



**Electronic Coating**  
TECHNOLOGIES



## **Parylene Coating Services**

[www.electroniccoating.com](http://www.electroniccoating.com)



## Experts in Protective Materials & Application Services



At ECT, our total service approach and over 25 years of experience in the industry allow us to offer the most complete service available in the market today. Our in-house technical experts support clients from project conception through delivery. These close partnerships allow us to develop complete solutions and support customer needs using state-of-the-art equipment and coating application technologies for quality excellence.

For over 25 years, ECT has been providing quality solution-based services and rapid speed to market capabilities. Our experience in protecting electronics is our top priority to ensure integrity and longevity of our customer's application for continuous operation. Our commitment to excellence, quality, and rapid customization is designed to ensure your success. From the initial design to proof of concept, to follow-up support through the life of your project, Electronic Coating Technologies is your partner, every step of the way.



Experts in protective materials and application services.



In-house experts with over 25 years of hands-on experience with the parlylene coating process.



World-class business partnerships to accelerate innovation and speed to market capabilities.



Engineering Team involved from start to finish to maximize coating cycles, optimize masking solution and superior quality.

# Parylene Coating Technology

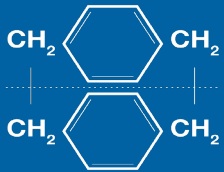


Parylene, or poly-para-xylylenes, is a liquid-free coating applied using a chemical vapor deposition (CVD) process. The solid dimer, once heated within a CVD chamber, transforms to a gaseous state before fully encapsulating all exposed surfaces. The uniform parylene conformal coating adds minimal weight to the PCB. The ultra-thin, transparent, film is created from the established polymers resulting in exceptional dielectric strength, high volume resistivity and low dissipation. Parylene's versatile characteristics allow for mission critical applications in the aerospace and defense, automotive, medical, and electronics markets.

ECT is ITAR, ISO 9001:2015 and ISO 13485:2016 registered. Materials are applied in accordance with IPC-A-610G and J-STD-001G.

- Liquid-free coating applied at room temperature using chemical vapor deposition process.
- Ultra-thin, transparent film
- Lightweight coating adds negligible weight to board
- Exceptional dielectric strength
- High volume resistivity
- Low dissipation
- Ideal for aerospace and defense, automotive, medical, and electronics

# The Process



## Stage 1 Sublimation of Dimer

The appropriate dimer is heated within the CVD (chemical vapor deposition) chamber to 110°C, when it changes from solid to vapor state.



## Stage 2 Pyrolysis (Heater) to Create Monomer

At 690°C the molecular structure of the gas changes and breaks down to a monomer.



## Stage 3 Deposition (Polymerization)

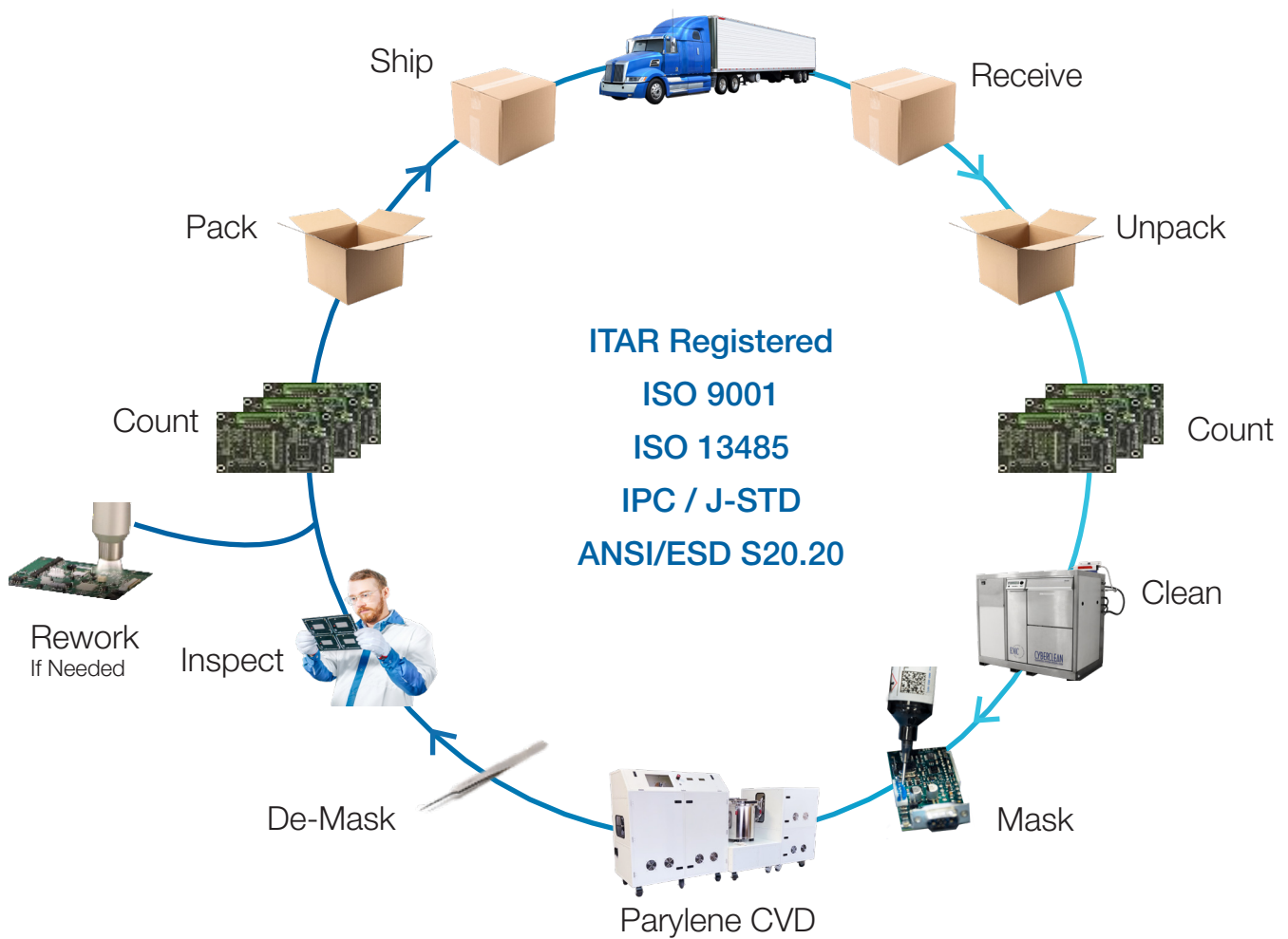
The monomer transforms to a polymer at room temperature and conforms to substrates placed in coating chamber, covering every exposed surface with an ultra-thin, transparent polymeric film.



## Stage 4 Pump and Cold Trap

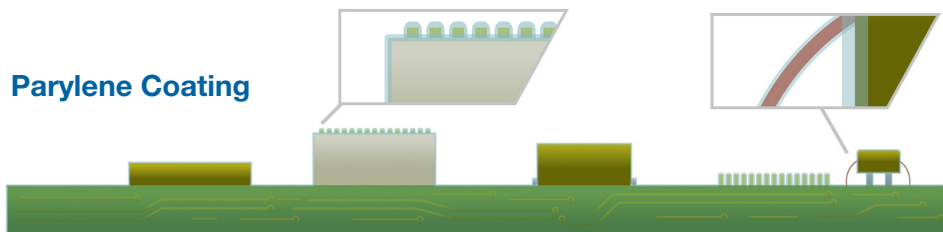
Excess polymer gas that is not deposited in the chamber travels to the cold trap where it is captured for disposal after the coating cycle is completed.

# ECT Processing Cycle

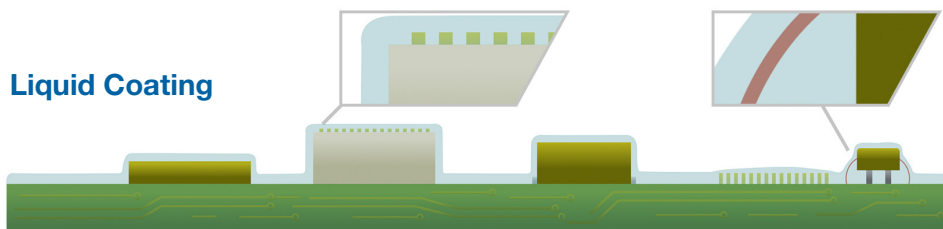


At ECT, we take pride in offering rapid and customized solutions to solve our customers manufacturing and design needs. We achieve customer satisfaction by working with you and your application from start to finish, every step of the way. We have set ourselves apart by working with quality partners and their materials, ensuring that we help you make the best decision when it comes to your application. Our extensive understanding and experience of specialty coating systems puts us a step above the competition. We are committed to providing the highest quality technical support, knowledge, and manufacturing services that meet or exceed all of our customers' expectations. When you partner with us, we work together to engineer a customized solution tailored to all of your needs.

# Application Process - Parylene vs Liquid Coatings



Parylene coating protects all surfaces with uniform coverage. The ultra-thin, lightweight film eliminates stress that heavier conformal coatings may cause on fragile components.



The liquid coating can collect and pool on the surface. They often flood the underside or fill between gaps on components due to capillary flow.



## Advantages of Parylene



### UNIFORMITY

Complete, uniform coverage on all surfaces.



### ULTRA-THIN

Ultra-thin coating between .25 to .75 microns.



### CONSISTENT THICKNESS

Consistency of coating thickness across the entire board.



### EXCELLENT PROTECTION

Complete protection from moisture, fumes, gases, salt water, corrosion, fungus, and other environmental conditions.



### CLEAR APPEARANCE

Parylene C and N are clear in appearance and ideal for optical applications.



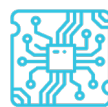
### NO CAPILLARY FLOW

No capillary flow under components on PCB.



### LIGHTWEIGHT

On 1" x 1" x 0.00125 mils FR4 board with no components, parylene added 0.040 grams.



### NO STRESS ON COMPONENTS

Deposition is completed at room temperature preventing stress on PCB components.

## Disadvantages of Parylene



### LONG PROCESS TIME

Limited throughput due to batch process cycle time.



### COST

Higher process and material costs than other conformal coatings.



### DIFFICULT TO REWORK

Very challenging to repair localized areas of a PCB without redoing the entire process and re-coating the PCB.



### NOBLE METALS

Poor adhesion to noble metals – gold, silver, and stainless steel.



### ADHESION

Adhesion promoter required to achieve parylene bond to the PCB.



### PREP TIME

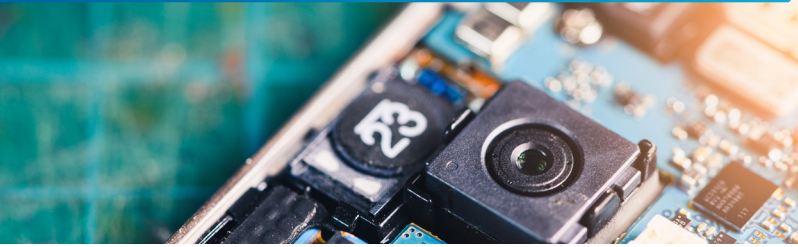
Labor intensive cleaning and masking process.



### FAILURES

Failures can occur from parylene lifting at the de-masking site, cracking, no transparency, or voids anywhere on the coating.

# What Markets Use Parylene?



As technology accelerates within this competitive landscape, demand for streamlined processes and advanced material solutions within the aerospace and defense, electronics, automotive, and medical markets continues to strengthen. Parylene coating continues to grow in popularity as the premier precision coating for high reliability applications that must withstand the most challenging environments.

## Markets

- Aircraft
- Spacecraft
- Satellites
- Missiles
- Electric Vehicles
- Automotive Electronics
- Medical Device Electronics
- Consumer Electronics

## Applications

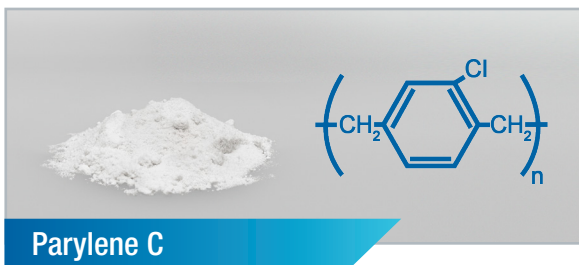
- Sensors
- PCBs & Assemblies
- Power Supplies
- Controllers
- Cameras
- Battery Management Systems
- Charging Stations
- And More...



# Types of Parylene ECT Offers

## Parylene C

Parylene C is an ideal choice for conformal coating protection in aerospace and defense, spacecraft, and automotive applications because of its high resistance to corrosion, moisture, vapor and chemicals.



Parylene C

### Strengths

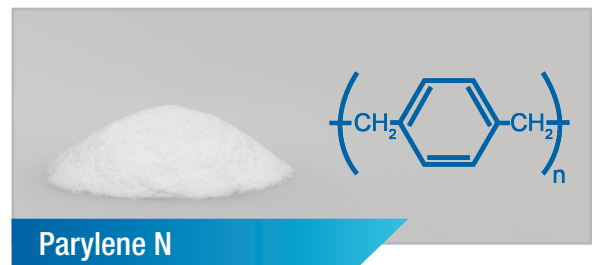
- Faster rate of deposition with thicker coating in less time
- Dielectric protection at 5k volts per 1 mil of coating
- Protection from moisture, chemicals, and solvents
- Thermal protection -200°C to 150°C
- Dimer C melting point of 290°C
- Tensile strength of 10,000 psi
- Most efficacy for warranty value

### Weaknesses

- Reliant on batch processing for improved throughput and costing
- Requires special masking compound for resistivity
- Limited UV resistance and operating temperature limit (around 120°C in the presence of oxygen)
- Hardest of all coating types to rework
- Contains chlorine
- Adhesion promoter required
- Does not fluoresce under black light

## Parylene N

Parylene N is commonly used because of its unique vacuum stability for applications of high frequency. It is ideal for use in aerospace and defense, spacecraft, and automotive and medical applications.



Parylene N

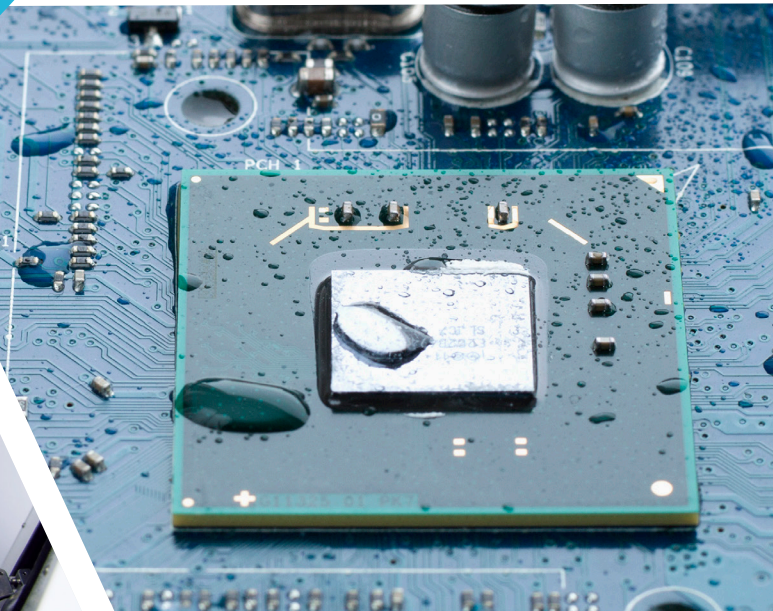
### Strengths

- Halogen & chlorine free - Ideal for medical components
- Cures as dry lubricity coating
- Higher thermal protection than parylene C
- Dimer N melting point of 420°C
- Thermal protection -200°C to 150°C
- Incredibly low permeability to moisture, chemicals, and corrosive gases
- Dielectric strength of 7k volts at 1 mil coating
- Tensile strength of 6,500 psi

### Weaknesses

- Reliant on batch processing for improved throughput and costing
- Requires special masking compound for resistivity
- Slower rate of deposition, increased process time
- Adhesion promoter required
- Does not fluoresce under black light

# Frequently Asked Questions



## Material FAQs

### What is Parylene?

Parylene is an ultra-thin conformal coating applied in a chemical vapor deposition (CVD). This coating is classified as XY.

### Is the parylene coating reworkable/repairable?

Yes, the PCB coated with parylene can be reworked. Options for rework: mechanical (micro-blaster or dry ice), heat (localized heat), chemical (organic solvent). Repairing the coating can be achieved with UR or AR/UR coatings.

### Does parylene coating add weight to my PCB?

This coating is ultra-lightweight with minimal added weight to the PCB surfaces.

### Is parylene coating optically clear?

Yes, parylene C and N ultra-thin coatings are colorless and transparent.

### Is parylene a rigid or flexible coating?

Parylene C elongation is 200%, and parylene N elongation is 40%.

### Is parylene a hydrophobic coating?

Yes, parylene coating has hydrophobic properties repelling water and moisture.

### Are parylene coatings cryogenic resistant?

Yes, this ultra-thin coating is cryogenic resistant to -200°C.

### Are there different types of parylene coating?

Parylene C is the go-to parylene coating. Parylene N is used for medical applications.

### Is parylene biocompatible?

Yes, parylene N and parylene C met the requirements of USP Plastic Class VI. Testing completed by Advanced Coating.

### **Does parylene bond to all surfaces on the PCB?**

Yes, the parylene (CVD) process will deposit the conformal coating on all surfaces of the PCB.

### **Does your parylene C meet Mil-I-46058C/IPC-CC-830-C?**

Yes, parylene C meets the requirements of Mil-I-46058C/IPC-CC-830-C. Testing completed by Advanced Coating.

## **Process FAQs**

### **Does parylene conformal coating add weight to my PCB?**

Parylene is an ultra-thin conformal coating that adds minimal weight to the PCB. The weight of the parylene layer over a 1" x 1" x .00125 mils on an FR4 board with no components is .040 grams.

### **Does parylene coating evenly coat complex and intricate surfaces on my PCB?**

Yes, parylene is a uniform coating over complex and intricate surfaces, controlled during the deposition phase.

### **What is the thickness of your parylene coating?**

The parylene coating thickness can range from .1 to 50 microns (.001 – 2 mils). Typically, most customers require mil-spec standard thicknesses, which are repeatable and achievable batch after batch with our equipment.

### **How is the thickness of the parylene coating controlled?**

The thickness of the parylene coating is impacted by the dimer mass, deposition rate, temperature, and other factors, such as the topography of the PCB.

### **What masking techniques will be used?**

The complexity of the PCB topography determines masking techniques. Masking options are liquid maskants such as UV-curable maskants, latex maskant, polyester or Kapton tape, caps, and boots (standardized or 3D printed).

### **Why is an adhesion promoter used before the parylene coating deposition process?**

Pre-treatment with silane stimulates parylene adhesion to promote a molecular bond from the substrate to the applied parylene coating.

### **Is a cleaning process necessary before the parylene process?**

Yes, all PCBs are cleaned before applying the adhesion promoter and the parylene process to ensure the adhesion of the parylene coating.

## **ECT Facility FAQs**

### **What is the ECT inspection process for my PCBs?**

ECT inspects PCBs to IPC-A-610 standards for all our in-house customers, no matter the material applied. We use 4x and 24x magnification on 100% of the customer product to ensure standards are met. Or ECT will use the inspection criteria requested by the customer.

### **What quality management system standard does ECT meet?**

ECT is certified by ISO 9001:2015 and ISO 13485:2016.

### **Is ECT an ITAR-registered facility?**

Yes, ECT NY is an ITAR-registered facility.

### **Is there a fast track/expedite available?**

Yes, please get in touch with ECT to discuss your needs.



ECT New York | 15 Solar Drive, Clifton Park, NY 12065 USA | Tel: (877) 262-8328 | Fax: (518) 688-2047

ECT Canada | 7425 Tranmere Drive, Unit 1A, Mississauga, Ontario L5S 1L5 Canada | Tel: (905) 866-6795 | Fax: (905) 866-6799



[www.electroniccoating.com](http://www.electroniccoating.com)

Technical data provided is of a general nature and is based on laboratory test conditions. Electronic Coating Technologies (ECT) does not warrant the data contained in this bulletin. Any warranty applicable to the product, its application and use, is strictly limited to that contained in ECT's standard Conditions of Sale. ECT does not assume responsibility for test or performance results obtained by users. It is the user's responsibility to determine the suitability for the product application and purposes and the suitability for use in the user's intended manufacturing apparatus and methods. The user should adopt such precautions and use guidelines as may be reasonably advisable or necessary for the protection of property and persons. Nothing in this bulletin shall act as a representation that the product use or application will not infringe a patent owned by someone other than ECT or act as a grant of license under any ECT Patent. ECT recommends that each user adequately test its proposed use and application before actual repetitive use, using the data contained in this bulletin as a general guide. ECT005 7/22/2022