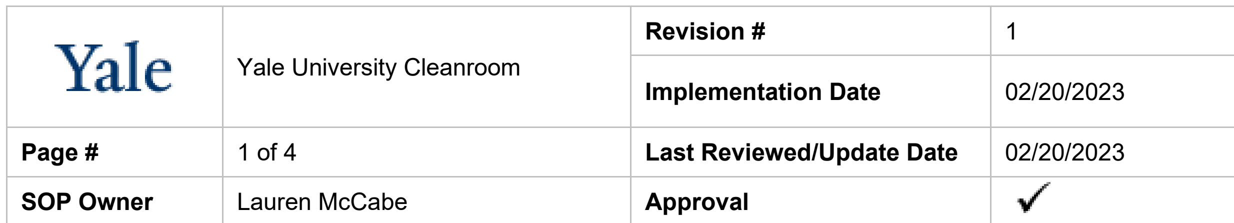

Yale	Yale University Cleanroom	Revision #	1
		Implementation Date	02/20/2023
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SOP Owner	Lauren McCabe	Approval	✓

Lesker CMS-18 Magnetron Sputtering System

1. Purpose

Standard operating procedure for the Lesker CMS-18 Magnetron Sputtering System.

Sputtering is a deposition technique that involves a gaseous plasma which is generated at the target. The surface of the target is eroded away by high-energy ions within the plasma, and the freed atoms deposit onto the substrate to form a thin film. Our KJL CMS-18 is a magnetron sputtering system dedicated to the deposition of Ta and Nb. The tool is capable of UHV and is equipped with a heated rotation state and load lock.

2. Scope

This SOP is intended for general purpose use of the Lesker CMS-18 Magnetron Sputtering System.

3. Prerequisites

Users must have cleanroom access.

4. Responsibilities

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5. Procedure

Login:	Login via FOM to reserve your tool time. In the top, left-hand corner of the KJL computer interface, login with your credentials. If someone else is logged in, you must log out and log in under your name. If you start a process while logged in as someone else, you will not be able to control the system as you would not the thread owner!
Load Sample:	Obtain a cleaned wafer (piranha-cleaned sapphire or RCA cleaned silicon). For high temperature processes, obtain the niobium thermalization disc from the orange cabinet in the deposition bay.

Double check the tool status on the ‘Vacuum’ tab. Both the process chamber and load lock should be pumped down, in the low -9 ~ high -10 torr and -8 torr ranges, respectively. In the log book, record your start time, the load lock and process chamber pressures, and the cryo pump temperature.

Tap “Run Recipe” on the right side of the computer interface. Locate the recipe you want to run, select it, and tap “Run Recipe” at the bottom of the dialog box.

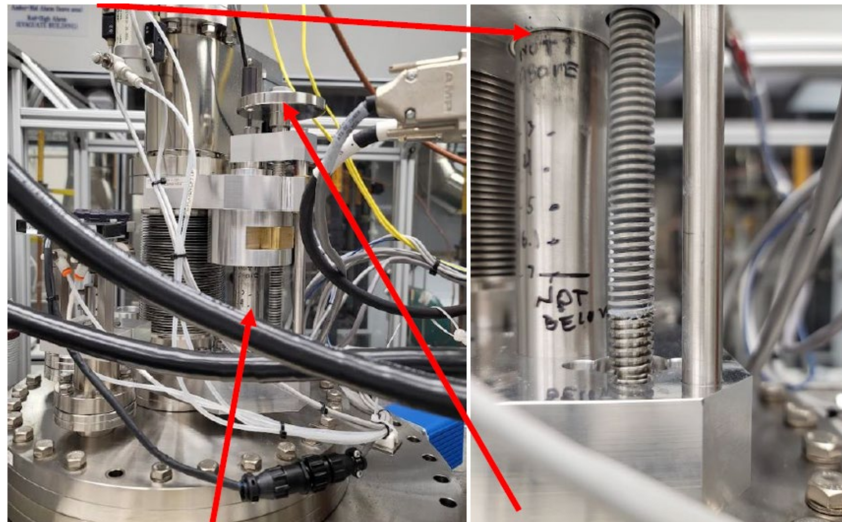
The parameters window will come up. Make sure the values are set exactly to the recipe in your notebook. If they are different, change them to the correct values. Tap “Continue Load” when you are ready.

The recipe will proceed to vent the load lock. Once it is finished the recipe will pause and wait for user input to proceed. Open the load lock door. Load the wafer **face down** with the wafer flat facing you. (If using the niobium thermalization disc, load it on top of the wafer. The thermalization disc is a little too large to properly fit. Align the disc against the 2 right prongs on the arm.)

Close the load lock door. Press “Resume” in the Recipe Monitor dialog box to proceed with pumping down the load lock. Once the system reaches a pressure below 1E-7 torr, the recipe will pause and wait Before transferring, record the time, the load lock and process chamber pressures, and the cryo pump temperature in the log book.

Press “Resume” to proceed with the transfer. The system will purge the argon line by toggling the valve open and closed a few times. This also relieves the pressure on the backside of the valve. Then the system will home the transfer and substrate rotation motors. Navigate to the ‘Motors’ tab for the transfer process.

The recipe will pause and wait for the user to adjust the platen Z shift position. **Visually confirm** that the platen Z position is correct (see photo). Make sure the Z position is on the “NOT ABOVE” line. **Failing to do this will ruin your sample and may damage the machine!**



Z height markings

Turn this to adjust Z height

Once you have visually confirmed the Z position is correct, press "Resume" to initiate the transfer process. Turn on the light and observe the sample transfer proceed through the viewport. When the arm is in position, the substrate lift will attempt to retract and pick up the sample. The recipe will pause. Visually confirm that the lift has picked up the sample and the arm is not stuck or caught by the lift. Resume the recipe to continue.

If the load is unsuccessful, you must extend the substrate lift by clicking the "Substrate Lift" button on the Motion page to put the wafer back on the arm. Then resume the recipe to return the sample to the load lock. Abort the recipe and notify Staff.

Deposition: Once the transfer is completed, the deposition process will begin. For high temperature process, the sample heating steps will take place before the deposition.

For the high temperature, the recipe will heat in two steps:1. Heat the sample to 400°C and bake the wafer for 15 mins (dehydration bake). 2. Heat the sample to 800°C and bake the wafer for 10 mins (deposition temperature). At the end of each step, record the pressures and cryo temperature in the log book.

The recipe will pause and wait for the user to adjust the platen Z shift position for deposition. Adjust the Z position to position 4. Press “Resume” to begin deposition. Argon will flow into the PC, and the gun will ignite. Look into the viewport and observe the plasma glow from the gun. Verify that the glow is steady and not flickering. Verify that there is no sparking or glowing discharge.

After the deposition is completed, the gun will power down and the PC will evacuate. For the high temperature process, the system will remain at 800°C for 10 minutes. At the end of this post-bake, record the pressures and cryo pump temperature in the log book. For the high temperature process, the system will then start the cool down process, which will take approximately 3 hours.

Unloading: The recipe will pause and wait for user input to initiate the transfer back to the load lock. Press “Resume” to continue with the transfer. The recipe will home the motors and pause again for the user to set the Z position to the transfer position. Raise the Z position to the “NOT ABOVE” line. Resume the recipe transfer.

Turn on the viewport light and observe the sample transfer. When the arm is in position, the substrate lift will extend and drop the sample onto the transfer arm. The recipe will pause. Visually confirm the sample on the arm and resume the transfer.

If the unload is unsuccessful, retract the substrate lift by clicking the “Substrate Lift” button on the Motion tab. Resume the recipe to return the arm to the load lock, then abort the recipe. Notify Staff.

After transferring back to the load lock, the recipe will pause again. Press resume to vent the load lock. Once the load lock is vented, retrieve the thermalization disk and return it to the orange cabinet. Retrieve your sample to its holder. Close the load lock.

Press resume to pump the load lock back down. Once the pumping has completed the recipe will end.

Log Off: Log off of the computer interface and FOM.