

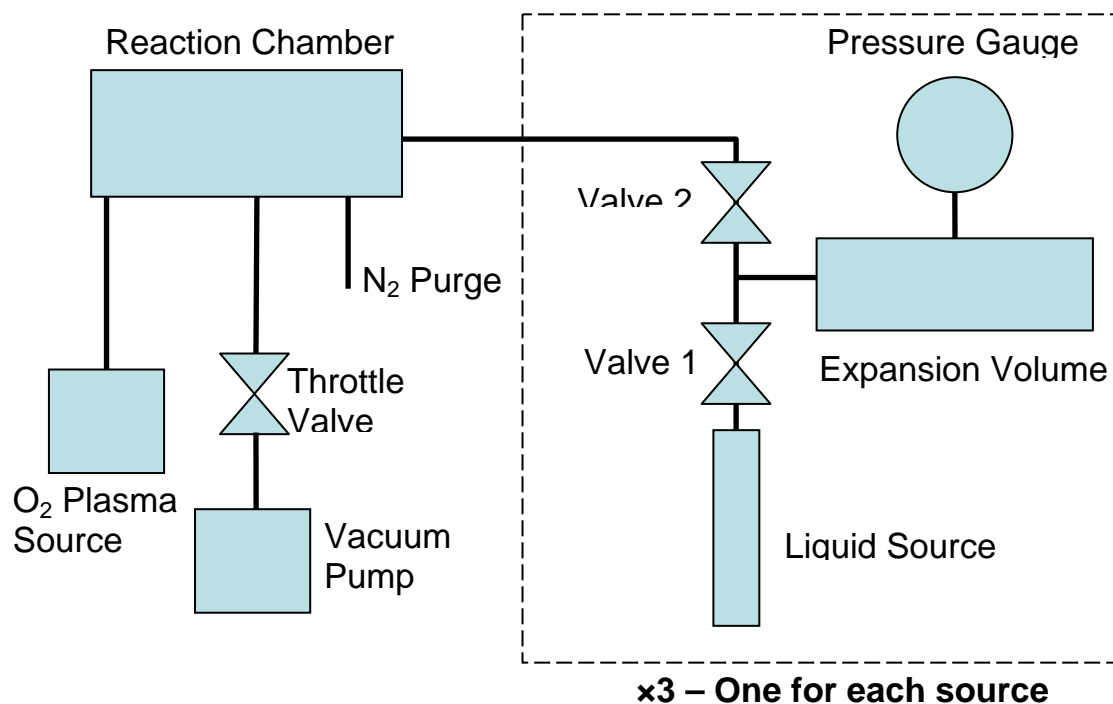


**Applied Micro Structures MVD 100
Operating Manual**

Operating Principle

The MVD 100 is a useful tool for depositing monolayers of organosilanes. It can be used to create highly hydrophobic surfaces, antifouling surfaces and biofunctionalized surfaces. A list of the monolayer deposition processes used in the system can be found on the tool's web page.

The operation of the system is fairly simple. The tool possesses a reaction chamber and 3 vapor delivery lines. Line 1 is dedicated for water vapor which is used in some processes as a catalyst. Line 2 is dedicated to APTMS due to cross contamination concerns. Line 3 is then used for all remaining organosilanes. Each line features a liquid source, an expansion volume connected to a pressure gauge and a set of control valves. During a vapor fill cycle, Valve 1 will open while Valve 2 is shut allowing the vapor to flow from the source to the expansion volume. Once a specified pressure is reached, Valve 1 closes. At this time the Throttle Valve closes and Valve 2 opens, allowing the vapor to flow into the reaction chamber. The vapor remains in the chamber for a specified amount of time and then is pumped away. An O₂ plasma source is also connected to the tool for surface preparation purposes.



Operating instructions

1. Log in

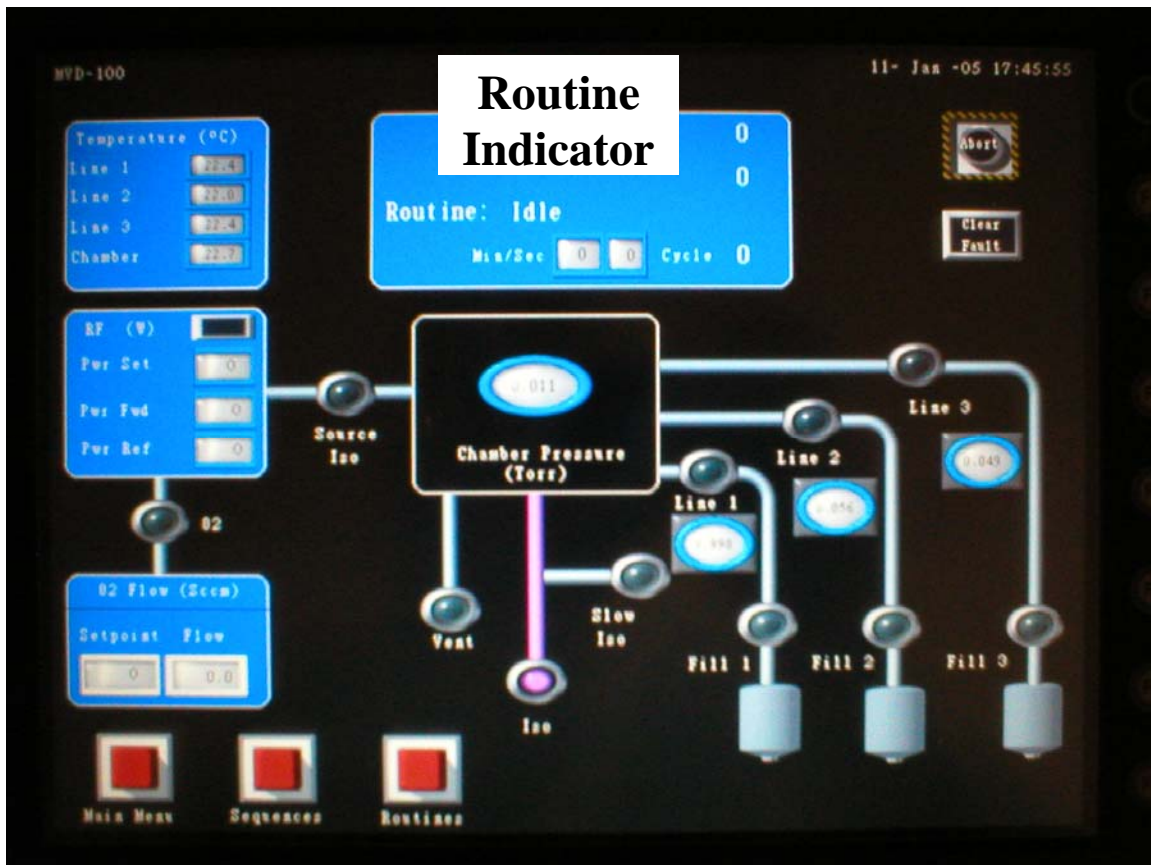
Log into CAC and then log into the tool as Level 2. The password is 456.

2. Check the chamber pressure.

The chamber pressure should be less than 0.03 Torr. If the chamber pressure is higher than this run a chamber clean following the instructions in that section.

3. Run a dummy run of your process.

It can be very beneficial to run a dummy run of your process to prepare the tool for your run as well as to verify the tool is running properly. A dummy run is basically a run with an empty chamber with a short reaction time of about 1 minute or less.



Main Menu button Sequences button Routines button

4. Vent the chamber and load your samples

Press the [Routines] button and then the green [Vent] button. The Routine Indicator will read “Vent” and then “Chamber Vented” when finished. Open the lid and load your samples. Samples can be placed anywhere inside the recessed floor of the chamber. Be careful not to drop anything down the two holes in the corners of the chamber floor.

5. Pumpdown the chamber

Press the [Routines] button and then the green [Pumpdown] button. The Routine Indicator will read cycle between “Pumping Chamber” and “Purge” as it goes through the pump / purge cycle to remove the atmosphere from the chamber. When it is finished the Routine Indicator will read “Idle”.

6. Verify / Program in your process

Press the [Sequences] button and then the settings button [Arrow] for either a single or dual layer film depending on the baseline process. Verify or enter in the process recipe for your film.

7. Run process

Press the [Run] button for the process you have programmed / verified. The Routine Indicator will read either “Single Layer” or “Dual Layer” depending on the process selected.

Note: RF plasma – If you have selected to do a RF O₂ plasma preclean of the substrate, the Routine Indicator should read “RF Plasma”. If the RF plasma matching unit fails to tune properly it will display a RF fault and abort the run. Press the [Abort] button on the upper right side of the screen followed by [Clear Fault]. Start the process again. If the RF plasma fails a second time, contact the tool manager.

The Routine Indicator will cycle through the recipe steps as the tool goes through the process. After the reaction time the tool will automatically purge the chamber several times and then the Routine Indicator will display “Idle”.

8. Vent the Chamber

Press the [Routines] button and then the green [Vent] button. The Routine Indicator will read “Vent” and then “Chamber Vented” when finished. Open the lid and remove your samples. If you have more samples to process, load them at this point and go to step 5.

9. Pumpdown the chamber

Press the [Routines] button and then the green [Pumpdown] button. The Routine Indicator will read cycle between "Pumping Chamber" and "Purge" as it goes through the pump / purge cycle to remove the atmosphere from the chamber. When it is finished the Routine Indicator will read "Idle".

10. Log Out

Press the [Main Menu] button and then [Log Out]. Log off the tool in CAC.

Chamber Clean

If the chamber pressure is more than 0.03 Torr then run an O₂ plasma clean before you vent the chamber and load your samples.

Press the [Routines] button. Press the run button located next to [RF Clean]. This process takes 10 minutes. Should the plasma fail, press the [Abort] button and then the [Clear Fault] button located in the upper right corner of the screen. Try running the "RF clean" again and if the plasma fails a second time, contact the tool manager

Baseline Process Recipes

FOTS - (Tridecafluoro-1,1,2,2-Tetrahydrooctyl)-Trichlorosilane

Single layer process

RF:	O2 Flow (sccm)	150	Power (W)	200	Time (sec)	60 – 300*
Vapor Order:	1 st (Line #)	3	2 nd (Line #)	1	3 rd (Line #)	0
Vapor Parameters:		Line 1		Line 2		Line 3
	Pressure (Torr)	6	Pressure (Torr)	0	Pressure (Torr)	0.7
	Cycles (#)	1	Cycles (#)	1	Cycles (#)	1
Reaction:	Time (sec)	600	Purge Cycles (#)	10		

* The RF Time can be from 60 sec to 300 sec depending on the length of the preclean you want.

PEG - 2-[Methoxy(polyethylenoxy)propyltrichlorosilane

The baseline PEG process requires a 4 “layer” process, that is to say, it is a 4 reaction step process. The MVD is only capable of sequencing two reactions at a time using the 2 layer process recipe. This means that you must run the 2 layer process twice to get 4 layers. The first time you run the process you may use an O₂ plasma. However, **YOU MUST SET THE TIME TO ZERO IN THE FIRST LAYER BEFORE YOU RUN IT AGAIN.** Failure to do this will result in destroying the PEG from the first two layers.

Layer 1 (First time)

RF:	O2 Flow (sccm)	150	Power (W)	200	Time (sec)	60 - 300*
Vapor Order:	1 st (Line #)	3	2 nd (Line #)	1	3 rd (Line #)	0
Vapor Parameters:		Line 1		Line 2		Line 3
	Pressure (Torr)	8	Pressure (Torr)	0	Pressure (Torr)	0.5
	Cycles (#)	1	Cycles (#)	1	Cycles (#)	4
Reaction:	Time (sec)	900	Purge Cycles (#)	10		

* The RF Time can be from 60 sec to 300 sec depending on the length of the preclean you want.

Layer 2 (First time)

Vapor Order:	1 st (Line #)	3	2 nd (Line #)	1	3 rd (Line #)	0
Vapor Parameters:		Line 1		Line 2		Line 3
	Pressure (Torr)	8	Pressure (Torr)	0	Pressure (Torr)	0.5
	Cycles (#)	1	Cycles (#)	1	Cycles (#)	4
Reaction:	Time (sec)	600	Purge Cycles (#)	10		

Layer 1 (Second time)

RF:	O2 Flow (sccm)	150	Power (W)	200	Time (sec)	0*
Vapor Order:	1 st (Line #)	3	2 nd (Line #)	1	3 rd (Line #)	0
Vapor Parameters:		Line 1		Line 2		Line 3
	Pressure (Torr)	8	Pressure (Torr)	0	Pressure (Torr)	0.5
	Cycles (#)	1	Cycles (#)	1	Cycles (#)	4
Reaction:	Time (sec)	600	Purge Cycles (#)	10		

* The RF Time must be set to zero or you will destroy the layers put down in the first cycles.

Layer 2 (Second time)

Vapor Order:	1 st (Line #)	3	2 nd (Line #)	1	3 rd (Line #)	0
Vapor Parameters:		Line 1		Line 2		Line 3
	Pressure (Torr)	8	Pressure (Torr)	0	Pressure (Torr)	0.5
	Cycles (#)	1	Cycles (#)	1	Cycles (#)	4
Reaction:	Time (sec)	600	Purge Cycles (#)	10		

APTMS - Aminopropyl Trimethoxysilane

APTMS is loaded into a separate line to avoid cross contamination with other sources. To prolong the life of the source material, the liquid source is held at room temperature until it is needed. Before running, open the right side front panel and flip on the circuit breaker labeled "Source 2 Heater Power". Allow the source to fully come up to temperature before starting your process. **Be sure to turn the heater off when you are finished your run.**

Single Layer Process

RF:	O2 Flow (sccm)	150	Power (W)	200	Time (sec)	60 - 300*
Vapor Order:	1 st (Line #)	2	2 nd (Line #)	0	3 rd (Line #)	0
Vapor Parameters:		Line 1		Line 2		Line 3
	Pressure (Torr)	0	Pressure (Torr)	1	Pressure (Torr)	0
	Cycles (#)	1	Cycles (#)	4	Cycles (#)	1
Reaction:	Time (sec)	900	Purge Cycles (#)	10		

* The RF Time can be from 60 sec to 300 sec depending on the length of the preclean you want.

Single layer process

Chamber temperature 35 ° C

NOTE: It can take a significant amount of time to pump out the expansion volume for line 3 at the end of the reaction step. Please be patient.

MPTMS - 3-Mercaptopropyltrimethoxysilane

Single layer process

RF:	O2 Flow (sccm)	150	Power (W)	200	Time (sec)	60 – 300*
Vapor Order:	1 st (Line #)	3	2 nd (Line #)	0	3 rd (Line #)	0
Vapor Parameters:		Line 1		Line 2		Line 3
	Pressure (Torr)	0	Pressure (Torr)	0	Pressure (Torr)	0.75
	Cycles (#)	1	Cycles (#)	1	Cycles (#)	4
Reaction:	Time (sec)	900	Purge Cycles (#)	10		

* The RF Time can be from 60 sec to 300 sec depending on the length of the preclean you want.

MAOPTS - 3-Methacryloxypropyltrichlorosilane

Single layer process

RF:	O2 Flow (sccm)	150	Power (W)	200	Time (sec)	60 – 300*
Vapor Order:	1 st (Line #)	3	2 nd (Line #)	1	3 rd (Line #)	0
Vapor Parameters:		Line 1		Line 2		Line 3
	Pressure (Torr)	9	Pressure (Torr)	0	Pressure (Torr)	0.5
	Cycles (#)	2	Cycles (#)	1	Cycles (#)	4
Reaction:	Time (sec)	900	Purge Cycles (#)	10		

* The RF Time can be from 60 sec to 300 sec depending on the length of the preclean you want.