



## PDS 2010 LABCOATER 2 PARYLENE DEPOSITION SYSTEM



**LOCATION:** 10K Lab in PVD area.

**PRIMARY TRAINER:** Glenn Elashuk (2-4373, glenne@ualberta.ca)

**SECONDARY TRAINER:** Les Schowalter (2-4829, les.schowalter@ualberta.ca)

### 1. OVERVIEW

The PDS 2010 is a vacuum system used for the vapor deposition of the Parylene polymer onto a variety of substrates. The clear polymer coating provides an extremely effective chemical and moisture barrier with high dielectric and mechanical strength.

The PDS 2010 transforms Parylene dimer to a gaseous monomer; upon deposition the material polymerizes, at room temperature, onto the substrate. There is no intermediate liquid phase or separate cure cycle. At the vacuum levels employed, all sides of the substrate are uniformly impinged by the gaseous monomer, resulting in a truly conformal coating.



## 2. SAFETY PRECAUTIONS

Never vent the chamber until the Vaporizer temperature is below 80° C, to prevent the operator from accidentally inhaling Parylene.

If you are bringing any new materials into the NanoFab for use in your process, it is necessary to fill out a chemical import form (available on our website, <http://www.nanofab.ualberta.ca>) and supply an MSDS data sheet to Stephanie Bozic.

## 3. PROCESS COMPONENTS OR FEATURES

The 2010 is equipped with a mechanical chilling unit; this includes a cold trap probe that is inserted into the cold trap housing. The mechanical chiller should be turned on for at least 45 minutes before initiating the vaporizer heaters. This is done to make sure that the cold trap probe is cold enough to adequately capture Parylene process by-products so the vacuum pump is protected.

## 4. OPERATING INSTRUCTIONS

- Insert the cold trap probe into the cold trap housing. Turn on the mechanical chiller for at least 45 minutes prior to starting a process to ensure that the temperature of the cold trap probe is below -75° C.
- Wear gloves while working with the vacuum system or handling the dimer boat.
- Release the Emergency by turning it clockwise.
- Press the **Main Power** pushbutton. The computer will initialize the vacuum and temperature control switches will illuminate.
- The system is kept under vacuum while not in use, so switch the **Vacuum** switch to the **Vent** position. When the system has been vented the vacuum will read approximately 990 vacuum units, switch the **Vacuum** switch to the **Hold** position.
- Weigh a certain amount of Parylene and load it into the Aluminum dimer boat: **The amount of Parylene used depends on the expected coating thickness.**
- Place the loaded boat into the vaporizer by opening the door located in the lower front compartment. The boat should be placed in the vaporizer flush with the door when closed. Keep the aluminum boat under 21 centimeters long, a longer boat will stick out directly under the pyrolysis furnace and cause premature vaporization. The maximum amount of Parylene dimer is 125 g.
- Load the substrate and close the chamber lid.
- Verify the setpoint (SP) values when depositing different types of Parylene (C or N). Figure 1 lists the setpoint values.

Parylene	Furnace Setpoint	Vaporizer Setpoint	Vacuum Setpoint
Type N	650°C	160°C	Base + 55 mTorr
Type C	690°C	175°C	Base + 15 mTorr



- Switch the **Furnace/Chamber Gauge** and the **Vaporizer** switch to **Enable**, and switch the **Vacuum** switch to **Vacuum**. Press **Process Start/Stop** button, the deposition is automatic. It takes ~ 1.5 hours for the furnace to reach setpoint. After the Furnace and Chamber Gauge reach setpoint the Vaporizer will heat up, when the Vaporizer reaches 90° C coating begins.
- The Vaporizer is triggered when the chamber reaches the base pressure and the furnace reaches the pyrolyzing temperature (650°C for parylene N or 690° C for Parylene C).
- When the deposition is complete the Vaporizer will hold at the setpoint temperature and the chamber pressure will return to base pressure. When base pressure is reached the 5 minute end-of-run timer begins timing out before initiating shut down.
- Shut down occurs when the end-of-run or a fault timer has elapsed. The Process Start/Stop (green) light will blink. The Furnace/Chamber Gauge and Vaporizer heaters will be disabled. If the shut down was caused by a fault, the red alarm light will turn on. The pump will remain on to secure the process by maintaining vacuum.
- Wait until the **Vaporizer** temperature drops to 90° C. (Never vent the chamber until the Vaporizer temperature is below 90°C to prevent the operator from accidentally inhaling Parylene.)
- Turn off the Mechanical chiller.
- Turn the **Furnace/Chamber Gauge** and **Vaporizer** switches to **Disable**.
- Switch the **Vacuum** switch to **Vent**. Press the **Process Start/Stop** button, (the green blinking light should be turned off).
- Remove your substrate.
- Allow the cold trap probe to warm up for 30 minutes before moving the cold trap probe to the holder on the side of the tool, to prevent damage to the flex line. Do not leave the cold trap probe in the cold trap housing for more than 30 minutes or the material on the probe will drip into the cold trap housing.
- Wait another 30 minutes, then start cleaning the Parylene coated on the cold trap probe. Avoid unnecessary flexing of the flex line to the probe. Mechanical shock to the probe can result in hair line fractures resulting in failure of the chiller. Note that small amounts of corrosive compounds are produced as a by-product of the Parylene deposition and are condensed on the probe surface. (see page 4 for cleaning instructions)
- When the cold trap probe has been cleaned and coated with Micro Soap 90, place the probe back into the cold trap housing and pump the system down to below 60 mTorr. Switch the Vacuum switch to the Hold position and press the emergency stop switch.

## 5. TROUBLESHOOTING

If the chamber does not reach base pressure within a reasonable amount of time vent the chamber and check the chamber lid o-ring for debris.

If there are large bubbles along the inner surface wall of the chamber contact Glenn Elashuk, the Parylene is lifting from the chamber wall and the chamber will need to be serviced before a deposition can proceed.

If you encounter an unexpected error or require assistance please contact the primary or secondary trainer listed above. Should they not be available, please contact any staff member for assistance.



## 6. **Cleaning the Cold Trap Probe**

- Allow the cold trap probe to warm up for 30 minutes before moving the probe from the cold trap housing to the probe holder on the side of the tool.
- Wait an additional 30 minutes for the cold trap probe to warm up while it is in the holder.
- Wear gloves while cleaning the cold trap probe. Note that small amounts of corrosive compounds are produced as a by-product of the Parylene deposition and are condensed on the probe surface.
- Gently scrape the Parylene build up off the probe with the provided scraper.
- After most of the Parylene build up has been scraped off, spray a little Micro Soap 90 onto a clean room wipe and clean the rest of the Parylene from the probe.
- When the probe is clean use a clean room wipe and coat the probe with Micro Soap 90 so that the entire surface of the probe is damp.

## 7. **Cleaning the Chamber**

- If the parylene starts to lift from the chamber walls, the system will require cleaning.
- Clean the system by peeling the parylene away from the chamber walls and by using micro soap 90 on a clean room wipe to scrub the chamber walls.
- Coat all of the surfaces that were cleaned with micro soap 90 when finished cleaning the chamber.

## 8. **Approval**

**QUALIFIED TRAINER:** Glenn Elaschuk  
**TRAINING COORDINATOR:** Eric Flaim