Parylene: Protection For a World of Electronics

- Medical
- Telecommunications
- Industrial
- Military
- Automotive
- Consumer
- Aerospace
- Solar

Safeguarding Electronic Devices

A variety of different materials can be used to coat and protect electronics. Parylene is by the far the most effective conformal coating offering the highest level of protection for a wide range of applications. Parylene is a thin, transparent polymer that lends no weight to the device on which it is deposited while providing physical, chemical and mechanical protection to components and circuit assemblies. It is deposited under vacuum at ambient temperatures and requires no curing. This eliminates risks from thermal stress. Parylene protects electronics from chemicals, moisture, temperature excursion, atmospheric variation, humidity and other conditions that induce damaging corrosion, mold, current leakage and dendritic growth.

RoHS Compliance

Recent environmental guidelines that restrict the use of lead in consumer products mean lead-free solders are more and more frequently found in electronic assemblies. Typically, lead-free solders reflow at higher temperatures, have greater moisture sensitivity and are more susceptible to metallic whiskers and other similar dendritic growth. RoHS compliant Parylene is able to protect electronic devices from these factors, making it an essential consideration for today's electronics.

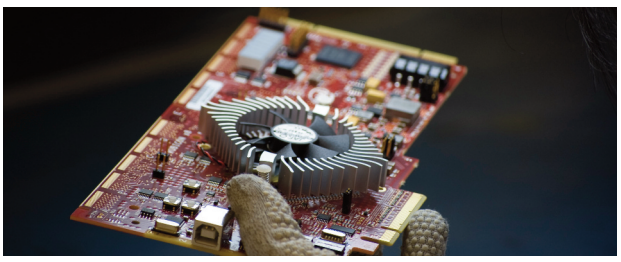

Photo courtesy of www.nbscorp.com

Miniaturization and Mobility

Miniaturization and mobility are two fundamental driving trends in the electronics of all industry segments. Smaller, lighter weight devices and more intricate component packaging configurations challenge traditional assembly processes and other coating alternatives. Parylene adds virtually no weight or volume to the devices it coats, and it conforms without sag or buildups to contours and crevices while maintaining pin-hole free film thicknesses of 0.5 microns or less.

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Properties of Parylene

TYPICAL PHYSICAL & MECHANICAL PROPERTIES	Parylene N	Parylene C
Tensile strength, psi	6,500	10,000
Tensile strength, MPa	45	69
Yield strength, psi	6,300	8,000
Tensile strength, MPa	43	55
Tensile modulus, MPa	2,400	3,200
Elongation at break, %	40	200
Yield elongation, %	2.5	2.9
Density, g/cm³	1.110	1.289
Coefficient of friction: Static	0.25	0.29
Dynamic	0.25	0.29
Water absorption: % (24hr)	0.01(.019")	0.06 (.029")
Index of refraction, n_D^{23}	1.661	1.639
TYPICAL ELECTRICAL PROPERTIES	**Parylene N**	**Parylene C**
Dielectric strength, short time (Volts/mil at 1 mil)	7,000	6,800
Volume resistivity, 23°C, 50% RH (Ohm-cm)	$1x10^{17}$	$6x10^{16}$
Surface resistivity, 23°C, 50% RH (Ohm)	10^{15}	10^{15}
Dielectric constant: 60 Hz	2.65	3.15
1,000 Hz	2.65	3.10
1,000,000 Hz	2.65	2.95
Dissipation factor: 60Hz	0.0002	0.020
1,000 Hz	0.0002	0.019
1,000,000 Hz	0.0006	0.013
TYPICAL BARRIER PROPERTIES	**Parylene N**	**Parylene C**
GAS PERMEABILITY cm³ - mil/100 in²-24hr – atm(23°C)		
Nitrogen	7.7	0.95
Oxygen	30	7.1
Carbon dioxide	214	7.7
Hydrogen sulphide	795	13
Sulfur dioxide	1.89	11
Chlorine	74	0.35
MOISTURE VAPOR TRANSMISSION g-mil/100 in²-24hr, 37°C, 90%RH	1.50	0.14
1 mil = 1/1000 in = 25.4 microns		
TYPICAL THERMAL PROPERTIES	**Parylene N**	**Parylene C**
Melting temperatures (°C)	410	290
Linear coefficient of expansion (10^{-5}/°C)	6.9	3.5
Thermal conductivity, @ 25°C watts/Meter.Kelvin	0.120	0.082

Fig. 1
Volume resistivity, 23°C, 50% RH (Ohm-cm)

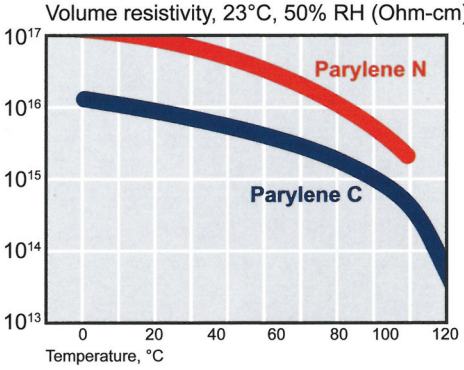


Fig. 2
Dielectric constant, 1,000 Hz

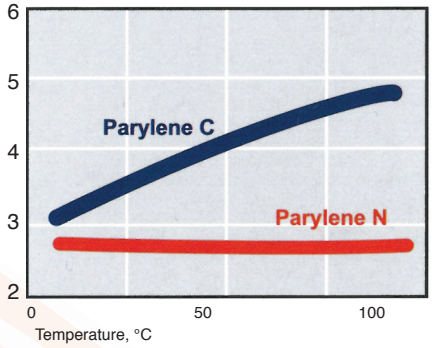
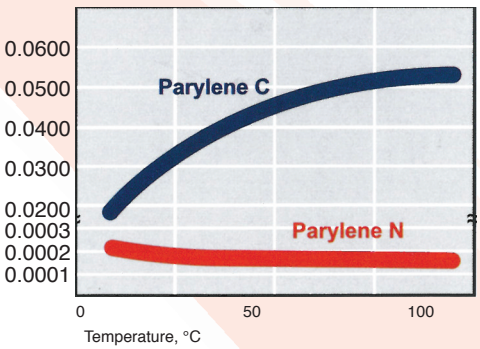
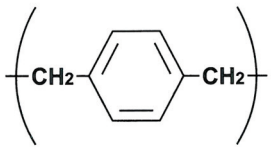


Fig. 3
Dissipation factor, 1,000 Hz

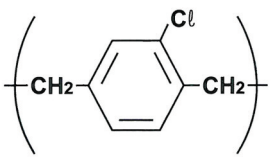


Parylene N



Where lubricity is needed

Parylene C



Excellent barrier protection

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