

PULSED LASER DEPOSITION (PLD1) DOCUMENT

Information Sheet:

Tool Name: Pulsed Laser Deposition (PLD1) System

Name	Role	Email ID	Mobile no.	Target
Neeraj Panwar	SO-1	panwar.iitr@gmail.com	9619507210	Pr _{0.7} Ca _{0.3} MnO ₃
Sangita chaki roy	SO-2	scroy@ee.iitb.ac.in	9987212731	BTO
Saurabh Nagar	AU	saurabh.nagar1986@gmail.com	9930779375	ZnO, MgO, ZnMgO
Pragati Chaturvedi	AU	prag10c@gmail.com	9987963198	Sb ₂ Te ₃ , Bi ₂ Se ₃
Biswajit saha	AU	biswajit25@gmail.com	9930315912	
Kalpana meena	AU	kalpana240991@gmail.com	9167624752	CaO
Shantanu Saha	AU	shantanu.rpe@gmail.com	9167782972	ZnO
Shailaja Sasi	AU (operator)	shailaja@ee.iitb.ac.in	9820935475	Lija Joy :GdSrMno,LSMO Savita Pillai: Fe ₃ O ₄ ,CoFe ₂ O ₄ ,C oCr ₂ O ₄ ,NiCr ₂ O ₄ Neeraj Khire :Y ₂ O ₃ ,La ₂ O ₃ ,BaC o ₃ ,SrCo ₃ ,CuO Sudhanshu :CrO ₂ ,Titanium dioxide Pijus :CuO Annop Bhatt :PbO,Indinium oxide,Ziconiumdio xide,Niobium Pentaoxide Deepak Bhatia:ZnO

Materials Allowed:

Substrates: Substrates with organic material or coating are not allowed

Targets: All oxide based target except some metal oxides

Training Information:

- Target properties must satisfy the criteria listed above.
- The student should have cleared the fabrication lab entry and safety tests.
- Written (letter/email) recommendation for system authorization from the advisor to be conveyed to both the SO.
- As a part of training, the student should attend at least 5 complete runs of SOP being performed by any of the SO/AU.
- Authorization test will have 2 aspects – written and practical.
- Success criteria for authorization: In the written test, the student needs to answer all questions correctly. In the practical test, the student needs to perform a complete run (SOP) correctly.

Violation:

1. Not using the Radiation Shield of the heater during deposition
2. Violating the SOP steps leading to system/laser downtime.
3. Failure to make entry in the log book (both PLD and LASER).
4. Booking the system in advance and not using it. The user is expected to inform the next user/SO a day in advance if the slot is not being utilized.

Violation Policy: Violation of the above rules would lead to suspension from using the system for upto 2 months or loss of authorization of the system. Extreme cases may lead to suspension from the lab.

Reauthorization Policy: If a user does not use the system for 6 months (s)he should pass the authorization test again to resume the system usage.

Nominal Process Flow:

Before Entering the Clean Room:

1. Check whether the RTP and Furnace exhaust are on or not. If not switch it on by pressing the green button
2. Check whether the chiller is working or not. Then open the water valve of the PLD1.
3. Check whether the O₂ cylinder is open or not. Set it to 2 bar. If the cylinder pressure is less than 10kg/cm², it may need to be replaced

Switching on the laser:

1. Switch on the main switch of the laser
2. Rotate the red knob (at the back of the laser) clockwise to put it in on position.
3. Check whether the corridor AC is ON or not. If not, then switch it ON and set the temperature to 23°C
4. Open the laser shutter and the pass box shutter. Place the desired aperture in its place.

Inside the clean room:

1. Vent the chamber and the tube using the respective vent valves.
2. Take out the heater and place your substrate on it and fix it either by using Ag-paste or pins provided. Close the shutter of the heater
3. Place the target in the chamber and measure the starting angle and end angle by focusing laser on the target. To do so:
 - Set the frequency of the laser to 1Hz
 - Press Run/Stop button followed by Exe button on the laser keypad
 - Adjust the target such that the laser hits almost the edge of the target and then stop the laser by pressing Break or Run/Stop button
 - Check the angle and repeat these steps for the other end of the target.
4. Measure the energy density by checking the laser energy and the spot size.
5. Load the heater (with the sample mounted) into the chamber.
6. Open the gate valve fully and start the rotary pump
7. Start the turbo once the pressure reaches 4E-1 mbar or below and put the turbo in "Standby-Off" mode after some time
8. Set the Start angle, End angle, Number of pulses frequency in the Target Carousel box.
9. Open the temperature controller and set the substrate temperature and the ramp rate. If your temperature is below 600°C, set the OUT to 80 else keep it at 100.
10. Wait for the chamber and heater to reach the required temperature and pressure (4E-5mbar or below)
11. Set the turbo into "Standby-On" mode
12. Close the gate valve partially. Open the main oxygen valve along with the gas valve in the chamber and the Control valve.
13. Set the required oxygen pressure with the help of gate valve, gas valve and flow meter.
14. Start the laser (Run/Stop + Exe buttons) and the target carousel (Start)
 - Before starting laser, set the Rep Rate, put the laser in constant energy mode (EGY NGR), and set the energy according to your needs.
15. After 1000 pulses, remove the shutter for deposition to take place.

16. After all the shots are completed, stop the laser and the target carousel.

*17. If you need to perform in-situ annealing, let the chamber be in the same state for the required time.

Steps for shutdown:

1. Close the gate valve completely and also close the oxygen valves.
2. Switch off the turbo and the heater (press set + down arrow simultaneously) and turn off the heater.
3. Wait till the frequency of the turbo shows 0Hz. Switch off the main switch of PLD1 and the rotary switch.

Turn OFF the laser:

- a. Set the Rep rate to 1Hz, put it in HV NGR mode, set the voltage to 18kV.
- b. Press F10, goto Shutdown by pressing the arrow keys, press enter and execute
- c. Wait for the controller to show "TURN MAINS OFF"

4. Open the tube vent valve and come out of the clean room.
5. Turn the red knob of the laser back to OFF position by turning it in anti-clockwise direction. Switch OFF the mains of the laser.
6. Close the water valve.

System Cleaning:

Before taking over the system, it needs to be cleaned properly to avoid any contamination in your samples. To clean the system:

1. Take the heater into the service corridor and scrub it thoroughly with fine emery paper to remove the coatings of the previous depositions. Also, clean the shutter, radiation shield and sample clips.
2. Clean all the parts using IPA/Acetone properly before taking it back into the clean room.
3. Clean the chamber from inside thoroughly by IPA/Acetone.
4. Put the system for degassing for around 2 hours (put it in high vacuum and set the heater temperature between 600°C to 800°C)