Dual-Cure 9771

Low Ionic Content and Low Outgassing Light + Moisture Cure Conformal Coating

APPLICATIONS

- Conformal Coating for Critical PCBs in Aerospace, Missiles, Satellites, and Space Applications
- Low Ionic Content Mission Critical Components
- Low Outgassing Mission Critical Components
- Aerospace Mission Critical Components

FEATURES

- UV/Visible Light Cure
- Secondary Moisture Cure
- Bright Blue Fluorescing
- Low Ionic Content Compliance with Mil Std 883 Method 5011
- Temperature/Humidity Resistance (85°C/85% RH - 1,000 Hours)
- Corrosion Resistance (Salt Spray 1,000 Hours - Passed)
- Consistent Coating Easily Achieved with Automated Dispense Systems
- Low Outgassing Conformal Coating
- Halogen-Free per IEC-IEC-61249-2-21
- REACH Compliant

OTHER FEATURES

- QPL-46058 AR UR
- Mil Std 883 Method 5011 Compliant
- UL 94V-0 Flammability
- UL 746-E Recognized
- Meets ASTM E595 Low Outgassing
- NASA MAPTIS Listed (Material Code 09841)
- Meets IPC-CC-830-B
- Passes Airbus AITM 3.0005 and Boeing BSS 7239 Test Methods for Smoke and Toxicity

Dymax dual-cure 9771 is a low-ionic, low-outgassing, high-performance light and moisture-cure reworkable conformal coating especially formulated to ensure complete cure for coating that flows underneath components on critical printed circuit boards in missiles, satellites, and spacecraft. Dymax 9771 is certified to MIL-I-46058C as listed in the QPL-46058 AR UR. Coating in the shadow areas cures with moisture. Dymax 9771 is engineered for coating thicknesses up to 0.203 mm (0.008 in). This conformal coating fluoresces a vivid blue when exposed to UV light (365 nm) for easy inspection of coating coverage. Dymax 9771 is expected to have good to excellent resistance against most chemicals but may be susceptible to synthetic hydraulic fluids. Please contact our Application Engineering team to discuss your project. Dymax conformal coating materials contain no nonreactive solvents and cure upon exposure to light. Their ability to cure in seconds enables faster processing, greater output, and lower processing costs. When cured with Dymax light-curing spot lamps, focused-beam lamps, or flood lamps, they deliver optimum speed and performance for PCB assembly. Dymax lamps offer the ideal balance of UV and visible light for the fastest, deepest cures. This product is in full compliance with RoHS directives 2015/863/EU. Properties below unless specified were measured after full light + moisture cure.

* Not Specifications

N/A Not Applicable

‡ DSTM Refers to Dymax Standard Test Method

Measured after UV cure followed by 40°C/50% RH for 72 hours

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ELECTRONIC CIRCUIT BOARD MATERIALS

9771 Conformal Coating Product Data Sheet

UNCURED PROPERTIES		
Property	**Value**	**Test Method**
Solvent Content	No Nonreactive Solvents	N/A
Chemical Class	Acrylated Urethane	N/A
Appearance	Clear, Light Yellow Liquid	N/A
Soluble in	Organic Solvents	N/A
Density, g/ml	1.08	ASTM D1875
Viscosity, cP	780 (nominal)	DSTM 502‡ (Cone & Plate)
Shelf Life at Recommended Conditions from Date of Manufacture	7 months	N/A

CURED MECHANICAL PROPERTIES (UV + MOISTURE CURE)		
Property	**Value**	**Test Method**
Durometer Hardness (UV Only)	A62	ASTM D2240
Durometer Hardness	D72	ASTM D2240
Tensile at Break, MPa [psi]	20.4 [2952]	ASTM D638
Elongation at Break, %	13	ASTM D638
Modulus of Elasticity, MPa [psi]	910.3 [132,026]	ASTM D638
Glass Transition Tg, °C	64	ASTM D5418
CTEα1, µm/m/°C	108	ASTM E831
CTEα2, µm/m/°C	191	ASTM E831

ADHESION	
Substrate	**Recommendation**
Ceramic	✔
Common Solder Masks	✔
FR4	✔
Flex Circuit (Polyimide)	✔
Lead Frame	✔
PCB	✔
Silicon	✔

✔ Recommended o Limited Applications

st Requires Surface Treatment (e.g. plasma, corona treatment, etc.)

OTHER CURED PROPERTIES (UV + MOISTURE CURE)		
Property	**Value**	**Test Method**
Refractive Index (20°C)	1.51	ASTM D542
Boiling Water Absorption, % (2 h)	1.16	ASTM D570
Water Absorption, % (25°C, 24 h)	0.21	ASTM D570
Linear Shrinkage, %	1.4	ASTM 2566
Volumetric Shrinkage, %	4.5	DSTM 6114‡
Outgassing – Total Mass Loss (TML), %	0.90	ASTM E595
Outgassing - Water Vapor Recovered (WVR)	0.2%	ASTM E595
Outgassing – Collected Volatile Condensable Material (CVCM), %	0.02	ASTM E595
Thermal Shock, -65°C to 125°C (50 cycles) B-2	Passes - No Degradation	MIL-I-46058C (MIL-STD-202 Method 107)
Moisture Resistance (10 cycles, 65°C max)	Passes - (1E10 ohms min)	MIL-I-46058C
Fungus Resistance (ASTM G21-13)	Passes Rating-0	MIL-I-46058C
Specific Ionic Content	Passes (all <5ppm)	MIL-STD-883 Method 5011 (By Ion Chromatography)
Specific Electrical Conductance	2.6 mS/m	MIL-STD-883 Method 5011
pH (Requirement 4.0 ≤ pH ≤ 9.0)	4.5	MIL-STD-883 Method 5011.7
Sequential Environmental Testing: Thermal Shock (15 cycles) + Cycle (100 cycles)	Passes	MIL-STD-883 Method 5011

ELECTRICAL PROPERTIES		
Property	**Value**	**Test Method**
Dielectric Constant (1 MHz)	4.29	ASTM D150
Dissipation Factor (1 MHz)	0.0287	ASTM D150
Dielectric Strength (V/mil)	665	ASTM D149
Surface Resistivity, ohm	2.23e+13	ASTM D257
Volume Resistivity, ohm-cm	3.48e+14	ASTM D257

CURING GUIDELINES

UV-curing guidelines for 9771 at 0.08 mm - 0.20 mm [0.003 in - 0.008 in] thickness:

Dymax Curing System (Intensity)	Cure Time or Belt Speed
UVCS Conveyor with Fusion F300S (2.5 W/cm^2)[A]	1.2 m/min [4 ft/min]

A ACCU-CAL™ 160 Radiometer for conveyors.

SECONDARY MOISTURE CURE

A combination of light and moisture cure is required to achieve full cured mechanical properties. Moisture is also used as a secondary cure mechanism for shadow areas that cannot be cured with light. While moisture cure time in shadow areas is typically 2-3 days at 25°C [77°F], 50% RH, actual moisture-cure time is application specific and may vary. For material that has been light cured, typical full property development is after 7 days at 25°C [77°F], 50% RH or for an accelerated moisture cure, 2 days at 40°C [104°F], 50% RH.

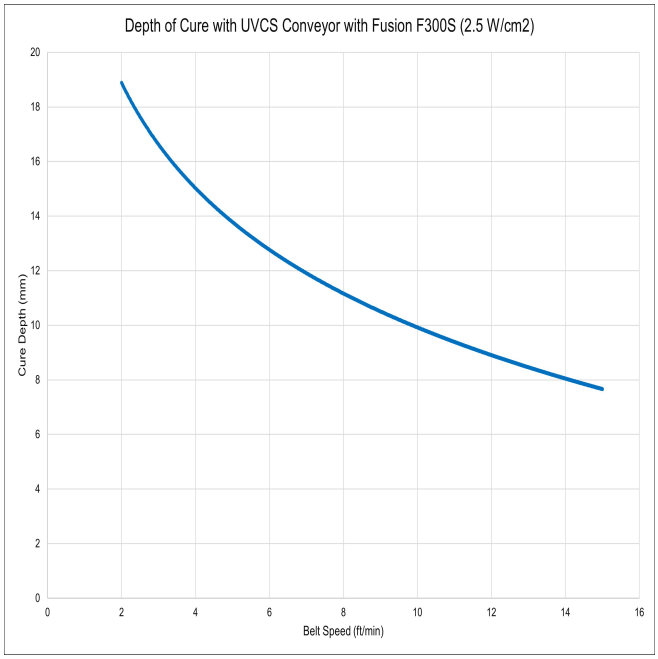
Cure time for both light-cured and shadow areas depends on humidity level, amount of material in shadow areas, and its proximity to humidity. Material entrapped under large components may have a prolonged cure time. Exposure to heat (typically 40°C-60°C) and higher relative humidity will accelerate cure.

Full cure is best determined empirically by curing at different times and intensities, and measuring the corresponding change in cured properties such as tackiness, adhesion, hardness, etc. Full cure is defined as the point at which more light exposure no longer improves cured properties.

Dymax recommends that customers employ a safety factor by curing longer and/or at higher intensities than required for full cure. Although Dymax Application Engineering can provide technical support and assist with process development, each customer must ultimately determine and qualify the appropriate curing parameters required for their unique application.

DEPTH OF CURE

The graph below shows the increase in depth of cure as a function of exposure time. A 9.5 mm [0.37 in] diameter specimen was cured in a polypropylene mold and cooled to room temperature. It was then released from the mold and the cure depth was measured.



OPTIMIZING PERFORMANCE AND HANDLING

1. This product cures with exposure to UV and visible light as well as moisture. Exposure to ambient and artificial light and moisture should be kept to a minimum before curing. Dispensing components including needles and fluid lines should be 100% light blocking, not just UV blocking.
2. All bond surfaces should be clean and free from grease, mold release, or other contaminants prior to dispensing the material.
3. Cure speed is dependent upon many variables, including lamp intensity, distance from the light source, required depth of cure, bond gap, and percent light transmission of the substrate.
4. Oxygen in the atmosphere may inhibit surface cure. Surfaces exposed to air may require high-intensity UV light to produce a dry surface cure. Flooding the bond area with an inert gas, such as nitrogen, can also reduce the effects of oxygen inhibition.
5. Parts should be allowed to cool after cure before testing and subjecting to any loads.
6. In rare cases, stress cracking may occur in assembled parts. Three options may be explored to eliminate this problem. One option is to heat anneal the parts to remove molded-in stresses. A second option is to open the gap between mating parts to reduce stress caused by an interference fit. The third option is to minimize the amount of time the liquid material remains in contact with the substrate(s) prior to curing.
7. Light curing generally produces some heat. If necessary, cooling fans can be placed in the curing area to reduce the heating effect on components.
8. At the point of curing, an air exhaust system is recommended to dissipate any heat and vapors formed during the curing process.
9. Resealing opened container under a dry, inert gas, such as nitrogen, can help to prolong the shelf life.
10. Light cure is recommended prior to moisture cure. Full cure develops after both light and moisture cure, not one or the other.

COATING WEIGHT

At a nominal coating thickness of 0.08 mm - 0.2 mm [0.003 in - 0.008 in] and coating area of 2580 mm² [4 in²], 9771 coating weight is expected to be approximately 0.212g - 0.566g. This value serves only as a reference point and is calculated using nominal material density, coating thickness, and coating area. Coating weight in your unique application should be confirmed as part of the validation process.

The Dymax Application Engineering team is ready to discuss your application requirements and determine the most appropriate dispensing and/or spraying solution. Visit our current dispensing equipment portfolio here, our guidelines for dispensing Dymax 9771 tech bulletin, or consult our global contact phone numbers and online chat feature (available in North America only) during normal business hours for instant support.

STORAGE AND SHELF LIFE

Store the material in a low humidity, cool, and dark place when not in use. This product may polymerize upon prolonged exposure to ambient and artificial light as well as moisture. This material shelf life noted on page 1 of this document, when stored between 10°C (50°F) and 25°C (77°F) in the original, unopened container. Resealing large containers under dry inert gas, such as nitrogen, can help maintain the work life. Smaller syringes and cartridges should be kept in moisture barrier bags with desiccant when not in use.

CLEANUP

Following dispensing, uncured Dymax dual-cure materials may be removed from dispensing components and parts with non-alcoholic solvents. Alcoholic solvents (such as IPA or ethanol) that contain moisture activate the curing process. Therefore, it is recommended that non-alcohols such as Butyl Acetate, Acetone, or MEK be used to clean up uncured material and purge wetted dispensing lines. Cured material will be impervious to many solvents and difficult to remove. For more information on rework or removal of cured conformal coatings, please consult TB095 Rework and Removal of UV Light-Curable Conformal Coatings.

GENERAL INFORMATION

This product is intended for industrial use only. Keep out of the reach of children. Avoid breathing vapors. Avoid contact with skin, eyes, and clothing. Wear impervious gloves. Repeated or continuous skin contact with uncured material may cause irritation. Remove material from skin with soap and water. Never use organic solvents to remove material from skin and eyes. For more information on the safe handling of this material, please refer to the Safety Data Sheet before use.

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