

LEEPOXY PLASTICS, INC.

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LEECURE B HARDENERS

Description

Leepoxy's LEECURE B series of hardeners are a family of boron trifluoride based epoxy curing agents providing a broad range of curing speeds. They can be used with commercially available epoxy resins to provide water, heat and chemical resistant products with exceptional physical strengths and electrical properties. They are used in electronic potting compounds, electrical varnishes, adhesives, filament winding, fiberglass and plastic reinforced composites and pre-preg compounds for casting. All Leecure B hardeners are liquids, making their incorporation into epoxy resins a simple matter. They contain no solvents and therefore add no volatiles to a system. They are less likely to cause toxicological or dermatological problems than many other epoxy hardeners.

Formulation

LEECURE B hardeners are compatible with Bisphenol A, Bisphenol F, flexible, novolac, and other multifunctional epoxy resins. The cure mechanism of these resins is catalytic, and an etherification reaction predominates. Novolac and cycloaliphatic epoxy resins are more reactive than Bisphenol A based resins, while most flexibilized resins are less reactive.

Judicious choice of additives, modifiers, and diluents should be made in formulating epoxy compounds with LEECURE B hardeners, since additives may have a marked effect on the cure rate and final properties of the cured system. Always use dry materials and avoid additives that are alkaline in nature. Fillers such as silica, barytes, glass, and clays that have a pH of 7 or lower are preferred and should be dried for several hours at 125 – 150°C before use. The addition of diluents, fillers, and flexibilizers will generally increase pot life.

Handling

LEECURE B hardeners are not hygroscopic as crystallized forms of BF₃-based curing agents like BF₃-MEA tend to be. Nonetheless, prolonged exposure to high humidity prior to cure – or contact with other ingredients in the epoxy system that have been moisture contaminated – may adversely affect reactivity as well as the physical properties and surface cosmetics of the cured system. Therefore, keep all LEECURE B hardener containers tightly sealed at all times. Avoid partial containers where possible and use dry nitrogen to blanket containers not likely to be completely emptied in a few weeks. Surfaces to be bonded, potted, coated or impregnated should be dry.

Pot Life and Cure Speed

The range of the reactivity of these catalysts, including LEECURE blends allows, fine tuning the product to a specific application. In general, when compared with other curing agents, BF₃ curatives provide the longest pot life for a specific cure speed. Hardeners in addition of those listed on Table I can be prepared as special products to provide a tailored reactivity.

The cure rates of LEECURE B hardeners are both mass and temperature dependent. Furthermore, they generate heat upon curing. Too much heat may result in micro-cracking and/or unacceptable out-gassing. It is important, therefore, to control the more reactive hardeners (B-610, B-612, B-614) by either mixing smaller quantities or using automatic mixing/dispensing equipment.

All but the most reactive LEECURE B curatives require added heat in order to achieve an acceptable cure and optimal physical properties. Even Leecure B-614 when applied in smaller mass requires a threshold cure temperature of 65°C. Leecure B-1310 and B-110 will require a minimum cure temperature regardless of mass. Leecure B-950 requires a minimum temperature of 80°C; B-550 needs 110 °C; and B-1550 requires 120 °C.

Only one of many possible time/temperature combinations for the pot life and curing speed of the LEECURE B hardeners is listed in Table I. Cure temperature refers to bondline temperature.

The effect of any heat sink that might exist and the size of the mixed and applied epoxy mass are variables that must be accounted for in estimating any specific cure schedule for a particular application.

Cure Temperature vs. Performance Properties

When fully cured all LEECURE B hardeners provide nearly identical properties. As illustrated in Table I, the physical and electrical properties for the systems listed are very similar at room temperature. The heat deflection temperatures for systems using reactive LEECURE B curatives (B-610, B-612, B-614) can be increased through use of a post cure. Post cure is often effectively realized by temperatures generated in use or operation.

Safety

The toxicological properties of the LEECURE B hardeners have not been thoroughly investigated. Care should be exercised in their use to avoid unnecessary exposure. In addition, some individuals may be sensitive to contact dermatitis that can be contracted from contact with epoxy resins. If skin contact occurs, wash with soap and water. If eye contact occurs, flush with copious quantities of water for at least 15 minutes and consult a physician. Use good ventilation and exhaust curing ovens. Refer to the Material Safety Data Sheet (MSDS) for any specific product for more detailed safety information.

TABLE I								
TYPICAL PROPERTIES OF LEECURE B HARDENERS								
	B-610	B-612	B-614	B-1310	B-110	B-950	B-550	B-1550
Appearance	Blue-Brown	Blue-Brown	Brown	Brown	Brown	Brown	Brown	Amber
Viscosity @ 25°C, cps	15,000	17,000	19,000	15,000	14,000	22,000	28,000	14,000
Density, lbs/gal	9.2	9.3	9.5	9.4	9.3	10.0	10.6	9.9
The following typical properties are obtained in conjunction with Bisphenol A Epoxy Resin (EEW=189)								
Mix Ratio, phr	8 –12	8 –12	8 –12	8 –12	8 –12	4 –6	4 –6	4 –6
Suggested Cure Time 3/16 inch bead, time/bondline temp	3 min/ 25°C	6 min/ 25°C	2 min/ 65°C	5 min/ 65°C	10 min/ 100°C	1 hour/ 100°C	1 hour/ 135°C	1 hour/ 150°C
Pot Life @ 25°C, 11g	20 sec	75 sec	13 min	20 min	5 hours	----	----	----
Pot Life @ 25°C, 100g	----	----	----	----	----	8 hours	2.5 mo	4 mo
Typical cured properties according to suggested cure cycle								
Tensile Strength, psi	1,000	1,000	2,000	4,000	10,600	9,000	11,900	9,250
Tensile Modulus, psi	----	----	480,000	480,000	480,000	480,000	450,000	350,000
Tensile Elongation, %	----	----	4.0	4.0	4.0	4.1	4.3	3.4
Heat Deflection Temperature, °C	70	75	78	78	86	91	123	130
Dielectric Constant, 1 MHz @ 25°C	----	----	3.9	3.9	3.9	3.8	3.9	3.9
Dissipation Factor, 1 MHz @ 25°C	----	----	0.018	0.018	0.018	0.014	0.018	0.024
Volume Resistivity @ 25°C, ohm-cm	----	----	10 ¹⁵	10 ¹⁵	10 ¹⁵	10 ¹⁴	10 ¹⁵	10 ¹⁵
Volume Resistivity @ 130°C, ohm-cm	----	----	10 ¹⁰	10 ¹⁰	10 ¹⁰	10 ⁹	10 ¹⁴	10 ¹¹
HDT's increase with an elevated temperature post-cure. Post cure can be realized by temperatures generated in use or operation								