

## EMAX 903-E

### Light/Moisture-Cure Conformal Coating

**APPLICATIONS**

- **Conformal Coating**

**FEATURES**

- **UV/Visible Light Cure**
- **Secondary Moisture Cure**
- **Solvent Free**
- **No VOC**
- **Low Odor**
- **One Part, No Mixing Required**

**OTHER FEATURES**

- **Bright Blue Fluorescing**
- **Chemically Resistant**
- **MIL-I-46058C**
- **IPC-CC-830B**
- **UL 94 V-0**
- **UL 746-E**

DYMAX EMAX 903-E is a light- and moisture-cure conformal coating specifically formulated to ensure complete cure for coating that flows underneath components on printed circuit boards. Coating in shadowed areas cures over time with ambient moisture. This coating fluoresces a vivid blue when exposed to UV light (365 nm) for easy inspection of coating coverage. DYMAX EMAX 903-E is engineered for coating thicknesses up to 0.127 mm [0.005 in]. DYMAX Dual-Cure materials contain no nonreactive solvents. 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 conformal coating. DYMAX lamps offer the optimum balance of UV and visible light for the fastest, deepest cures. This product is in full compliance with the RoHS Directives 2002/95/EC and 2003/11/EC.

**UNCURED PROPERTIES \***

Property	Value	Test Method
Solvent Content	No Nonreactive Solvents	N/A
Chemical Class	Acrylated Urethane	N/A
Appearance	Clear/Light Amber Liquid	N/A
Soluble in	Organic Solvents	N/A
Density, g/ml	1.07	ASTM D1875
Viscosity, cP (20 rpm)	125 (nominal)	ASTM D2556

**CURED MECHANICAL PROPERTIES \***

Property	Value	Test Method
Durometer Hardness	D75	ASTM D2240
Elongation Yield, %	5.3	ASTM D638
Modulus of Elasticity, MPa [psi]	150 [21,800]	ASTM D638
Glass Transition $T_g$ , °C	56	DSTM 256 <sup>‡</sup>

**OTHER CURED PROPERTIES \***

Property	Value	Test Method
Boiling Water Absorption, % (2 h)	1.4	ASTM D570
Water Absorption, % (25°C, 24 h)	0.2	ASTM D570
Linear Shrinkage, %	1.6	ASTM D2566

\* Not Specifications

N/A Not Applicable

‡ DSTM Refers to DYMAX Standard Test Method

**ELECTRICAL PROPERTIES \***

Property	Value	Test Method
Dielectric Constant (1 MHz)	3.90	ASTM D-150
Dissipation Factor (1 MHz)	0.01	ASTM D-150
Dielectric Withstand Voltage, V	>1,500	MIL-I-46058C
Volume Resistivity, ohm-cm	$1.01 \times 10^{16}$	ASTM D-257
Surface Resistivity, ohm	$3.92 \times 10^{15}$	ASTM D-257

**ADHESION**

Substrate	Recommendation
Leadframe	✓
Ceramic	✓
PCB	✓
Flex	-
Silicon	o

✓ Recommended                      o Limited Applications

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



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### CURING GUIDELINES

Fixture time is defined as the time to develop a shear strength of 0.1 N/mm<sup>2</sup> [10 psi] between glass slides. Actual cure time typically is 3 to 5 times fixture time.

DYMAX Curing System (Intensity)	Fixture Time or Belt Speed <sup>C</sup>
2000-EC (50 mW/cm <sup>2</sup> ) <sup>A</sup>	3 s
5000-EC (200 mW/cm <sup>2</sup> ) <sup>A</sup>	2 s
BlueWave <sup>®</sup> LED Prime UVA (10 W/cm <sup>2</sup> ) <sup>B</sup>	4 s
BlueWave <sup>®</sup> 200 (10 W/cm <sup>2</sup> ) <sup>A</sup>	<1 s
UVCS Conveyor with one 5000-EC (200 mW/cm <sup>2</sup> ) <sup>D</sup>	>7.0 m/min [23 ft/min]
UVCS Conveyor with Fusion F300S (2.5 W/cm <sup>2</sup> ) <sup>D</sup>	>8.2 m/min [27 ft/min]

**A** Intensity was measured over the UVA range (320-395 nm) using a DYMAX ACCU-CAL<sup>™</sup> 50 Radiometer.

**B** Intensity was measured over the UVA/Visible range (350-450 nm) using a DYMAX ACCU-CAL<sup>™</sup> 50-LED Radiometer

**C** Curing through light-blocking substrates may require longer cure times if they obstruct wavelengths used for light curing (320-400 nm for UV light curing, 320-450 nm for UV/Visible light curing). These fixture times/belt speeds are typical for curing thin films through 100% light-transmitting substrates.

**D** At 53 mm [2.1 in] focal distance. Maximum speed of conveyor is 8.2 m/min [27 ft/min]. Intensity was measured over the UVA range (320-395 nm) using the DYMAX ACCU-CAL<sup>™</sup> 100 Radiometer.

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. Higher intensities or longer cures (up to 5x) generally will not degrade DYMAX light-curable materials.

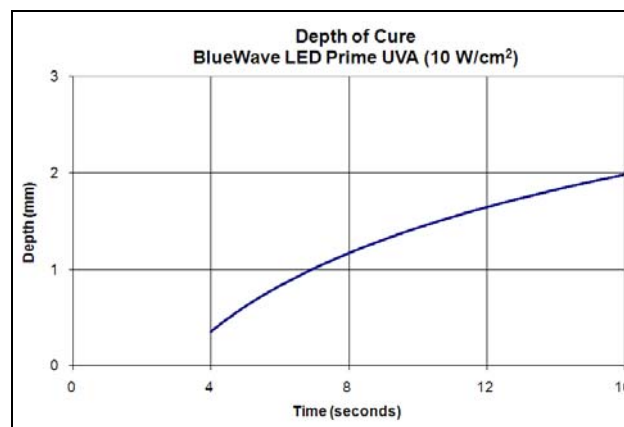
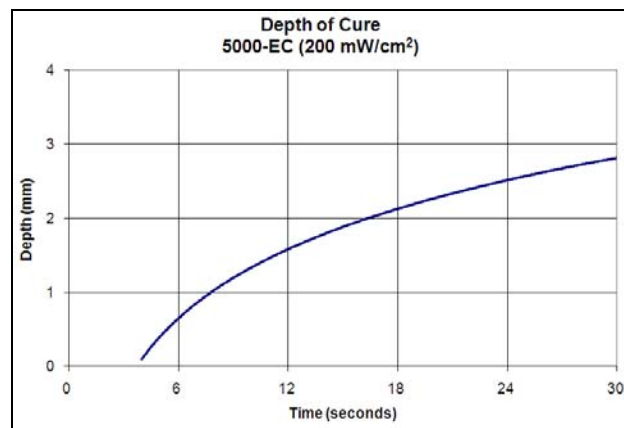
DYMAX recommends that customers employ a safety factor by curing longer and/or at higher intensities than required for full cure. Although DYMAX Applications Engineering can provide technical support and assist with process development, each customer ultimately must determine and qualify the appropriate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

### Moisture Cure Following Light Exposure

Moisture may be used as a secondary cure mechanism for shadowed areas that cannot be cured with light. Light cure is recommended prior to moisture cure. While moisture cure time is typically 2-3 days at 23°C [73°F], 50% RH, actual moisture cure time is application specific and may vary. Cure time depends on humidity level, amount of coating in shadowed areas, and proximity of shadowed coating to humidity. Coating entrapped under large components may have a prolonged cure time. Exposure to heat (typically 65°C-80°C) and higher relative humidity will accelerate cure. Accelerated moisture cure time is also dependent on the variables listed above.

### DEPTH OF CURE

The graphs below show the increase in depth of cure as a function of exposure time with two different lamps at different intensities. 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. Exposure to ambient and artificial light 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 surfaces in contact with the material should be clean and free from flux residue, 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, coating thickness and amount of material in shadowed areas.
4. Oxygen in the atmosphere may inhibit surface cure. Surfaces exposed to air may require high-intensity ( $>100 \text{ mW/cm}^2$ ) UV light to produce a dry surface cure. Flooding the curing 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 or electrical testing.
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 any 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 containers under nitrogen extends shelf life.

**DISPENSING THE MATERIAL**

This material may be dispensed with a variety of manual and automatic applicators or other equipment as required. Pressurizing air must be free of moisture to prevent premature curing in dispensing equipment. Pressurizing with an inert gas, such as nitrogen is recommended. Questions relating to dispensing and curing systems for specific applications should be referred to DYMAX Applications Engineering.

**CLEAN UP**

Uncured material may be removed from dispensing components and parts with non-alcoholic solvents, like Butyl Acetate. Cured material will be impervious to many solvents and difficult to remove. Clean up of cured material may require mechanical methods of removal.

**PERFORMANCE AFTER TEMPERATURE EXPOSURE**

Light cured DYMAX materials typically have a lower thermal limit of  $-54^\circ\text{C}$  [ $-65^\circ\text{F}$ ] and an upper limit of  $150^\circ\text{C}$  [ $300^\circ\text{F}$ ]. Many DYMAX products can withstand temperatures outside of this range for short periods of time, including typical wave solder processes and reflow profiles. Please contact DYMAX Applications Engineering for assistance.

**STORAGE AND SHELF LIFE**

Store the material in a cool, dark place when not in use. Do not expose to light. This product may polymerize upon prolonged exposure to ambient and artificial light as well as atmospheric moisture. Keep container covered when not in use. Resealing the container under nitrogen or other inert gas extends shelf life. This material has a minimum six-month shelf life from date of shipment, unless otherwise specified, when stored between  $10^\circ\text{C}$  [ $50^\circ\text{F}$ ] and  $32^\circ\text{C}$  [ $90^\circ\text{F}$ ] in the original, unopened container.

**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 Material Safety Data Sheet before use.

**RECOMMENDED DYMAX LITERATURE**

LIT010A	Guide to Selecting and Using UV Light-Curing Systems
LIT019	Light-Curing Materials for Electronic Assembly
LIT077	Chemical Safety
LIT133	UV Light-Curing System Safety Considerations
LIT159	ACCU-CAL™ 50 Radiometer
LIT206	Flood and Focused-Beam UV Light-Curing Systems
LIT218	BlueWave® 200 UV Light-Curing Spot Lamp
LIT267	BlueWave® LED Prime UVA Spot-Curing System
LIT276	ACCU-CAL™ 50-LED Radiometer

Literature is available through our website [www.dymax.com](http://www.dymax.com), or by calling any DYMAX location.

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