

Specialty Coating Systems - PDS 2010 LABCOATER2 Parylene Deposition Users Manual



Coral name: Parylene Dep
Model: PDS 2010 Labcoater
Location: Nanofab, Building 215, Room B104
Contact: nanofab_deposition@nist.gov
Version: 1.0

Overview

Parylene conformal coatings are ultra-thin, pinhole-free polymer coatings that find wide-ranging application in the medical device, electronics, automotive, military and aerospace industries. The family of Parylene coatings offers many valuable surface treatment properties to these industries, including excellent moisture, chemical and dielectric barrier properties. Additionally, Parylene coatings offer thermal and UV stability, and dry-film lubricity

Parylene is applied at room temperature. The PDS 2010 Labcoater controls all coating parameters except coating thickness. Film thickness is controlled by amount material loaded. Polymer deposition takes place at the molecular level:

- Raw material Dimer is vaporized under vacuum and heated to a dimeric gas.
- The gas is then pyrolyzed to cleave the dimer to its monomeric form.
- In the room temperature deposition chamber, the monomer gas deposits as a transparent polymer film.

The required thickness of a coating can vary based on the application, but thickness can range from the hundreds of angstroms to several mils, with the typical coating being in the microns range

The system operation is center around 3 areas of the equipment

- 1) Deposition chamber
- 2) Vaporizer
- 3) Chiller/cold finger

Special Notes and Restrictions

- You must be qualified by a super user to use this tool
- This tool is reserved for Parylene C and N.
 - Parylene “N” The basic member of the series, called Parylene “N,” is poly-P-xylylene, a completely linear, highly crystalline material. Parylene “N” molecules are extremely elastic and will "bounce" around many times before depositing and polymerizing. This has the net effect of greater penetration into small openings than the other types of Parylene. The expected increase of pressure in the Deposition Chamber during a coating run is controlled at a higher pressure than the other Parylenes. Parylene “N” deposits at a much

slower rate than “C”. Parylene “N” deposits at the rate of approximately .00003" per hour.

- Parylene “C” is commercially available and is produced from the same monomer modified only by the substitution of a chlorine atom for one of the aromatic hydrogens. Parylene “C” molecules are less elastic than “N” molecules and "bounce" around considerably less than “N.” The pressure in the Deposition Chamber due to Parylene “C” monomer is controlled at a value of approximately one half that for Parylene “N.” Deposition rates for Parylene “C” are in the order of .0002" per hour
- An adhesion promoter is available.
- When process is complete, always put the chamber under vacuum for 2 minutes and leave in vacuum switch in **HOLD** position.
- Make sure the chiller is **ON** only when the system is under vacuum and running a process deposition.
- DO NOT stop process until **PROCESS START/STOP** button is flashing.



I. Automatic Operation

1. Logon to CORAL

2. Vent chamber

- Move vacuum control switch from **HOLD** to **VENT**
- Make Aluminum boat for Parylene source material
 - i. Measure Parylene by weight for deposition.
- Remove chamber lid

3. Load material, wafer and pump-down

- Load Aluminum boat/Parylene in Vaporizer
- Place substrate on sample stage
 - i. Reinstall chamber lid
- Move vacuum control switch from **VENT** to **VACUUM**
 - i. Make sure cold finger is held in place during this step.
- Turn cold finger chiller **ON** and **wait 45 minutes before starting deposition**

4. Deposition

- Check parameters of Furnace and Vaporizer
 - Parylene C Vaporizer set to 175 C, Pyrolysis heater set to 690 C
 - Parylene N Vaporizer set to 160 C, Pyrolysis heater set to 650 C
- Turn Furnace control switch from **DISABLE** to **ENABLE**
- Turn Vaporizer control switch from **DISABLE** to **ENABLE**
- Make sure vacuum pressure is below 10
- Press the Process **START** button
- Process takes approximately 5 to 7 hours to complete
- The run is complete when the Green "**PROCESS START/STOP**" button/lamp is blinking.

5. Unload Substrate

- Turn cold finger chiller **OFF** (wait 15 minutes)
- Turn Furnace control switch from **ENABLE** to **DISABLE**
- Turn Vaporizer control switch from **ENABLE** to **DISABLE**
- Move vacuum control switch from **VACUUM** to **VENT**
- Remove substrate
- Move vacuum control switch from **VENT** to **VACUUM**
 - Wait 2 minutes and move switch from **VACUUM** to **HOLD**
- Log system to "Shutdown" under the "Equipment Action" pull down on CORAL with the comment "Needs clean"

- Nanofab staff must clean the cold finger after each process run.