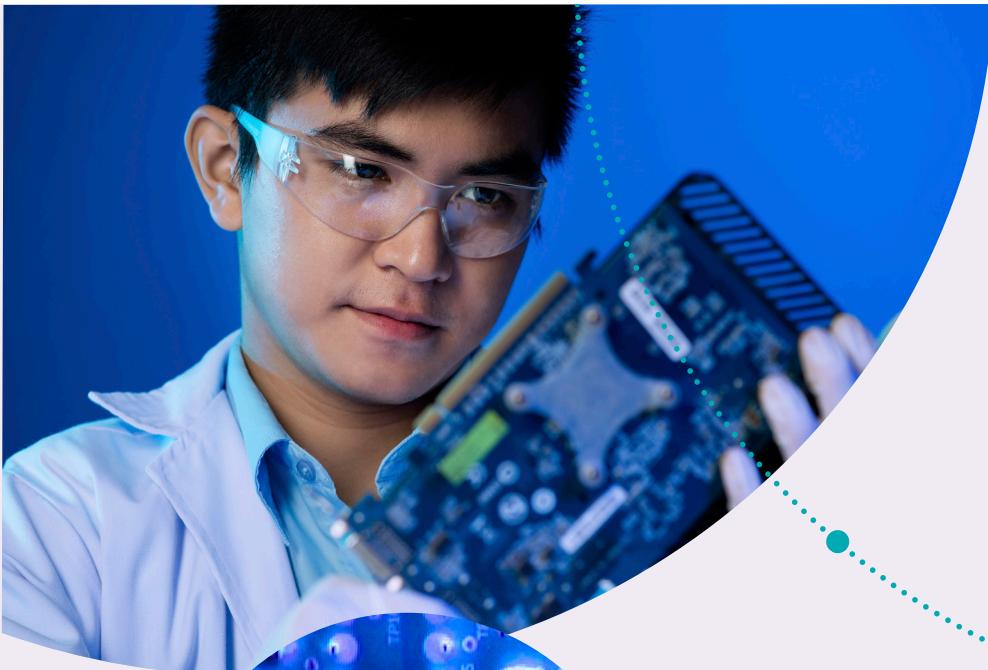


LIGHT-CURE CONFORMAL COATINGS PRODUCT SELECTOR GUIDE



Only Dymax offers expert knowledge of light-cure technology, along with a full array of light-cure products. Dymax is committed to developing a true collaborative partnership — applying our extensive process knowledge to your specific application challenges.

We create custom solutions to ensure that chemistry and equipment work seamlessly together with maximum efficiency. Our application engineering team works side-by-side with our customers, providing assistance with formulation, testing, evaluation, and pre-production trials. Our laboratory is fully equipped to deliver mechanical or electrical testing, as well as specialty testing such as flowers of sulfur, salt spray, or thermal shock to ASTM standards. We also offer an extensive inventory of curing equipment, manual and automated dispensing systems to help you achieve a more efficient, cost-effective manufacturing process.

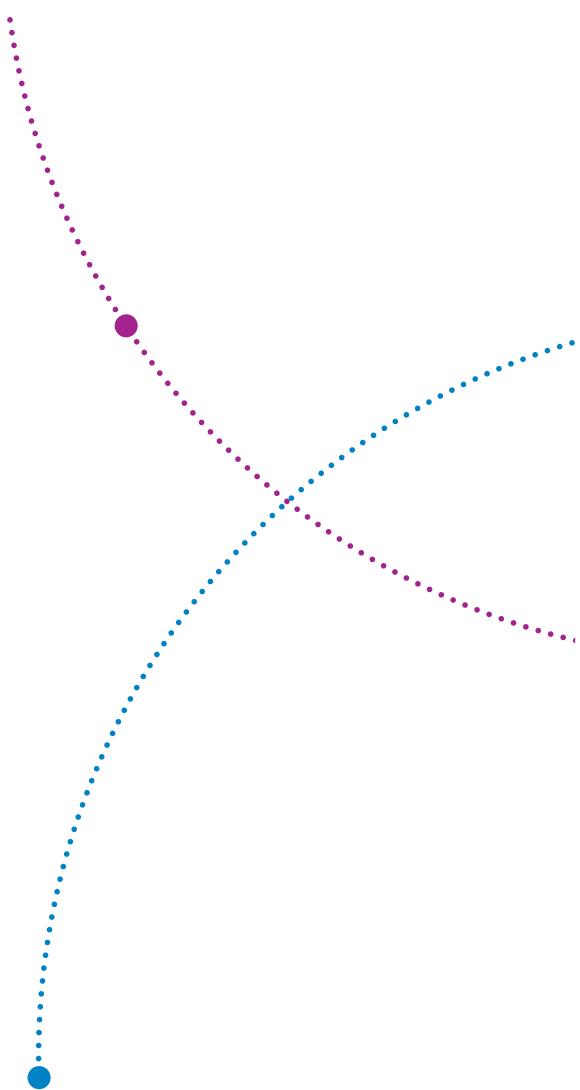
Dymax Light-Cure Conformal Coatings

Better Circuit Board Protection with Higher Process Throughput

Dymax light-curable conformal coatings have been used to protect printed circuit boards (PCBs) for over thirty years in many high-reliability applications, including military, aerospace, consumer electronics, medical, automotive, appliance, and telecom applications. Our conformal coatings improve the circuit reliability of PCBs in harsh environments, protecting the boards from humidity, dust, fungus, and other contaminants that can cause either current leakage or corrosion.

Our conformal coatings are designed to help streamline the assembly process, curing tack free in seconds upon exposure to UV/Visible light to help streamline manufacturing assembly processes. Manufacturers can apply, cure, and ship immediately, eliminating time-consuming steps associated with traditional thermal-cure and room temperature-cure conformal coatings. Each conformal coating is one part (no mixing required) for easy dispensing and is electrically insulating so it can be applied over the entire PCB surface or in select areas to provide protection from service environments.

Our conformal coatings contain no added solvents and very low VOCs, eliminating the need for solvent handling, while enhancing worker safety and minimizing environmental impact.



Superior Protection

- IPC-CC-830, Mil-I-46058C, and UL listed
- Excellent environmental resistance
- Excellent electrical properties
- Tenacious adhesion to flex circuits (FPCs)
- Low stress under thermal cycling
- Non-slumping viscosities
- Excellent abrasion resistance
- Black coatings help hide proprietary circuitry
- Excellent chemical resistance

Superior Processing

- Easier automation
- Full cure in seconds
- No racking or long ovens
- No risk of silicone migration
- No added solvents
- Thick coatings in a single application
- Repairable
- One part - no mixing or viscosity problems

Selecting a Conformal Coating

When selecting a light-curable conformal coating, consider these questions when making your selection:

How is the coating being applied and cured?

Typically, the best way to apply Dymax conformal coatings is by selective spray application. This method ensures that areas which must be protected are coated at the desired thickness and areas which should not be coated remain uncoated. In addition, selective spray application can be used to avoid depositing the conformal coating underneath components where the material is shadowed from light.

Dymax conformal coatings cure in seconds under high-intensity UVA and blue visible light. With proper coating application, UV cure is a very simple processing step.

How well does the coating adhere to the PCB and component materials?

To provide effective protection to PCB components and surfaces, conformal coatings must wet well upon application and adhere well after cure. Optimal results are obtained with clean boards. Adhesion testing is performed on materials commonly used in the industries for each of our conformal coatings. This information is reported on our product data sheets.

What cured properties/specifications are required?

Dymax conformal coatings are excellent insulators. In practice, properties affecting the degree of protection include coating thickness (thicker is typically better), moisture absorption (less is better), and resistance to other environmental stresses. Flexible grades are designed to enhance thermal cycling performance. Hard, more rigid grades are preferred to enhance chemical resistance in harsh environments. Required specifications are also important considerations. Dymax conformal coatings are used in a multitude of military and automotive applications. Dymax carries an array of MIL-I-46058C listed, IPC-CC-830-B approved and UL recognized coatings.

Do you have any special requirements?

Other than the coating's cured properties, you'll want to note any special requirements your process may need. Dymax offers many conformal coatings formulated with unique features that improve the quality inspection process or that add extra security to PC boards. Conformal coatings are also available with a secondary cure option such as heat or moisture for applications that may have shadowed areas that are difficult to reach with light.

Assistance with Selection and Testing

Selecting the correct coating and equipment for your application is important to the overall success of your process. Our technical experts are available to assist with product and process design, equipment selection and integration, testing, evaluation, and pre-production trials throughout the life of the assembly process. Our laboratory is fully equipped to perform testing under a variety of environmental conditions including:

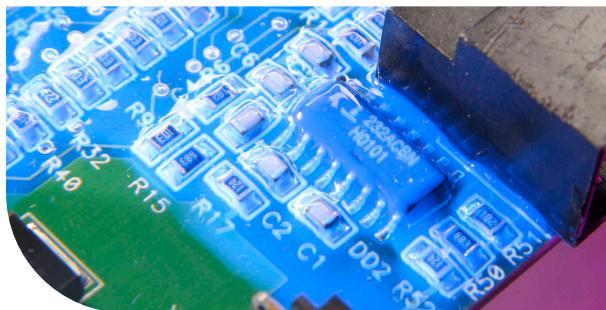
- Salt Spray
- Flowers of Sulfur
- Humidity aging per ASTM standards
- Shear strength
- Thermal shock
- And more

Please contact our application engineering department for more information.

Specialty Coatings & Technologies

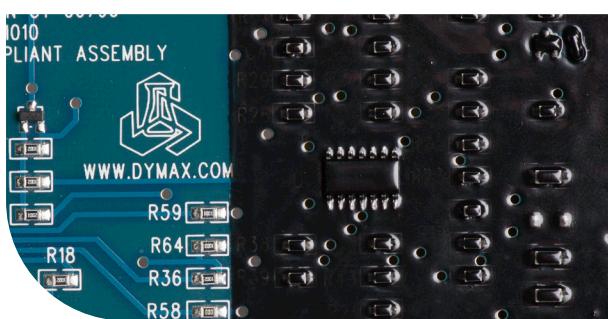
Shadow Cure - Secondary Heat & Moisture Cure for Hard to Reach Areas

Dymax Multi-Cure® coatings are formulated to ensure complete cure in applications where shadowed areas on high-density circuit boards are a concern. They are designed with either secondary moisture or thermal cure mechanisms. Our moisture cure formulas ensure shadowed areas cure over time with moisture, eliminating the need for a second process step and concerns of component life degradation due to temperature exposure.



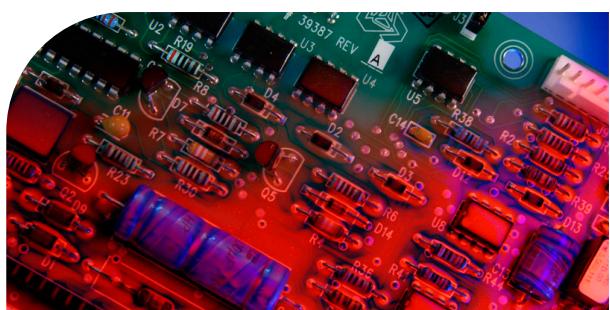
Multi-Cure® 9451: Black Conformal Coating for Protecting Sensitive Information

Dymax 9451 black conformal coating was developed specifically to protect sensitive information on the PCB. Like a typical conformal coating, it improves circuit reliability in harsh conditions, but thanks to its matte black color, it has the added benefit of being able to conceal markings, labels, sensitive information, and other identification on the circuit board. This coating has excellent coverage and can be applied and cured up to 5 mils thick in one pass. It can also be dispensed in multiple passes if a thicker coating is required.



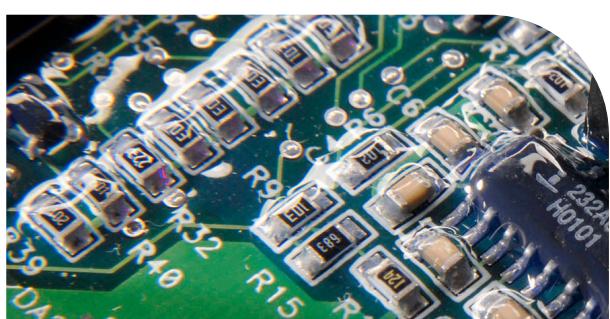
Ultra-Red® Fluorescing Technology for Easier Coverage Inspection

Ultra-Red® fluorescing technology enhances bond-line inspection processes and product authentication. Adhesives formulated with Ultra-Red® remain clear until exposed to low-intensity UV light at which point they fluoresce bright red. This is particularly effective while bonding plastics that naturally fluoresce blue, such as PVC and PET. Ultra-Red® technology also produces a unique spectral signature that can be used by manufacturers for product authentication.



Multi-Cure® 9452-FC: Low Viscosity LED-Curable Conformal Coating

Multi-Cure® 9452-FC conformal coating contains no added solvents and has a viscosity of only 20 cP, making it the ideal choice for film/flow coating or similar dispensing methods. It cures with UV/visible light but also has the ability to be cured with heat for applications where shadowed areas exist. The coating is LED optimized, curing in just seconds for immediate processing. 9482-FC also fluoresces blue under black light, allowing easier in-line inspection of coating coverage.



Available Conformal Coatings

Dual-Cure Coatings: UV Broad-Spectrum Light Cure + Secondary Moisture Cure

| Product | Description | Viscosity, mPas | Durometer Hardness | Modulus of Elasticity, MPa (psi) | Tensile at Break, MPa [psi] | Elongation at Break, % | Dielectric Withstand Voltage, V/mil | Approvals |
|---------|--|-----------------|--------------------|----------------------------------|-----------------------------|------------------------|-------------------------------------|--|
| 9483 | Excellent thermal shock resistance; corrosion resistant; great temperature/humidity performance; blue fluorescing; recommended for automotive applications | 750 | D60 | 276 [40,000] | 16,2 [2,350] | 22 | 1.500 | MIL-I-46058C IPC-CC-830-B UL 94V-0 Flammability UL 746E |
| 9481-E | Low viscosity for thin coatings; low surface energy for difficult-to-wet components and assembly materials; high chemical and abrasion resistance; excellent resistance to corrosion from sulfur | 125 | D75 | 150 [21,800] | 11 [1,600] | 60 | >1.500 | MIL-I-46058C IPC-CC-830-B UL 94V-0 Flammability UL 746E |
| 9482 | Thermal shock and chemical resistance; superior re-workability; blue fluorescing; Excellent resistance to corrosion from sulfur | 1.100 | D70 | 275 [40.000] | 15,8 [2.300] | 26 | 1.100 | MIL-I-46058C IPC-CC-830-B UL 94V-0 Flammability UL 746E |
| 9771 | Low ionic content; low outgassing; corrosion and temperature/humidity resistance; blue fluorescing | 780 | D72 | 910,3 [132.026] | 20,4 [2.952] | 13 | 665 | MIL-STD-883 Method 5011 ASTM-E595 Low Outgas MIL-I-46058C IPC-CC-830-B UL 94V-0 Flammability UL 746E NASA MAPTIS material number 09841 |

Multi-Cure® Coatings: UV Broad-Spectrum Light Cure + Secondary Heat Cure

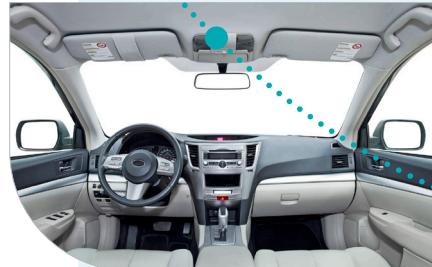
| Product | Description | Viscosity, mPas | Durometer Hardness | Modulus of Elasticity, MPa (psi) | Tensile at Break, MPa [psi] | Elongation at Break, % | Dielectric Withstand Voltage, V/mil | Approvals |
|---------------|--|-----------------|--------------------|----------------------------------|-----------------------------|------------------------|-------------------------------------|--|
| 9-20557 | Isocyanate free; medium viscosity for wetting components; low modulus for enhanced thermal cycling performance | 2.300 | D60 | 37,9 [5.500] | 15,8 [2.300] | 150 | >1.500 | MIL-I-46058C IPC-CC-830-B UL Flammability UL 746 |
| 9451 | Black color is excellent for hiding components and board features; designed for thin coatings; optimized for single pass coatings up to 0.005" | 6.000 | D80 | 717 [104.000] | 42,7 [6.200] | 4,4 | 1.200 | UL 94V-0 Flammability |
| 9-20557-LV | Isocyanate free; low viscosity for thin coatings; low modulus for enhanced thermal cycling performance | 850 | D70 | 310 [45.000] | 21,7 [3.150] | 100 | >1.500 | MIL-I-46058C IPC-CC-830-B |
| 9-20558-REV-A | Thixotropic, high-viscosity coating; bonds well to FPCs; flexible; can be used as a conformal coating as well as an encapsulant | 24.000 | D35 | 2,3 [340] | 6,2 [900] | 160 | 1.100 | UL 94V-0 Flammability |
| 984-LVUF | Isocyanate free; low viscosity for thin coatings; rigid for high chemical and abrasion resistance; optimized for LED curing | 160 | D85 | 724 [105.100] | 55,8 [8.100] | 4 | 1.800 | MIL-I-46058C IPC-CC-830-B UL 746C UL 94V-0 Flammability |

■ Featured Product

Industries Served

Automotive

Typical applications include speedometer circuitry, engine control modules and sensors, door and window controls, airbag sensors, audio circuitry, and more.



Instrumentation

Typical applications include sensor circuits, display connectors, mother boards, and more.



Smart Connected Devices

Typical applications include PCBs for camera modules, tablets, cell phones, computers, wearables, and more.



Appliance

Typical applications include control boards, sensors, and modules used in handheld power tools, appliance sub-components, small consumer appliances, and major home appliances.

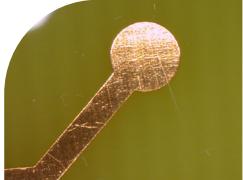
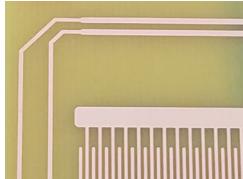
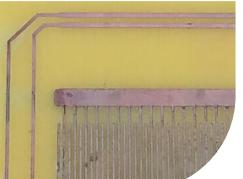
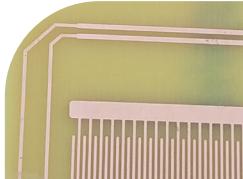
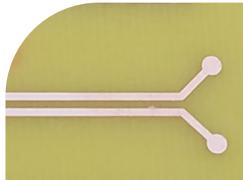
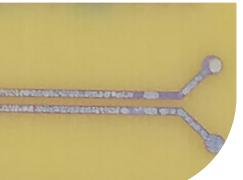
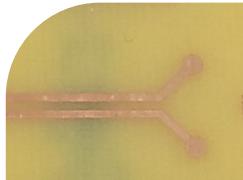
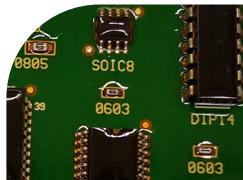


Industrial

Typical applications include circuit boards used in electrical sockets, power supplies, and switches.



Coating Performance Studies

| Testing | | | |
|--|--|---|---|
| Corrosion Resistance - Flowers of Sulfur (ASTM B809) 50°C, 90% RH, 96 hours exposure to sublimed sulfur. Test boards were then inspected for tarnish and corrosion on the copper finish of the test board. |  |  |  Before - Uncoated PCB After - Uncoated After - Coated w/Dymax |
| Corrosion Resistance - Salt Fog (ASTM B117) 35°C, 5% salt solution for 96 hours. Test boards were then inspected for corrosion on the copper finish of the test board. No disruptive change by flash over, spark over, or break-down in dielectric voltage transient test. |  |  |  Before - Uncoated PCB After - Uncoated After - Coated w/Dymax |
| High Temp./High Humidity 85°C/85% Humidity for 500 hours. Inspect for softening, chalking, blistering, cracking, tackiness, loss of adhesion, reversion or liquefaction. No disruptive change by flash over, spark over or breakdown in dielectric voltage transient test. |  |  |  Before - Uncoated PCB After - Uncoated After - Coated w/Dymax |
| Thermal Shock Resistance*** -55°C to 125°C, 30 minute dwell time, 300 cycles. Sn-Pb components assembled PCB003 test boards with AgIn finish. Test boards were then inspected for any cracking or delamination. |  |  | After - PC003 Test Boards After - Flat Boards |
| Flexibility (IPC-TM-650 2.4.5.1) 180° bend test was performed. The test boards were then inspected for cracking or delamination. | | | |
| Flammability UL94 Vertical burn test | | | |

* Tested to IPC-TM-650 2.6.11.1

** Meets UL V-0. Testing completed internally at Dymax

*** 9452-FC tested on flat boards. 9482 and 9-20557 tested on PCB003 test boards. 9481-E & 984-LVUF tested to IPC-TM-650 2.6.7.1 testing.

| | 9-20557 | 984-LVUF | 9451 | 9452-FC | 9481-E | 9482 | 9483 |
|--------|---------|-----------|-----------|-----------|-----------|-----------|-----------|
| Poor | Good | - | Excellent | Excellent | Excellent | Excellent | Excellent |
| Good | Good | Excellent | Excellent | Excellent | Excellent | Excellent | Excellent |
| Pass | Pass* | TBD | Pass | Pass | Pass | Pass | Pass |
| Pass | Pass | TBD | Pass | Pass | Pass | Pass | Pass |
| Pass | Pass | Pass | Pass | Pass | Pass | Pass | Pass |
| UL V-1 | UL V-0 | UL V-0 | UL V-0** | UL V-0 | UL V-0 | UL V-0 | UL V-0 |



Flowers of Sulfur Testing Chamber



Salt Fog Chamber



Flammability Test



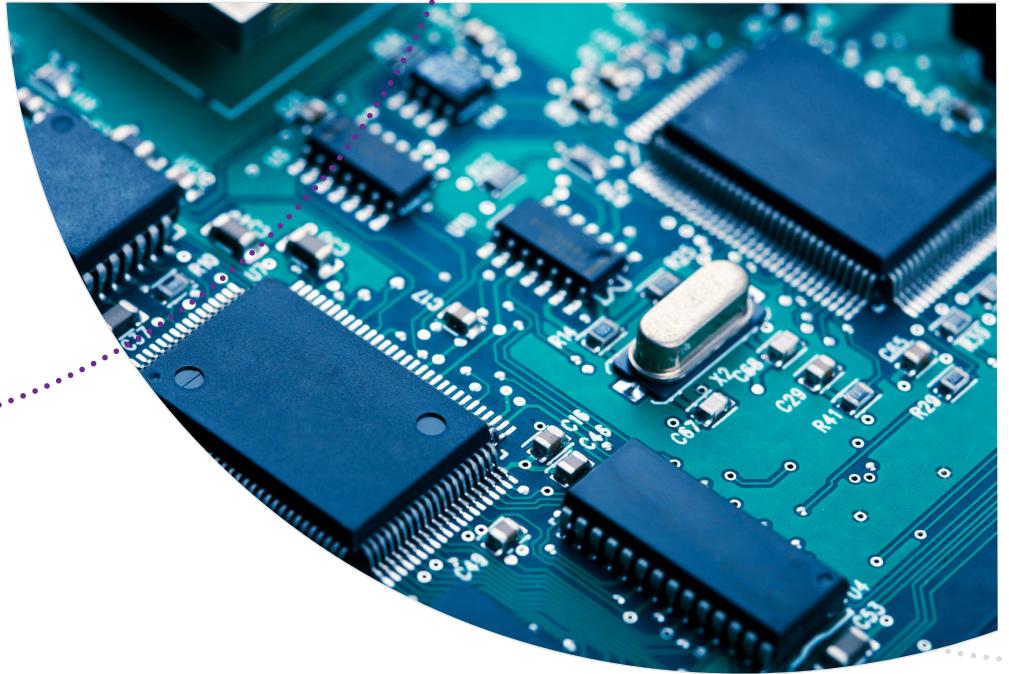
Flexibility Testing

Chemical Resistance - Automotive Fluids

A selection of Dymax conformal coatings were tested for their chemical resistance against a variety of fluids commonly found in the automotive industry. The conformal coatings were dispensed and then cured for 20 seconds using a Dymax 5000-EC flood lamp at an intensity of 200 mW/cm². The samples were then immersed in the fluids for 72 hours, after which they were removed and wiped clean. The samples were then left at room temperature for 1 week. The initial weights of the sample coatings were recorded, as well as the weights after the 72 hour soak and after the 1 week.

| Product | | | Motor Oil | Brake Fluid | Transmission Oil | Power Steering Fluid | Water 5% NaCl | IPA 99% | Diesel Fuel |
|----------|----------------------------|----------|-----------|-------------|------------------|----------------------|---------------|---------|-------------|
| 9-20557 | Initial Weight (grams) | | 0.71 | 0.70 | 0.67 | 0.68 | 0.69 | 0.72 | 0.69 |
| | Change from Initial Weight | 72 Hours | 0.24% | 64.59% | 0.88% | 0.13% | 3.02% | 64.45% | 9.02% |
| | | 1 Week | 0.06% | 60.29% | 0.49% | -0.13% | -0.41% | 2.49% | 4.28% |
| 9451 | Initial Weight (grams) | | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.07 | 0.06 |
| | Change from Initial Weight | 72 Hours | 0.32% | 57.86% | 0.69% | 0.45% | 2.57% | 20.95% | -0.25% |
| | | 1 Week | 0.31% | 34.82% | 0.42% | -0.19% | 0.22% | 2.17% | 0.40% |
| 9483 | Initial Weight (grams) | | 0.75 | 0.76 | 0.78 | 0.78 | 0.78 | 0.78 | 0.80 |
| | Change from Initial Weight | 72 Hours | -0.90% | 7.47% | 0.00% | 0.00% | 0.44% | 18.73% | 0.42% |
| | | 1 Week | -1.33% | 4.84% | 0.00% | -0.44% | -0.43% | 3.00% | 0.42% |
| 984-LVUF | Initial Weight (grams) | | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 | 0.69 |
| | Change from Initial Weight | 72 Hours | 0.04% | 13.40% | -0.07% | 0.09% | 5.57% | 26.73% | 0.08% |
| | | 1 Week | -0.02% | 10.53% | -0.07% | -0.01% | 0.00% | 10.88% | 0.02% |
| 9481-E | Initial Weight (grams) | | 0.71 | 0.72 | 0.70 | 0.70 | 0.70 | 0.07 | 0.71 |
| | Change from Initial Weight | 72 Hours | 0.05% | 1.00% | -0.04% | 0.13% | 0.66% | 7.51% | 0.07% |
| | | 1 Week | 0.06% | 0.45% | 0.01% | 0.04% | 0.01% | 5.08% | -0.03% |
| 9482 | Initial Weight (grams) | | 0.72 | 0.71 | 0.71 | 0.72 | 0.72 | 0.71 | 0.72 |
| | Change from Initial Weight | 72 Hours | 0.02% | 5.15% | -0.05% | -0.01% | 0.73% | 15.62% | 0.49% |
| | | 1 Week | 0.02% | 3.74% | 0.01% | -0.07% | -0.03% | 5.35% | 0.07% |

.....



Board Preparation

Best Practices to Ensure Complete Coverage and Good Adhesion

Cleaning

It's important to note that conformal coatings protect the board from outside attack. They also seal contaminants present on the board surface at the time of coating. These residues remain between the coating and the board surface. Over time, some contaminants can react with small amounts of moisture and lead to localized delamination in the immediate area of the contaminant.

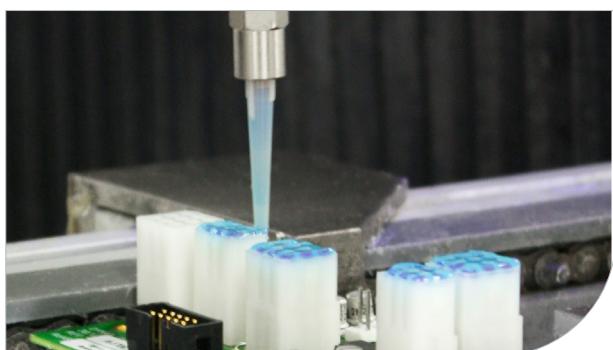
Cleaning boards prior to applying conformal coatings is always a best practice in order to eliminate contaminants and maximize wetting and adhesion. Solvent or aqueous washes are recommended. Cleaning solutions typically have recommended drying cycles, which ensure a dry assembly prior to conformal coating. Always handle boards with gloves to prevent oils from reaching the board surface. Should there be time between the drying and coating process, covering or sealing the boards in an ESD (electrostatic discharge) bag is recommended to ensure no further contamination occurs.



Masking

Masking prescribed areas of the board may be required to ensure conformal coatings do not flow into connectors, through-holes or other keep-out areas in the assembly.

Dymax light-cure conformal coatings are compatible with most common masking methods but UV light-cure masks are preferred as some alternative methods, such as silicone-based masks, can migrate into the prescribed coating area. Light-cure coatings will bond to UV masks, therefore UV-masking processes typically call for the mask to be applied and cured prior to the conformal coating application, and then be removed prior to curing the coating. The best edge definition is achieved when the mask is removed with tweezers or a similar tool.



SpeedMask® Masking Resins

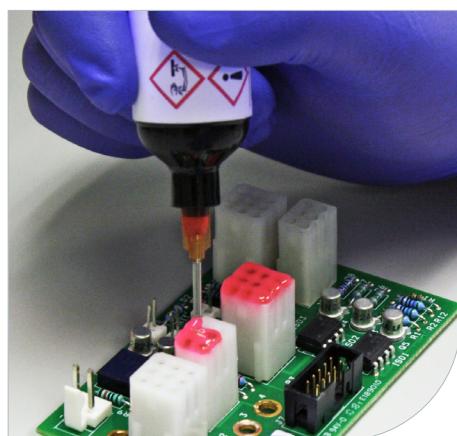
SpeedMask® peelable masks are designed for the masking of printed circuit board components prior to conformal coating application or wave solder and reflow processes. They cure in seconds “on-demand” when exposed to UV/Visible light. The fast cure allows boards to be immediately processed without the need for racking or waiting. The masks have low odor and require no special venting. The cured materials also leave no silicone, ionic contamination, or corrosive residues.

Dymax electronic masks can be used to protect many different PCB substrates including FR-4, ceramic, gold fingers or frames, connectors – surface mounted and raised as well as the many materials used in the manufacture of electronic components. The masks are available in a variety of packaging sizes for easy automated dispensing from standard pressure-fed dispensing equipment.

| Product | Description | Viscosity, cP | Durometer Hardness | Tensile at Break, MPa [psi] | Elongation at Break, % |
|-----------------|---|------------------|-----------------------|--------------------------------|---------------------------|
| 9-20479-B-REV-A | Blue in color for easy visual inspection; compatible with gold and copper connector pins; silicone free; halogen free; exceptionally thixotropic for manual or automated dispensing | 125,000 | A75 | 3.37 [490] | 140 |
| 9-318-F | Highly thixotropic for manual or automated dispensing; silicone free; very low VOCs; blue fluorescing | 50,000 | A55 | 3.0 [440] | 130 |
| 9-7001 | Visible pink color in uncured state; resistant to solvent-based conformal coatings and primers; compatible with gold and copper connector pins; lower shrinkage; silicone free | 40,000 | A70 | 3.8 [560] | 180 |

Key Attributes

- No added solvents
- UV/Visible light cure in seconds for faster processing
- Bright colors for high visibility
- Fluorescing grades for easy in-line inspection
- One part – no mixing
- Rapid cure speeds allow for flexibility in production volumes





Application - Selective Coating

The effectiveness of a conformal coating is dependent upon how well it is applied. Conformal coatings can be applied using simple hand-application equipment, but are most commonly applied using three- or four-axis robotic selective-spray systems. This method allows for sufficient coverage of all areas that require coating while avoiding those areas that must not be coated.

In designing and operating a selective-coating system, there are several key factors to consider. These include the pressure pot, fluid lines, application equipment/process, and the compatibility of the coating with all wetted surfaces. Most importantly, the accuracy of the spray pattern desired should be considered in choosing a spray system to avoid coating application in shadow areas.

Pressure Pot

One of the first steps in designing a selective-coating operation is to determine the appropriate coating package size and corresponding pressure pot. Most customers purchase Dymax conformal coatings in 1-liter bottles or 15-liter pails. In most cases, Dymax conformal coatings are stable in sealed pressure pots for extended periods of time (6 months or more).

Fluid Lines

Light-curable curable coatings can react in the presence of fluorescent overhead lighting. Black, opaque fluid lines will prevent curing in the fluid lines. Opaque polyethylene, polypropylene, or PTFE fluid lines are typically recommended to ensure material compatibility.

Application Process

Selective-spray methods include either atomized or non-atomized spray techniques. An atomized process utilizes air to produce a fine mist. A non-atomized process is air free and relies on a variety of spray pattern designs to produce a uniform film. The technology is ideal for lower viscosity formulations.

Selective-spray pattern widths can vary from 0.125" to over 2" and are highly dependent upon the height of the applicator from the work surface. A thickness of 0.002" or greater can be achieved in a single pass. Coating thickness is controlled by robot speed and a flow regulator on the spray valve.

Aside from the obvious quality and repeatability benefits, robotic application aims to eliminate manual masking operations. The success or failure of satisfying this objective lay not just with the applicator, but on the capability of the robot itself. It is critical to explore the necessary axes of motion required to meet your objectives. Two-, three-, and four-axis robots are available to access all necessary coating areas while avoiding keep-out areas. In areas where a spray valve alone either can't access an area or covers too much area, a separate needle dispensing valve (with optional tilt) can be incorporated into the selective-coating system.

Curing Your Coating

High-Intensity Light-Curing Systems

Success with light-curable conformal coatings is partly dependent on the curing system employed. In general, higher-intensity lamps yield faster, more efficient cures and better overall performance. There are two basic types of light sources that can be used for curing conformal coatings: mercury-arc lamps and electrodeless lamps.

Mercury-Arc Lamps

This type of light source typically provides 50-1,000 mW/cm² of UVA light at the curing surface and is appropriate for lower-volume applications where conveyor speeds of 1 to 5 feet per minute are acceptable. These systems have a lower capital cost, but bulb degradation must be monitored with a radiometer to ensure a controlled process.

Electrodeless Lamps

This type of light source generally provides 1,000 - 3,000 mW/cm² of UVA light at the curing surface and is recommended for medium-to high-volume applications. These systems cure faster for higher throughput. While capital costs are higher, total cost of ownership is lower due to longer bulb life, less maintenance, and better energy efficiency.

Establishing a Controlled Light-Curing Process

Maintaining a consistent curing process is important to the success of your coating process. To ensure consistency, follow these simple steps:

1. Establish the lower limit lamp intensity/energy needed for curing your part in your specified time frame. This step requires a radiometer.
2. If using mercury arc lamps, choose a lamp system and process settings such that a new bulb provides 3-4 times the energy required for your process. If using electrodeless lamps, choose process settings (exposure time or conveyor belt speed) such that a new bulb provides 2-3 times the energy required for your process.
3. Monitor lamp output with a radiometer and change the bulbs when they approach the established energy limit of your process.

For more information on establishing a controlled light-cure process, read our "Comprehensive Guide to Light-Curing Technology".

Compatibility of the Coating with Dispensing Equipment Materials

Dymax conformal coatings are readily dispensed through a wide variety of commercially available spray valves, pressure pots, and pail/drum ram pumps (for thicker coatings). When selecting a dispensing system, make sure that wetted equipment materials are compatible with Dymax products. Incompatible wetted components can be attacked by Dymax coatings or may cure prematurely.

Recommended Materials for Dispensing Equipment

| | |
|----------------------|--|
| Acetals | Nylon (pure) |
| Hard Chrome | Opaque PTFE |
| Opaque HDPE, HDPP | Stainless Steel (300 series, non-magnetic) |
| Opaque Silicone | |

Common Materials to Avoid in Dispensing Equipment

| | |
|------------|--|
| Aluminum | N-Butyl "O" Rings |
| Brass | Polycarbonate |
| Bronze | Polyurethane |
| Cast Iron | PVC |
| Copper | Stainless Steel (400 series, magnetic) |
| Mild Steel | Zinc |

Secondary Curing for Shadow Areas

Where significant deposition of light-curing conformal coating occurs in shadow areas, a secondary curing mechanism can be used to ensure complete cure in those areas. Dymax has developed conformal coatings that are formulated with secondary heat or moisture cure capabilities.

Multi-Cure® Light/Heat Cure

Dymax Multi-Cure® conformal coatings are formulated with a secondary heat-cure mechanism. Light-curing must be done prior to heat curing. A heat cure schedule of 110°C for 1 hour or 120°C for 30 minutes is typical. Heat cure times will vary due to part configuration, volume of coating applied, and oven efficiency. For this reason, it is important that the proper testing is done to determine and qualify the appropriate curing parameters required for each unique application.

Dual-Cure Light/Moisture Cure

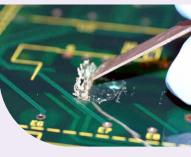
Dymax Dual-Cure conformal coatings contain a secondary moisture-cure mechanism. While moisture cure time is typically 2-3 days at 25°C [77°F], 50% RH, actual moisture cure time is application specific and may vary. Cure time depends on humidity level, amount of coating in shadowed areas, and proximity 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.

Coating Rework and Removal

The purpose of conformal coatings is to protect PCBs and components from environmental attack or stress. They function by adhering tenaciously to PCB/solder/component surfaces through environmental stresses such as humidity and water exposure, chemical and particulate exposure, and heat and cold. The same properties that make a conformal coating a good protective coating make its removal more difficult.

In general, solvent-based, non-cross-linked varnish-like coatings (not supplied by Dymax) will be relatively easy to remove with solvents. Other chemistries with relatively low adhesion to electronic surfaces, particularly silicones, can be removed mechanically. Dymax UV conformal coatings are cross-linked coatings that are designed to form strong bonds to electronic surfaces. Therefore, somewhat more aggressive removal options are required for rework compared to solvent-based systems and silicones.

| Rework Process | | Steps |
|----------------|---|---|
| Solder Through |  | <p>Position the soldering iron over the solder joint</p> <p>Press the iron lightly onto the solder joint until the coating is penetrated</p> <p>Move the iron to slice through the rest of the coating on the joint and around the component</p> <p>Lift the component off</p> <p>Gently sever the coating around the perimeter of the empty area, making room for the new component</p> <p>Wash the area with IPA or other solvent</p> |
| Heat |  | <p>Position the heat gun over the component and heat the coating to 150°C [300°F]</p> <p>Gently scrape the coating with a spatula as it softens</p> <p>Blow off parts with dry air to remove scraped coating</p> |
| Abrasive Media |  | <p>Blast abrasive media at solder joints with conformal coating added</p> <p>Blow off parts with dry air to remove any remaining media</p> <p>Recommended Product: Crystal Mark Swam Blaster</p> |
| Solvent | | <p>Dip board in solvent</p> <p>Remove the board once the coating has dissolved</p> <p>Recommended Products: Dynasolve or Uresolve Plus SG, Kutzit or Strypeeze</p> |



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