

Usage Policies Notebook for PERKIN-ELMER 4400 RF Sputtering System for Metallic Materials

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Emergency Plan for PE 4400 Sputtering System

Standard Operating Procedures for Emergencies

Contact information

Person	Phone number
Lab Manager	Jake Hes, 949-824-8239 (day), 562-522-8328 (alternate)
Director	G.P. Li: 949-824-4194 (day), 949-824-2047 (alternate)
Staff	Mo Kebaili: 949-824-8239 (day), 949-494-5892 (alternate)
Super User	Carlos Ruiz (818) 527-6349 (Anytime, voicemail or text only)

Hazardous chemicals, gases, and conditions

Hazard name	Description of hazard
High voltage	Electrical shock, ignition source
High RF voltage	
Ar (Argon) gas	nonflammable gas
N ₂ (nitrogen) gas	Asphyxiant

Alarms or indications of danger

Alarm type	Condition and response
Excess Temp Alarm	Problem with process state. Halt the process. Correct the problem or notify the staff and the lab manager before continuing.
Pungent or foul smell	Gas leak. Shutdown the tool at once and evacuate the area. Contact the staff and the lab manager.
Gas Detector	

Emergency shutdown plan #1

In the event of an emergency, when there is very little time, *press the large red emergency shut-off button at the entrance of the room 1*, this will shutdown the gas system, and stop gas flow. Leave the facility at once, and then contact the lab manager or the staff.

Emergency shutdown plan #2

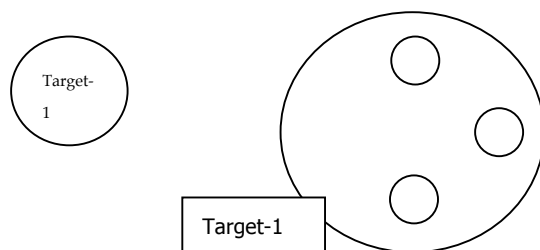
In the event of an emergency, when there are a few minutes available, *turn off gas switches on the gas panel, the control power and the main power*. This will stop gas flow into the system. If there is no fire, and no smell of gases, enter the room and close off all gas cylinders by turning them fully clockwise. Check the oxygen tank in **room w**, feel the door for possible fire, and if safe, close the oxygen tank by turning the cylinder head valve fully clockwise. Leave the facility at once, and then contact the staff and the lab manager.

Usage Policies for PE 4400 Sputtering System

Standard Policies for Usage

Description

The model 4400 Sputtering System deposits a wide variety of metallic materials onto substrates such as ceramics, metals, plastics, glass and semiconductors. The system is capable of depositing material in RF and DC sputtering modes. The bombarding ionized gas is argon and can be mixed with O₂ gas for reactive sputtering. So when high voltage is passed into the vacuum chamber and ionizes the Argon gas within, these positively charged argon ions strike the metallic target at the top of the chamber and the “newly freed” metallic particle deposit onto the substrate resting below.



Contact information

The INRF staff or the lab manager can be reached at (949) 824-8239 or (949) 824-9831.

Authorized users

Only the INRF registered users who have completed the training and passed the certification may use this equipment. Users may only use the portion of the system for which they have been trained.

Training

Users must have received direct training from the staff in order to use this equipment. Users are expected to understand the nature of the system, as well as the proper control and use of the gases. Training varies slightly, depending on the process to be performed. Contact the staff for details and to arrange for a training session.

Usage logs

Users are required to log all activities in the log sheets provided. All users must log when they used the system (name, date and time), which metallic target they used, and when they completed their process run in the user log sheets. If users notice anything unusual, they should record it in the user log sheet, and add details in the main comments area of the log sheets. Any maintenance to the tool will be logged in the maintenance log sheet (maintenance staff only).

Safety equipment

As safety equipment for use on this equipment, cleanroom gloves and tweezers should be used when handling substrates in the system chamber.

Standard equipment and materials

The laboratory provides the following gases: Ar, and O₂. Other gases must be cleared with the lab manager.

Waste disposal

Dispose of alcohol soaked wipes in a waste container marked for flammable solid waste.

Scheduling

Reservation can be done online, and the system can be use on a first-come, first served usage if no reservation was made.

Other issues

Users should remain physically present in the cleanroom facility during the entire use of the system. This includes the time when the system pumps down the chamber.

Gases should be turned off at the cylinders valves when finished.

At no time should a user adjust a pressure regulator on a gas line. Gas control should be “on” or “off” only, using only the valves appropriate. For most gases, this is usually the valve at the cylinder head.

Non-standard use

Users may not modify any hardware on this equipment. For use of non-standard processes, gases or materials, contact the staff or the lab manager.

Usage Notes for PE 4400 Sputtering System

Guide for using the PE 4400 Sputtering System

Gas cylinders

All gas cylinders should be turned on or off at the cylinders valves. At no time should a user adjust a pressure regulator, clockwise for all valves means CLOSED. The standard off configuration for the system is to close the cylinders valves, but leave all other valves alone.



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PE 4400 RF Sputtering-etching process for Metallic Targets

Follow these steps for deposition of metallic materials on substrates using RF power.

Verify that the chamber pressure is less than 1×10^{-6} Torr before beginning your process, and that the argon gas supply is on. Record on the log sheets your name, the date, and your process run.

The PE 4400 Sputtering system has a load lock mechanism and a load chamber that allows the user to load the substrates to the sputtering chamber without breaking the chamber vacuum. The metallic targets in the sputtering chamber are always under vacuum.

1. Check list for system:

- a. Record the chamber base pressure in the user log sheets.
- b. Make sure that the chilled water flow indicator shows flow. The chilled water cools the RF power supply, the targets and the substrate platform.
- c. The cryo pump temperature must be below 20K
- d. The compressed air is open, and at 80 (psig).
- e. The N₂ gas is open and is at 60 (psi).

2. Stand by Mode:

- a. The chamber is under vacuum, and the chamber pressure on the ion gage system is below 2×10^{-6} Torr.
- b. The chilled water is off.
- c. The high vacuum valve is open.
- d. The RF power supply is off.
- e. The Ar gas supply to the system is off.

3. Loading Substrates into the Chamber:

- a. Record the sputtering chamber base pressure in the log sheets.
- b. Open the vent valve by switching to "OPEN" the vent toggle switch located on the load chamber front panel to vent the load chamber, and wait until the vent light goes on, this will indicate that the load chamber is at atmospheric pressure. Switch to "CLOSED" the load chamber vent toggle switch, to stop the nitrogen venting.
- c. Open the load chamber by pressing and holding to the "UP" position the two front panel rocker switches. Make sure that the table substrates holder is centered before loading your substrates. After loading your substrates, close the load chamber by pressing and holding to the "DOWN" position the two front panel rocker switches.
- d. You are ready to rough out the load chamber by switching to "OPEN" position the roughing valve toggle switch on the load chamber front panel. When the load chamber pressure reaches 10 mTorr on the MKS pressure controller digital display, switch to "CLOSED" position the load chamber roughing valve toggle switch.
- e. You are ready to transfer the table substrates holder from the load chamber to the sputtering chamber. Switch off the MKS ion gauge pressure controller. Open the load lock door by switching to "OPEN" position the lock valve toggle switch on the load chamber front panel. Move the carrier to the sputtering chamber by switching to "IN" position the carrier switch on the load chamber front panel. Wait until the carrier "IN" RED LED is "ON" and the carrier motors have stopped moving to switch to "UP" position the PALLET switch on the load chamber front panel. There is a time delay

before the motor is activated and the pallet starts moving. You can see the pallet moving through the sputtering chamber window. When the pallet has stopped moving, switch to "OUT" position the carrier switch on the load chamber front panel. Wait until the carrier RED LED "OUT" is "ON" and the carrier motors have stopped moving to switch to "CLOSED" position the lock valve switch on the load chamber front panel. This will isolate the load chamber from the sputtering chamber.

- f. Switch back on the MKS ion gauge controller, and wait for the sputtering chamber base pressure to be below 5×10^{-6} Torr before sputtering.

4. RF Sputter Deposition:

- a. Using select mode, place the toggle switch to sputter deposit for deposition. Now select the metallic target by placing the switch to the desired target to be sputtered.
- b. Switch off the MKS ion gauge controller, and the MKS pressure gauge controller. Close the gas throttle, and switch on the Ar gas flow valve to the system. Adjust the Ar flow, to set the desired sputtering pressure on the analog pressure gauge. Adjust the Ar gas flow as needed.
- c. Make sure that the RF wattage control is set to zero (counterclockwise).
- d. Make sure that there is water flow to the system, by checking the water paddle wheels motion for flow.
- e. Turn on the main power switch on the RF generator, the power light will come on.
- f. Turn the RF power switch on, the RF power is now on, and slowly increase the RF wattage clockwise at 50 watts or less the meter scale is $\times 10$. Adjust the forward and reflected power by using the load and tune switches. Keep increasing the RF wattage control until the desired power is reached. The maximum usable power is 450 watts.
- g. For some targets it desirable to pre-sputter for 5-10 minutes.
- h. With the plasma ignited move the table to the desired target using table rotation control.
- i. Start the timer when your samples are under the desired metallic target for the deposition time.
- j. When the deposition run is completed, turn off the RF power, and turn the wattage control knob completely counterclockwise.
- k. Turn off the Ar gas by closing the gas valve on the front panel. Open the throttle valve.
- l. Switch off the main power to the RF generator. Switch back on the MKS ion gauge controller and the pressure gauge controller.
- m. Record your process run in the log sheets. Wait at least 30 minutes for the system to cool down before unloading your substrates from the chamber.

5. Unload Substrates & Put System in Standby Mode :

- a.
- b. Open the vent valve by switching to "OPEN" the vent toggle switch located on the load chamber front panel to vent the load chamber, and wait until the vent light goes on, this will indicate that the load chamber is at atmospheric pressure. Switch to "CLOSED" the load chamber vent toggle switch, to stop the nitrogen venting.
- c. Open the load chamber by pressing and holding to the "UP" position the two front panel rocker switches. Make sure that the table substrates holder is centered before loading your substrates. After loading your substrates, close the load chamber by pressing and holding to the "DOWN" position the two front panel rocker switches.
- d. You are ready to rough out the load chamber by switching to "OPEN" position the roughing valve toggle switch on the load chamber front panel. When the load chamber

- pressure reaches 10 mTorr on the MKS pressure controller digital display, switch to "CLOSED" position the load chamber roughing valve toggle switch.
- e. You are ready to transfer the table substrates holder from the load chamber to the sputtering chamber. Switch off the MKS ion gauge pressure controller. Open the load lock door by switching to "OPEN" position the lock valve toggle switch on the load chamber front panel. Move the carrier to the sputtering chamber by switching to "IN" position the carrier switch on the load chamber front panel. Wait until the carrier "IN" RED LED is "ON" and the carrier motors have stopped moving to switch to "UP" position the PALLET switch on the load chamber front panel. There is a time delay before the motor is activated and the pallet starts moving. You can see the pallet moving through the sputtering chamber window. When the pallet has stopped moving, switch to "OUT" position the carrier switch on the load chamber front panel. Wait until the carrier RED LED "OUT" is "ON" and the carrier motors have stopped moving to switch to "CLOSED" position the lock valve switch on the load chamber front panel. This will isolate the load chamber from the sputtering chamber.
 - f. Switch back on the MKS ion gauge controller, and wait for the sputtering chamber base pressure to be below 5×10^{-6} Torr before sputtering.