

Parylene P6/P8 Coater Operating

Instructions

This machine is to be used by authorized personnel only. For training & consultation contact:

Lab Manager, **James Bohlman**, (520) 971-3405 jimbob1@arizona.edu

1. Contact a Staff Member immediately if you observe anything unusual is observed such as the controller being off, or strange and unusual noises from the vacuum pump compartment below.

DO NOT ATTEMPT TO OPERATE THE COATER if you have any doubts!

Safety Caution: System has extremely hot ($> 750\text{ C}$) and cold ($< -100\text{ C}$) components and surfaces.

Cleaning Caution: Do not scratch metal sealing surfaces and O-rings.

1. Turn on the main power (If the disconnect switch on the wall is off, turn this on first).
2. Watch if the Windows operating system is booted up. Program will be automatically initiated.
3. Log in (left top corner) – Password and Username are in the physical copy of the user manual.

- UMSCHALTTASTE is the SHIFT key, EINGABE is the ENTER key

4. To vent the system, change to Manual mode (must be logged in with Controller turned on) – press Venting (pressure should increase to $1\text{E}+3\text{ mbar}$).
5. Inspect the cold trap to ensure it is clean of excess Parylene. The trap should be cleaned after every deposition. (Note: The cold trap will not work as intended if it is not clean, thus impacting vacuum pressure. Additionally, excess parylene polymer may deposit inside the vacuum hoses and mix into vacuum pump oil, degrading pump performance.)
6. Enable the Cooler now before continuing with coating preparation, as it will take time to reach temperature and it must be at its target temperature for pumpdown to succeed.
7. Measure your dimer weight with electrical scales (usually, 5 g will coat $\sim 9\text{ um}$ thick

Parylene-C). The programs saved on this machine are specifically devised for Parylene C deposition (Programs 1 and 2) and expect at least 5g dimer, with no more than ~5.2g per coat.

8. Open the vaporization chamber.

- The vaporization chamber door needs to be cleaned every time with IPA-soaked lint-free towels. Regularly with stainless steel wire brush, clean the chamber to remove unwanted coating on the chamber.

9. **Cover inside of boat with Al foil.** Do not wrap it over the outside of the boat. Press the Al foil to have good contact with the boat so that the heat can be transferred efficiently during the evaporation.

10. Put dimer into the boat and insert the boat all the way to the back of the chamber. **Slide it back out 5 mm** (to ensure even heating the boat should not touch the back of the chamber or the door) and close the door. Tighten the vaporizer chamber sealing knob by hand, taking care not to overtighten. Never use a wrench or pliers as overtightening can strip the plastic knob from the thread.

11. Open the sample chamber lid and confirm the sample chamber is reasonably clean of Parylene. (Note: Air and moisture can potentially get trapped under or between layers of Parylene, impacting pump down). Clean the O-ring and the door with IPA-soaked lint-free towels.

12. Suspend or place your samples to be coated within the sample holder. Place sample holder into the chamber, ensuring it is seated in the chamber carousel holes, and close the door. Note that **any points of contact** between samples and suspending wire / sample holder **will not be coated!** For complete coverage and waterproofing, a second coat is required where samples are rotated to ensure the uncoated points are not in contact with anything else.

13. If using an adhesion promoter, e.g., A-174 or Silane, it must be added **only before** running **the first coat**. Untighten the sealing nut on the adhesion promoter port on top of the machine, verifying the chamber is not pressurized, and open the port valve (if equipped). Inspect the port and ensure it is free of Parylene. Administer 1 mL of adhesion promoter, then close the valve (if equipped) and replace the sealing nut.

14. Set the pressure sensor temperature to 140C and enable it. You may wait for the pressure sensor to reach temperature or proceed to the next step; however, the sensor must be hot for readings to be accurate.

15. Start the vacuum soft pump. At around 5 mbar, enable the edge valve and disable the soft pump. Wait until the vacuum level reaches below <0.030 mbar (Note: If the sealing surfaces are not sufficiently free of parylene, this may take up to an hour).

16. Change into automatic mode - select desired program then press start- There is a blank button next to the automatic sign – you can check the overall procedures through clicking this button.

Check if all steps are heated up properly as set values.

17. Deposition will be automatically processed.

Two steps of temperature increment will be shown in every process.

The coating phase will be shown even though the temperature has not reached as high as set temperature in 2nd step of chamber.

18. During the deposition, be aware of these values on the Diagram:

1) red – actual chamber pressure

2) yellow – actual vaporizer temperature

3) green – actual pump pressure

19. When the deposition is done, the program changes from the coating to cooling phase. The pressure is lower than the desired base pressure and the temperature is the same as the desired temperature of 2nd phase. 20. After the system cooling phase has been completed, the system will vent according to the current program setting. If the program is set for the user to vent, wait until the pyrolysis chamber temperature reaches 200 C or lower to vent.

21. Remove samples from the chamber.

22. Clean chamber, chamber lid, including sealing surfaces and O-ring. Clean the Parylene coatings off the cold trap and reinstall cold trap. Open dimer door, remove foil, and clean sealing surface and O-ring.

- Use Plastic Scrapers. Do Not Use metal scrapers, as metal scrapers will scratch tool surfaces and make it harder to remove future Parylene coatings.

- Spraying parts with a 1:10 Micro-90: Water solution and waiting about 20 minutes can often make Parylene scraping and removal easier (the solution doesn't dissolve Parylene, but can help loosen the bond)

23. Put chamber under vacuum manually (turn off venting, turn on pump, turn on soft pump).

24. When the vacuum level is around 0.100 mbar, close the edge valve, turn off the pump.

26. Turn off the controller and exit the program. Shut off the main switch.

Parylene: The vendor recommends using dimer from Diener Electronics or Specialty Coating Systems. The dimer impacts the deposited film quality.

Run Time: A typical run may take about 4 hours between running the program and performing tool cleanup. Times for Parylene C program primary steps when starting with 5 grams of dimer are approximately: Preparation (20 minutes), Coating (around 90 minutes), Cooling (20 minutes), Waiting (40 minutes), Venting (set to 0, requires manual venting). Plus, tool cleaning time.

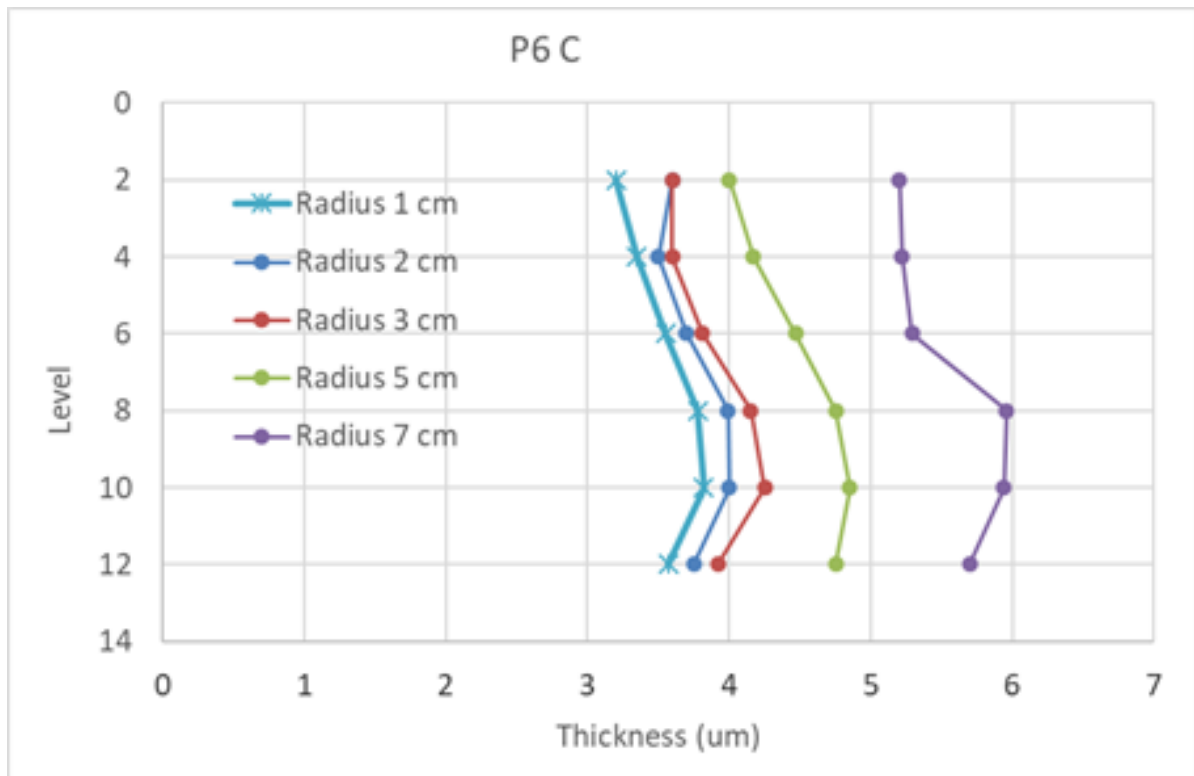


Fig. 1. Film Thickness Variation: The graph above shows deposited film thickness for a sample carousel using 6 perforated plates. Thickness varies with radial position (distance from center to edge of the carousel) and vertical position (which of the up to 6 perforated plates in the sample holder the sample sits on).



Fig. 2. Baffle Opening Orientation: The orientation recommended by the vendor is shown above. The baffle orientation influences residence time and likely deposition rate and uniformity.