

Technical Data Sheet

EPIKURE™ Curing Agent P-101

Product Description

EPIKURE Curing Agent P-101 is a versatile, chemically stable, low bake or ultra-rapid curing epoxy powder coating converter. This product is a free flowing pulverized amine adduct especially designed to cure epoxy resin powder coatings at temperatures down to 250 °F (121 °C). This allows the use of energy saving baking schedules and application to temperature sensitive substrates. EPIKURE Curing Agent P-101 is compatible with epoxy resins when extruded or hot melt mixed in the normal fashion. This results in a truly homogeneous blend of epoxy resin and Curing Agent that provides a cured film with superior appearance and performance. Because of these features, EPIKURE Curing Agent P-101 is a marked improvement over accelerated dicyandiamide type curing agents which are widely used in thin film decorative or functional epoxy powder coatings.

EPIKURE Curing Agent P-101 either can be incorporated as a curing agent with EPON™ resins 2002, 2004, or 2024 at levels of 2-4 phr1 or it can be blended with dicyandiamide to function as an accelerator. This provides the powder coating chemist with significant latitude in meeting specific formulating requirements.

Application Methods

The typical application methods for EPON Resins 2002, 2004, and 2024 with EPIKURE Curing Agent P-101 in powder coatings include electrostatic spray, fluidized bed, electrostatic fluidized bed, and flocking.

Sales Specifications

Property	Value	Unit	Test Method
Amine Value	110 - 130	mg/g	ASTMD2896

Typical Properties

Property	Value	Unit
Alkalinity	3.5 - 3.8	meg/gm
Appearance	Free Flowing Tan Powder	
Melt Viscosity ¹ at 150°C	10 - 30	poise
Specific Gravity ² at 25°C	1.16	

¹ICI Cone and Plate Viscometer.

²Powder Coating Institute-Recommended Procedure #4.

Film Properties

Our laboratories have evaluated EPIKURE Curing Agent P-101 in both clear and pigmented powder coating formulations. The following parameters were studied:

- Effect of Curing Agent Level; and,
- Effect of Cure Time and Temperature.

Several trends were noted and will be discussed in the following section; however, each formulator is encouraged to fully optimize his own formulation.

Performance Properties

EPIKURE Curing Agent P-101
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Figure 1 / Low Temperature Curing Study (White pigmented EPON Resin 2002/EPIKURE Curing Agent P-101, 100/3 phr)

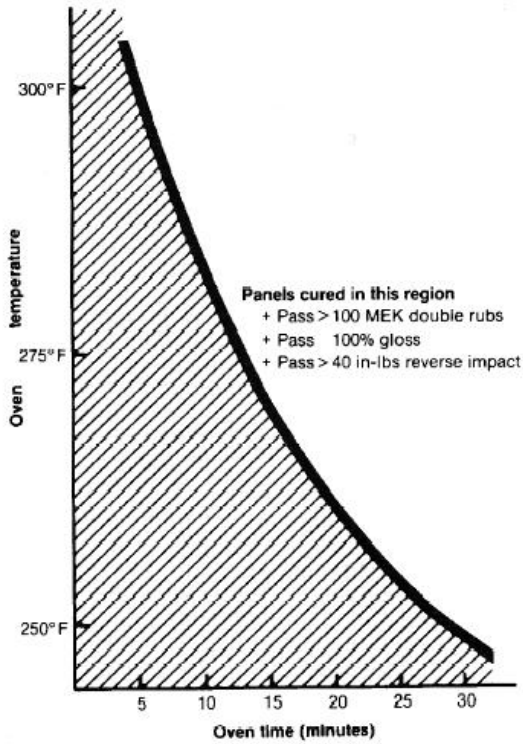
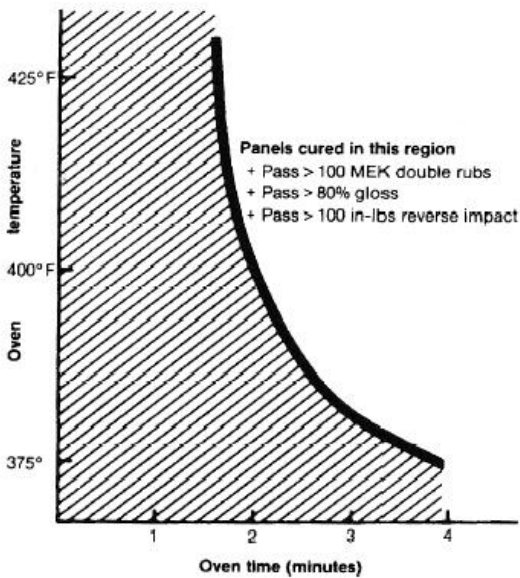


Figure 2 / High Temperature Curing Study (White pigmented EPON Resin 2004/EPIKURE Curing Agent P-101, 100/3 phr)



Formulating with EPON Resins

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The choice of epoxy resin has a significant influence on the flow properties and the appearance of the powder coating, especially for coatings cured below 300 °F (149 °C). The low melt viscosity, compatibility and high reactivity of EPIKURE Curing Agent P-101 provides optimum appearance and high performance properties in thin film decorative/ functional coatings. For applications requiring ultra high flow characteristics, product can be selected from the lower viscosity range of the EPON Resin 2002 sales specification. It is suggested you contact your Hexion Sales Representative for assistance in product selection.

For high temperature rapid curing powder systems, e.g., 2 minutes at 400 °F (204 °C), we suggest you consider the higher melting EPON Resins 2004 or 2024. The primary difference between these two products is the latter contains 0.5%w Modaflow.

EPIKURE Curing Agent P-101 can be used as the sole Curing Agent with epoxy resin or in combination with dicyandiamide. The incorporation of dicyandiamide has been found to be effective in adjusting cure rate, reducing discoloration and improving package stability.

Low Temperature Curing Study

Figure 1 displays a summary of a study where the following formulation was applied electrostatically onto CRS Q-panels at 2.0 +/- 0.1 mils and was cured over a temperature range of 250 °F to, 300 °F and at an oven time of 5 to 30 minutes. The films were tested for MEK resistance, gloss, and reverse impact.

Formulation	Parts by Weight
EPON Resin 2002 ¹	92.8
EPIKURE Resin 2002-FC ² -10	10
EPIKURE Curing Agent P-101	3
TiO ₂ (DuPont, R-900)	50
Cab-O-Sil, M-5 (Cabot)	1
	154.8

¹This resin had an epoxide equivalent of 675-725 and a kinematic viscosity of 10-15 cP at 40% wt in MEK.

²A master batch containing 90%w EPON Resin 2002 and 10%w ModaflowTM (Solutia Inc.)

Powder Manufacture

- All ingredients preblended in Welex, one minute at 1000 rpm plus one minute at 2400 rpm.
- Extruded through Buss-Kneader Type PLK-46.
 - Screw Temperature: 25 °C
 - Barrel Temperature: 65 °C
 - Speed: 72 rpm
- The resulting product was chilled-rolled, cooled, crushed, and Wiley milled.

Powder Manufacturing Instructions

EPIKURE Curing Agent P-101 is a low melting solid powder that is easily solubilized in the epoxy resin during the melt-mix processing step. EPIKURE Curing Agent P-101 is supplied as a 200 mesh powder for ease of preblending with the other components in the powder formulation. The homogeneous blend is then melt-mixed in a single or twin-screw extruder and pulverized to a suitable particle size.

EPIKURE Curing Agent P-101 is quite hygroscopic and care should be exercised to minimize its exposure to atmospheric moisture during storage and the manufacturing operation.

Test Description/Conditions

- A high efficiency forced draft electric oven was used to cure all panels. The time indicated in Figure 1 reflects the time the panels were actually in the oven. This becomes very important in Figure 2 when oven residence times are less than that needed to bring actual substrate temperature up to the indicated level. It should be noted that heat-up rates vary from oven to oven and variations in cured properties should be expected.
- Reverse impact data was developed on a Gardner Impact Tester at ambient temperature according to ASTM D-2794. Any surface defect observable with a 10X scope was considered a failure.
- Methyl ethyl ketone (MEK) resistance data was developed by rubbing a cotton ball, moistened with MEK, over a portion of a cured film in a back and forth manner until there was a film failure. A film resisting more than 100 back and forth rubs was reported as greater than 100 MEK double rubs.

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Effect of Curing Agent Level

Fully cured pigmented systems, as evidenced by greater than 100 MEK double rubs solvent resistance, are attainable with 2, 3, or 4 phr EPIKURE Curing Agent P-101 cured 15 or more minutes at 250 °F or greater temperature. Reverse impact was found to improve with increasing amounts of EPIKURE Curing Agent P-101. For example, films (1.5-2.0 mils) cured 30 minutes at 250 °F incorporating 4 phr EPIKURE Curing Agent P-101 passed 100 inch-pounds reverse impact. It should be pointed out, however, that clear formulations easily pass 160 inch-pounds reverse impact with 2 phr EPIKURE Curing Agent P-101 at a very attractive cure cycle of 15 minutes at 250 °F. Our assessment of EPIKURE Curing Agent P-101 indicates it provides essentially no cure response at 1 phr.

Yellowing characteristics of EPIKURE Curing Agent P-101 do not appear to present a problem when cured at 250 °F. However, panels cured at higher temperatures, longer cure times or increasing levels of Curing Agent all contribute to yellowing. If yellowing is a problem, we suggest you substitute EPIKURE Curing Agent P-108. This Curing Agent lessens the yellowing tendency dramatically with some sacrifice in cure response.

High Temperature Curing Study

Figure 2 displays a summary of a study where the following formulation was applied electrostatically onto CRS Q-panels at 2.0 +/- 0.1 mils and was cured over a temperature range of 375 °F to 425 °F at an oven time of 1 to 4 minutes. As before, the films were tested for MEK resistance, gloss, and reverse impact.

Formulation	Parts by Weight
EPON Resin 2004	92.8
EPON Resin 2002-FC ¹ -10	8
EPIKURE Curing Agent P-101	3
TiO ₂ (DuPont, R-900)	50
Cab-O-Sil, M-5 (Cabot)	1
	154.8

¹A master batch containing 90%w EPON Resin 2002 and 10%w Modaflow™ (Solutia Inc.)

Results

The results of this study, as summarized in Figure 1, indicates that a white pigmented system based on EPON Resin 2002/EPIKURE Curing Agent P-101, 100/3 phr will provide satisfactory cure in a time/temperature range of 5 minutes at 300 °F down to 30 minutes at 250 °F.

Safety, Storage & Handling

Please refer to the MSDS for the most current Safety and Handling information.

Please refer to the Hexion web site for Shelf Life and recommended Storage information.

Exposure to these materials should be minimized and avoided, if feasible, through the observance of proper precautions, use of appropriate engineering controls and proper personal protective clothing and equipment, and adherence to proper handling procedures. None of these materials should be used, stored, or transported until the handling precautions and recommendations as stated in the Material Safety Data Sheet (MSDS) for these and all other products being used are understood by all persons who will work with them. Questions and requests for information on Hexion Inc. ("Hexion") products should be directed to your Hexion sales representative, or the nearest Hexion sales office. Information and MSDSs on non-Hexion products should be obtained from the respective manufacturer.

Packaging

Available in bulk and drum quantities.

Contact Information

For product prices, availability, or order placement, please contact customer service:

www.hexion.com/Contacts/

For literature and technical assistance, visit our website at www.hexion.com

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