Parylene Deposition System Operation Manual

Information

Deposition of Parylene:

Model PDS 2010 LABCOTER deposition system is the first portable system designed for deposition of protective Parylene conformal coating. This unit is suitable for laboratory research applications, circuit board repairs, electronic sensors, medical components, organic samples, and many other substrates.

The deposition process begins with the granular form of Parylene, raw material Dimer, the material is vaporized under vacuum and heated to a dimeric gas. The gas is then pyrolized 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 microns.

Properties of Parylene:

Good to excellent adhesion of Parylene to a wide variety of substrates can be achieved by the simple treatment with a dilute solution of an organic silane prior to Parylene coating. Parylene exhibits very little absorption in the visible region and is, therefore, transparent and colorless. Below about 280 nm both Parylene N and C absorb strongly. The Parylenes resist room temperature chemical attack and are insoluble in all organic solvents up to 150° C. Furthermore, chemical resistance and moisture vapor permeability rates for Parylene C are superior to almost all polymeric materials.

PARYLENE OPTIONS:

Users may select one of three forms of the Parylene polymer, Parylene N, C and D, depending on the nature of the intended application. These three versions have slightly different molecular forms that result in varying properties. All three Parylene forms are applied in the same manner, with some differences in their polymerization rates.

High Penetration - Parylene N provides particularly high dielectric strength and a dielectric constant that is independent of frequency. Because of its greater molecular activity in the monomer state, Parylene N has the highest penetrating power and is able to coat relatively deep recesses and blind holes. The low dissipation factor and dielectric constant of this Parylene form suits high frequency substrates where the coating is in the direct EH field.

Low Permeability - Parylene C has a chlorine atom on the benzene ring, and this variant offers an excellent combination of electrical and physical properties including very low permeability to moisture and corrosive gases. Parylene C deposition is substantially faster than N, and consequently its crevice penetrating ability is somewhat reduced.

Thermal Stability - Parylene D, with two chlorine atoms on the benzene ring, has the highest degree of thermal stability of the Parylenes, and therefore possesses superior physical and electrical properties at high temperature. Its crevice penetration ability is the lowest of the three Parylene variants.

PDS 2010 Operating Instructions

1. Sign-in to the Parylene Coater on the Portal.

2. Twist the EMO button to ensure the button is in the out position. Then Press **MAIN POWER** button on the console. The machine will power up. Wait for gauges to read actual numbers.

3. Rotate the vacuum switch from the **HOLD** position counter clockwise to **VENT**. When the system pressure reads above 1000 the system is at atmosphere.

4. Upon venting, remove the chamber and place it on the prep table to the left of the machine. Use pry bar as needed, chamber sticks due to parylene coating inside.

5. Place a plastic weighing dish onto the scale and zero the weight of the dish. Measure out the proper amount of dimer (Parylene). Do not exceed 25 grams. Anything above 25 grams will require additional depositions.

6. Locate a foil boat for the type of dimer you are using. Boats are marked either with N,C, or D. Then ensure there are not heavy deposits of black material (Left over residue from dimer) in the boat. Construct a new boat if heavy deposits are present. Instructions on how to make a boat are located in this manual.

7. Put the dimer in the boat; ensure dimer is evenly distributed in the boat. Place the boat with the dimer in the vaporization chamber.

8. Place the substrates on the platform, and then apply a thin coating of soap solution to the chamber gasket and the base plate mating surface. Then place the chamber onto the system.

9. Verify that the cold finger has been cleaned; there should be no Parylene on the cold finger at the start of a deposition. If deposits are present, follow the cleaning procedure in step 15.

10. Verify the cold finger o-ring is clean and place the **cold finger** into its chamber. Rotate the vacuum switch clock wise to **VACUUM**.

11. Wait until the pressure is below 200mTorr. This could take as long as 15minutes and primarily depends on the out-gassing of samples and soap solution from the cold finger. -When pressure is below 200mTorr, **turn the mechanical chiller ON**.

    NOTE: If the chamber does not pump down below 200 millitorr within 5 minutes, place the machine in the HOLD state and contact a staff member (submit Trouble Call on Portal).

12. Wait until pressure is below 150 millitorr and then turn both the furnace and vaporization switch to **ENABLE** and press the **Green PROCESS Start/Stop** switch. The switch at this time will be illuminated.

13. The process has now begun and after a few hours (dependant on type and amount of dimer) the **Green** switch will start blinking. The **Green** Light Blinking indicates that the deposition process is complete. Both the vaporizer and furnace will start to cool.

14. When the furnace temperature reaches below 400^{o}C, **DISABLE** the furnace and vaporizer, turn **OFF** the chiller, place the vacuum switch into the **HOLD** position for a few seconds, then rotate the vacuum switch clockwise to **VENT**.

15. Upon venting, remove the chamber and place it on the prep table to the left of the machine. Remove your samples. Place the cold finger in the outer holder and wait ~15 minutes for it to warm.

16. **Clean the Cold Finger**. Upon warming, use the scotch brite pads and clean wipes with isopropanol to remove the condensed Parylene. **DO NOT USE TWEEZERS, RAZOR BLADES OR ANYTHING THAT CAN SRATCH THE COLD FINGER! Cold Finger Cleaning is the RESPONSIBILITY of the USER.**

17. Change gloves. Using IPA and a clean wipe, wipe the cold finger and its flange, ensure all parylene deposits are gone. Subsequently, with a clean wipe apply a thin but even coating of soap solution to the cold finger.

18. If coating in chamber or on substrate plate is beginning to peel, contact Joe Lonjin (JJL13@psu.edu) so the chamber can be cleaned. **Chamber and Plate cleaning will be performed by STAFF.**

19. Secure the chamber and the cold finger. Place the system under **VACUUM**.

20. **WAIT** until the base pressure is below 200mTorr and move the vacuum switch to **HOLD**

21. Press the EMO button on the tool to shut off the power. Sign out of the tool in the Portal.

Control Panel on the Parylene Deposition System

Sample Plate

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Cold finger (a) pumped down and (b) in the outer holder.

Vaporization Chamber