

# PVD 4 – Lesker CMS 18 Deposition System

## Standard Operating Procedure

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### Overview

This document will provide a detailed operation procedure of the PVD 4 System. Formal Training is required for all users prior to using the system.

### Revision History

#	Revised by:	Date	Modification
0	Chris Balicki	2011/11/24	Document Initial Release
1			
2			
3			
4			

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## General Information

The Lesker CMS 18 Deposition System (PVD 4) is a 4 source RF, 2 source pulsed DC sputter deposition system. The each source can accommodate 3" diameter targets of maximum 0.250" thickness. Conductors are best suited for DC sputtering. Insulators are best suited for RF sputtering. Oxide/nitride deposition is also possible via reactive sputtering, by utilizing pulsed DC sputtering and careful gas flow control. RF Sputter materials approved include: Silicon Dioxide (SiO<sub>2</sub>), Titanium Dioxide (TiO<sub>2</sub>), Zinc Oxide (ZnO), Aluminum Oxide (Al<sub>2</sub>O<sub>3</sub>), Aluminum-doped Zinc Oxide (AZO), Indium Tin Oxide (ITO), Tin Oxide (SnO<sub>2</sub>), Niobium Pentoxide (Nb<sub>2</sub>O<sub>5</sub>), Niobium Dioxide (NbO<sub>2</sub>), Tantalum Pentoxide (Ta<sub>2</sub>O<sub>5</sub>), Hafnium Oxide (HfO<sub>2</sub>), Silicon Nitride (Si<sub>3</sub>N<sub>4</sub>), Titanium Nitride (TiN), Aluminum Nitride (AlN). DC Sputter materials approved include: Niobium (Nb), Chromium (Cr), Silicon (Si), Titanium (Ti), Tungsten (W), Molybdenum (Mo), Aluminum (Al), Chromium-Tantalum (Cr/Ta 50/50). The system features a load-lock for quick sample processing and high vacuum conditions. Other features include substrate cleaning/etching via argon/oxygen plasma and heating up to 800°C.

## Operation

### First Steps Prior to Operation

1. Login.
2. Enter the 'Platen Motion' screen.
3. Confirm that platen motor is referenced. If not, press 'Home' to reference it.
4. Confirm that platen z-shift motor is referenced. If not, press 'Home' to reference it.
5. Enter the 'LRP Motion' screen.
6. Confirm that LRP Arm Extender motor is referenced. If not, press 'Home' to reference it.
7. Enter 'Cooling' screen. Confirm that all flow switches are green.

### Sample Loading

1. Enter the 'Vacuum' screen.
2. Press 'Start LL Vent' button. Wait for the recipe to finish.
3. Load your sample. If assistance is required, please contact the Nanofabrication Staff.
4. When ready, close LL chamber door.
5. Press 'Start LL Pump' button. Be sure to acknowledge the check step. Wait for the recipe to finish.
6. Wait until LL is less than 5.00E-6 Torr.
7. Press 'Start Sample Load' button. Wait for the recipe to finish.
8. Confirm that the PC Turbo Backing valve is open.

### Deposition via Manual Control

1. Enter the 'Vacuum' screen.
2. Turn off the PC Ion Gauge.
3. Open the PC High Vac Throttle valve.
4. Enter the 'Gas' screen.
5. Open the Source Gas valve(s).
6. Open the MFC valve(s).
7. Enter the desired mode for each open MFC.
8. Enter 20mTorr for Capman Pressure SP.
9. Confirm that gas flow is present and that chamber pressure is converging on 20mTorr.
10. Enter the 'Platen Motion' screen.
11. Turn on substrate rotation by pressing the 'FWD' button.
12. Enter the 'Deposition' screen.
13. Turn on the source switch.
14. Enter 50W for Working Power SP.
15. Turn on the source power supply.

16. **For RF:** Confirm that Forward Power is ~50W, Reflected Power is 0W, and DC BIAS is >5V.  
*If experiencing problems with RF plasma ignition, try to open/close the source shutter.*  
**For DC:** Confirm that Power is ~50W, Volts is >0V, and Amps is >0A.
17. Once plasma is ignited, take the necessary steps to setup your sputtering conditions – working power, gas composition, and pressure.
  - a. Reduce pressure (PC Cap SP) to desired working pressure. Enter gas ratios if desired.
  - b. Enter ramp rate (check Materials Information sheet).
  - c. Enter new Working Power SP. Wait until SP is reached.
  - d. Once SP is met, wait  $\geq 10$ min to presputter the target.
  - e. Confirm that DC BIAS is stable.
18. Open the source shutter.
19. Enter the desired time (sec) under Start Timed Deposition.
20. When ready, turn on the Deposition Timer.  
*The substrate shutter opens automatically and the timer starts. The sample is being sputtered. The substrate shutter will close automatically when the timer expires. It is okay to leave the system during sputtering. When finished...*
21. Close the source shutter.
22. Enter ramp rate (check Materials Information sheet).
23. Enter 0W for Working Power SP. Wait for power and all other indicators to ramp down to 0.
24. Turn off the source power supply.
25. Turn off the source switch.
26. Enter the 'Platen Motion' screen.
27. Turn off substrate rotation by pressing the 'FWD' button.
28. Enter the 'Gas' screen.
29. Enter 0mTorr for Capman Pressure SP.
30. Enter 0 mode for all MFCs.
31. Close all MFC valves.
32. Close all Source Gas valves.
33. Enter the 'Vacuum' screen.
34. Close the PC High Vac Throttle valve.
35. Turn on the PC Ion Gauge.

## Deposition via Recipe Control

Deposition via Recipe Control is only permitted to users who have a mastery of manual control of the system. It is best suited to individuals who are repeatedly performing the same process.

Additional training is required for recipe creation and deposition. Please contact the Nanofabrication Staff for further information.

## Sample Unloading

1. Press 'Start Sample Unload' button. Wait for the recipe to finish.
2. Press 'Start LL Vent' button. Wait for the recipe to finish.
3. Open the chamber door, remove your sample, and close the chamber door.
4. Press 'Start LL Pump' button. Be sure to acknowledge the check step. Wait for the recipe to finish.
5. Confirm that the PC Turbo Backing valve is open.

## Closing Steps Prior to Leaving

1. Confirm that PC Turbo Backing valve is open.
2. Confirm that Chamber Light is off.
3. Confirm that viewport shutter is closed.
4. Confirm that LL Turbo Pump Reset is on.
5. Logout.

## Data logging

1. Enter the 'System' screen.
2. Click the 'Suspend Screen Updates' button (the button will highlight green).
3. Select/de-select the signal names that you wish to data log.
4. Click the 'Suspend Screen Updates' button.
5. Click the 'Generate Data Log' button (this will start a new file for the data log).
6. Enter the 'Operation' screen.
7. To start data logging, click 'Recording Start'.
8. To stop data logging, click 'Recording Stop'.
9. To retrieve data, open MS Access.

10. Open the Datalog.mdb file in the 'Open Recent Database' screen.  
*IMPORTANT: Do not attempt to open the Datalog.mdb directly from Windows Explorer. The file can only be opened through MS Access, as per the above procedure.*
11. Select you data log in the left hand column.  
*Note: To save/process data, users must export data to excel and save the excel file to a flash drive. Please ensure that you format your flash drive prior to inserting it into the system computer. Do not store any sort of files on the computer. Data logs will be regularly deleted from the system.*

## References and Files

Kurt J. Lesker CMS 18 Operation Manual

## Contact Information

Questions or comments in regard to this document should be directed towards Chris Balicki ([balick-i@4dlabs.ca](mailto:balick-i@4dlabs.ca)) in 4D LABS at Simon Fraser University, Burnaby, BC, Canada.