Parylene News

Parylene Variants - Know Your Options

There are four commercially available Parylene variants. All four are ultra-thin, pinhole-free and absolutely conformal, with excellent moisture, chemical and dielectric barrier properties. However, there are significant differences between them that make it important to select the optimum grade for a given application.

Parylenes N, C and D - the readily available commercial formulations - account for more than 90 percent of Parylene coating uses across electronic, industrial, medical device, automotive, military and aerospace applications. Each of these coatings exhibits particular strengths, enabling users to meet specialized requirements. The fourth variant, Parylene F (or HT*), is more costly, and delivers selective advantages.

Parylene N is the primary or precursor form of Parylene, characterized by particularly high dielectric strength and low dielectric constant, suiting it to high frequency uses. Its measured rate of deposition allows for excellent crevice penetration on mechanically complex substrates. This variant is most commonly used as a dry film lubricant over elastomeric substrates.

Parylene C is chlorinated Parylene N, carrying a chlorine atom on the benzene ring for enhanced impermeability to moisture and gases. It can be deposited relatively quickly, with uniformity. Parylene C is typically chosen for its chemical resistance and overall protection of high-risk circuit assemblies.

Parylene D has two chlorine atoms on the benzene ring, a higher degree of thermal stability, and superior physical and electrical properties at high temperatures. It is most frequently selected for applications involving mechanical substrates undergoing thermal cycling.

Finally, Parylene F (or HT) carries fluorine atoms on the benzene ring rather than hydrogen atoms, resulting in a higher continuous service temperature, greater UV stability, and reduced dielectric constant and dissipation factor values. Parylene F is more costly, and requires specialized equipment and processing. Parylene F may be required for substrates that are directly exposed to sunlight and function at low electric currents.

In some cases, users may specify Parylene F unnecessarily where an alternative material could satisfy special requirements. For example, Parylene D, with its extended temperature range, may be a practical and more cost-effective coating option for some thermally demanding tasks.

Para Tech has long experience with dimer selection and process engineering, and our specialists will assist in achieving the most efficient solution to your coating challenge.

Proprietary Methods Optimize Coating Results

Unlike liquid coatings, which are typically applied by spray or dip methods, Parylene is applied without solvents, catalysts or mechanical stress. This chemical vapor deposition process involves a three-stage coating sequence with controlled temperature and pressure values at each stage.

In the first zone a powdered dimer is vaporized (sublimated), and the resulting gas is cleaved to form a monomer. It then polymerizes at room temperature in the vacuum chamber, depositing as a film on substrates.

Para Tech has refined this process over nearly 50 years, and holds eight patents for production enhancements. A key distinctive is our “Ramp & Soak” method, which raises the sublimating temperature at a precise programmed rate independent of vacuum fluctuations caused by monomer flow. Pressure in the vacuum chamber moves to a set and predictable level throughout each coating cycle.

This eliminates thermal excursions and coating bursts, and the unpredictable cycle length of conventional Parylene deposition systems. It results in film of superior clarity, caliper uniformity and thickness accuracy. Further, closely controlled coating parameters allow substrates such as elastomers to outgas more effectively at the initial stage of deposition for better encapsulation.

With tighter cycle timing control, Para Tech is able to accurately manage production scheduling, to the benefit of our customers.

New & Improved Website

Our updated and easy to use website now has more information. Visit parylene.com for more details.
VOCs

Substrate Cleanliness - an Absolute Necessity!
Production related contaminants on substrates to be Parylene coated can disrupt the film-to-surface bond, and result in both near and long-term performance problems. Compromised film adhesion can lead to delamination due to thermal cycling or mechanical stress. Non-organic residues are electrically conductive, and can form current leakage paths under the coating that will disturb the function of an electronic assembly.

The most common challenge to Parylene film adhesion to electronic assemblies is flux residue. Other less common but serious contaminants include chemical residues, halides, leached plastics, waxes, light hydrocarbon and silicone oils, adhesive residues, dust and fingerprints. The IPC-J-STD-001 target for surface cleanliness is 10µgm NaCl/in² or less, and this standard of performance is as important for demanding commercial equipment as it is for military/aerospace systems.

Manufacturers should measure, monitor and inspect every production run to avoid costly cleaning issues related to ionic contamination. Para Tech follows a sampling process per industry guidelines for assemblies in every production run to confirm the readiness of a customer’s assemblies for Parylene coating.

Pristine substrates support pristine results. If contamination problems are indicated during sampling tests, the customer is so advised, and Para Tech can assist with failure analysis, testing and cleaning.

We Are Growing!
Para Tech is experiencing strong growth and is adding production capacity and staff. We are responding to recent industry demands with important investments to support our valued customers. These include:

- Additional equipment, tools and instruments at existing coating centers
- Upgrades to production controls and procedures
- Added personnel at all levels, with expanded management training support
- A new state-of-the-art coating center opening soon in the Midwest region

We continue to pursue the very best in Parylene coating quality, engineering support and efficient, timely production.

Parylene is Green
Where liquid coatings are concerned (i.e. epoxies, acrylics, silicones, urethanes), manufacturers may need to contend with issues such as fumes, flammability, toxicity, storage, transport and hazardous waste disposal.

In contrast, Parylene involves no VOCs, solvents or catalysts, and causes no disposal issues or pollution threats. It is, in fact, environmentally friendly, which means that users avoid the high costs of handling hazardous materials and processes.

Parylene film is formed from a powdered raw material, with no external chemicals. It poses no health concerns or special restrictions. This is a significant characteristic of vacuum deposited Parylene film, and a key factor in overall cost.

Para Tech is a member of the PERM (Pb-Free Electronics Risk Management) Council, which focuses on Pb-free electronics issues helping the industry develop and coordinate risk management approaches for the transition to Pb-free electronics.

Click here for further details on Parylene.