Low-Shrink™ OP-81-LS

Low-Shrinkage Optical Positioning Epoxy with LED and Heat-Cure Capability

APPLICATIONS

- Optical Positioning
- Lens and Prism Alignment
- Fiber Positioning

FEATURES

- UV/Visible Light Cure
- 80-85°C Heat-Cure Capability
- Low Shrinkage and Low CTE
- Meets ASTM E595 Outgassing Requirements
- One Component, No Mixing Required
- Cold Ship/Cold Storage at 1-5°C

RECOMMENDED SURFACES

- Polycarbonate
- Glass
- Acrylic
- Metallic Surfaces

Dymax Low-Shrink™ OP-81-LS is a UV/Visible light-curable epoxy featuring very low volumetric shrinkage during cure and low CTE for stability through thermal excursions making it ideal for rapid positioning of optical components. OP-81-LS is especially formulated to cure primarily with UV light and includes a low-temperature heat-curing function in applications where shadow areas exist or where heat cure only is preferred. Dymax 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 camera module assembly. Dymax lamps offer the ideal balance of UV and visible light for the fastest, deepest cures. This product requires cold store and cold shipping and should be kept between 1°C [34°F] and 5°C [41°F] in the original, unopened container. This product is in full compliance with RoHS directives 2015/863/EU.

UNCURED PROPERTIES *

Property	Value	Test Method
Solvent Content	No Nonreactive Solvents	N/A
Chemical Class	Epoxy	N/A
Appearance	Off White Opaque Gel	N/A
Soluble in	Organic Solvents	N/A
Density, g/ml	1.6	ASTM D1875
Viscosity, cP (20 rpm)	60,000 (nominal)	DSTM 502‡
Shelf Life @ 1°C to 5°C from Date of Manufacture	7 months	N/A

CURED MECHANICAL PROPERTIES *

Property	Value	Test Method
Durometer Hardness	D90	ASTM D2240
Tensile at Break, MPa [psi]	45 [6,600]	ASTM D638
Elongation at Break, %	2	ASTM D638
Modulus of Elasticity, MPa [psi]	1,600 [230,600]	ASTM D638

OTHER CURED PROPERTIES *

Property	Value	Test Method
Boiling Water Absorption, % (2 h)	0.9	ASTM D570
Water Absorption, % (25°C, 24 h)	0.1	ASTM D570
Volumetric Shrinkage, %	1.5	DSTM 6114‡
Glass Transition Tg, °C	153	ASTM D5418
CTEα1, µm/m/°C	17	ASTM E831
CTEα2, µm/m/°C	80	ASTM E831

ADHESION

Substrate	Recommendation
Aluminum	✓
CAP (cellulose acetate propionate)	✓
FR-4 Board	✓
Glass	✓
LCP (liquid-crystal polymer)	✓
PA (polyamide)	✓
PC (polycarbonate)	✓
PETG (polyethylene terephthalate glycol)	✓
PMMA (polymethyl methacrylate)	✓
PPS (polyphenylene sulfide)	✓
PS (polystyrene)	✓
SAN (styrene-acrylonitrile)	✓
Stainless Steel	✓

✓ Recommended o Limited Applications

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

* Not Specifications

N/A Not Applicable

‡ DSTM Refers to Dymax Standard Test Method

Technical Data Collected 9/2018 Rev. 01/14/2021

CURING GUIDELINES

Fixture time is defined as the time to develop a shear strength of 0.1 N/mm^2 [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 [A]
5000-EC (200 mW/cm^2)[B]	1 s
BlueWave® 200 (10 W/cm^2)[B]	0.4 s
BlueWave® LED Flood RediCure® 365 nm (450 mW/cm^2)[C]	0.4 s
BlueWave® LED Flood PrimeCure® 385 nm (850 mW/cm^2)[C]	0.2 s
BlueWave® LED Flood VisiCure® 405 nm (950 mW/cm^2)[C]	0.4 s
UVCS Conveyor with 5000-EC (200 mW/cm^2)[D]	7 m/min [25 ft/min]
UVCS Conveyor with Fusion F300S (2.5 W/cm^2)[D]	8 m/min [27 ft/min]

A Fixture times/belt speeds are typical for curing thin films through 100% UV and light-transmitting substrates. Light-obstructing substrates may require longer cure times.
B Intensity was measured over the UVA range (320-395 nm) using a Dymax ACCU-CAL™ 50 Radiometer.
C Intensity was measured over the UVA/Visible range (350-450 nm) using a Dymax ACCU-CAL™ 50-LED Radiometer.
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™ 160 Radiometer.

HEAT CURE

Heat can be used as the sole cure mechanism **or** in conjunction with light curing. The following heat-cure schedule may be used*

80°C [176°F] 30-35 minutes
85°C [185°F] 20-25 minutes

*Note: Actual heat-cure time may vary due to part configuration, volume of adhesive applied, and oven efficiency.

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 adhesives.

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 ultimately must 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. 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 bond surfaces should be clean and free from grease, mold release, or other contaminants prior to dispensing the adhesive.
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. High humidity environments or basic materials may inhibit cure.
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 adhesive 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.

DISPENSING SUPPORT

Material should be allowed to reach room temperature prior to use. This may take approximately 20-60 minutes depending on the package size being used. Due to the filler in this material, 25-gauge (ID 0.25 mm or 0.010") is the smallest recommended tip size in order to eliminate potential clogging issues.

The Dymax Application Engineering team is ready to discuss your application requirements to provide the most appropriate dispensing and/or spraying solution. Visit our current dispensing equipment portfolio here 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 covered material in a cool, dark place when not in use. This product may polymerize upon prolonged exposure to ambient and artificial light as well as ambient temperatures. This material shelf life noted on page 1 of this document, when stored between 1°C (34°F) and 5°C (41°F) in the original, unopened container.

The pot life is 7 days at 25°C. In a production setting, once material is removed from 1-5°C storage, it should be used in its entirety or be disposed of within 7 days.

CLEAN UP

Uncured material may be removed from dispensing components and parts with organic solvents. Cured material will be impervious to many solvents and difficult to remove. Cleanup of cured material may require mechanical methods such as ultrasonic bath, water jet, vacuum tweezers, air knife, and/or warming to aid in the removal.

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.

The data provided in this document are based on historical testing that Dymax performed under laboratory conditions as they existed at that time and are for informational purposes only. The data are neither specifications nor guarantees of future performance in a particular application. Dymax does not guarantee that this product's properties are suitable for the user's intended purpose.

Numerous factors—including, without limitation, transport, storage, processing, the material with which the product is used, and the ultimate function or purpose for which the product was obtained—may affect the product's performance and/or may cause the product's actual behavior to deviate from its behavior in the laboratory. None of these factors are within Dymax's control. Conclusions about the behavior of the product under the user's particular conditions, and the product's suitability for a specific purpose, cannot be drawn from the information contained in this document.

It is the user's responsibility to determine (i) whether a product is suitable for the user's particular purpose or application and (ii) whether it is compatible with the user's intended manufacturing process, equipment, and methods. Under no circumstances will Dymax be liable for determining such suitability or compatibility. Before the user sells any item that incorporates Dymax's product, the user shall adequately and repetitively test the item in accordance with the user's procedures and protocols. Unless specifically agreed to in writing, Dymax will have no involvement in, and shall under no circumstances be liable for, such testing.

Dymax makes no warranties, whether express or implied, concerning the merchantability of this product or its fitness for a particular purpose. Nothing in this document should be interpreted as a warranty of any kind. Under no circumstances will Dymax be liable for any injury, loss, expense or incidental or consequential damage of any kind allegedly arising in connection with the user's handling, processing, or use of the product. It is the user's responsibility to adopt appropriate precautions and safeguards to protect persons and property from any risk arising from such handling, processing, or use.

The specific conditions of sale for this product are set forth in Dymax's General Terms & Conditions of Sale. Nothing contained herein shall act as a representation that the product use or application is free from patents owned by Dymax or any others. Nothing contained herein shall act as a grant of license under any Dymax Corporation Patent.

Except as otherwise noted, all trademarks used herein are trademarks of Dymax. The "®" symbol denotes a trademark that is registered in the U.S. Patent and Trademark Office.

The contents of this document are subject to change. Unless specifically agreed to in writing, Dymax shall have no obligation to notify the user about any change to its content.

CONTACT DYMAX

www.dymax.com

Americas
USA | +1.860.482.1010 | info@dymax.com

Europe
Germany | +49 611.962.7900 | info_de@dymax.com
Ireland | +353 21.237.3016 | info_ie@dymax.com

Asia
Singapore | +65.67522887 | info_ap@dymax.com
Shanghai | +86.21.37285759 | dymaxasia@dymax.com
Shenzhen | +86.755.83485759 | dymaxasia@dymax.com
Hong Kong | +852.2460.7038 | dymaxasia@dymax.com
Korea | +82.31.608.3434 | info_kr@dymax.com