HEXION™
Specialty Chemicals

Technical Data Sheet

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HELOXY™ Modifier 116

Product Description
HELOXY 116 Modifier is a commercial grade of 2-ethylhexyl glycidyl ether. A low viscosity, almost colorless monoepoxide, its primary use is the viscosity reducing modification of epoxy resin formulations.

Benefits

- Efficient viscosity reduction of conventional epoxy resins
- Excellent substrate and filler wetting characteristics
- Low volatility relative to other members of monoepoxide class

Sales Specification

Property	Units	Value	Test Method/Standard
Weight per Epoxide	g/eq	215-225	ASTM D1652
Viscosity at 25°C	cP	2-4	ASTM D445
Color	Gardner	1	ASTM D1544
Epichlorohydrin	mg/kg	10	SMS 2445

Typical Properties

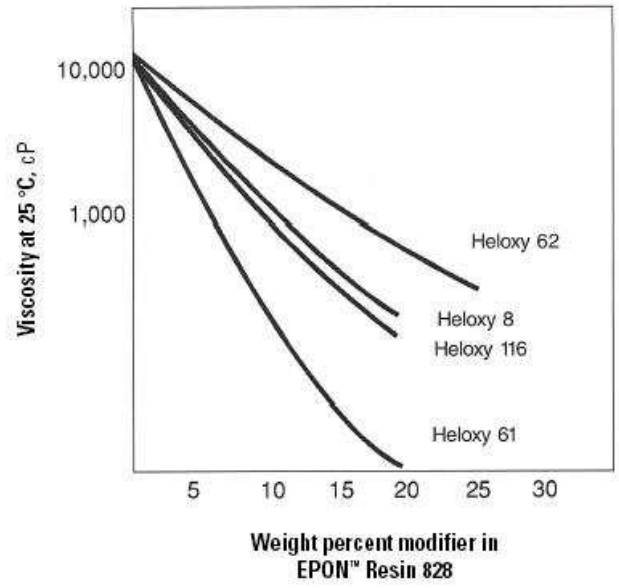
Property	Units	Value	Test Method/Standard
Density	lbs/gal	7.49-7.66	ASTM D1475

General Information
A comparison of the viscosity reduction efficiency of HELOXY Modifier 116 with other HELOXY epoxy functional modifiers is illustrated in Figure 1. Since the quantity of diluent modification required in an epoxy system is normally dictated by its viscosity reducing efficiency, a comparison of monoepoxide diluted epoxy systems of equal viscosity has shown that HELOXY Modifier 116 ranks just below butyl glycidyl ether (HELOXY Modifier 61) in retaining physical strength and thermal performance of the unmodified system.

HELOXY Modifier 116 possesses an odor quite different from that of other aliphatic monoepoxides, and systems modified with this diluent might be less objectionable in this regard to certain individuals.

Since the degree to which performance properties are affected depends on the amount of HELOXY Modifier 116 in the formulation, the amount used in the formulation should be limited to that necessary to yield the required viscosity reduction. The maximum recommended quantity of HELOXY Modifier 116 is about 20 percent of the resin portion.

Figure 1 / **Viscosity dilution effectiveness of HELOXY Modifiers**



Properties of Cured Systems

Curing agents that are recommended for unmodified basic liquid epoxy resins can also be used with compositions containing HELOXY Modifier 116. When calculating the proper stoichiometric amount of curing agent to be used with HELOXY Modifier 116 modified resins, differences in epoxy content of the resin resulting from this modification are small and can generally be ignored at modification levels below 10 parts per hundred resin (phr).

HELOXY Modifier 116 is compatible with epoxy resins in all proportions and is easily blended with liquid resins at room temperature. These blends can be cured with any of the commonly used epoxy resin curing agents. Since HELOXY Modifier 116 is a monoepoxide compound, it reduces the functionality of the system and impairs the chemical and solvent resistance of the cured resin.

Unless excessive amounts of HELOXY Modifier 116 are used, the physical properties of the cured systems are not seriously affected at room temperature. However, physical and electrical properties at elevated temperatures might be reduced considerably. Data listed in Table 1 illustrate the effect of HELOXY Modifier 116 on systems cured with various curing agents including conventional polyamines, anhydrides, and EPIKURE™ Curing Agent 3072.

Performance Properties

Table 1 / **Typical Properties of epoxy resin systems containing HELOXY Modifier 116**

	Method	Units	A	B	C	D	E	F
Composition								
EPON Resin 828		pbw	100	87	82	87	82	82
HELOXY Modifier 116		pbw	–	13	18	13	18	18
Triethylenetetramine		pbw	13	12	12	–	–	–
EPIKURE Curing Agent 3072		pbw	–	–	–	34	34	–
Hexahydrophthalic anhydride		pbw	–	–	–	–	–	77
Diethylaminoethanol		pbw	–	–	–	–	–	0.5
Handling Properties at 25°C								
Viscosity, Resin Portion		cP	11,000	1,100	600	1,100	600	600
Gel time, 100g @ 23 °C		min.	28	46	53	70	85	–
¼ in. thick, @ 93 °C		min.	–	–	–	–	–	80
Peak Exotherm, 100g @ 23 °C		°C	223	209	199	159	130	–
Cured State Properties [1]								
Heat Deflection Temperature	ASTM D648	°C	106	76	69	66	59	90
Tensile strength, Ultimate	ASTM D638	psi	12,300	10,300	9,000	8,400	6,800	10,000
Tensile elongation at Break		%	4.9	5.9	8.5	77	2.2	2.8
Tensile Modulus, Initial		ksi	470	490	470	390	320	470
Flexural Strength, Ultimate	ASTM D790	psi	19,500	17,000	14,400	12,600	10,400	19,500
Flexural Modulus, Initial		ksi	480	470	420	360	310	450
Compressive Strength, Ultimate	ASTM D695	psi	42,000	33,800	34,800	21,300	23,500	31,000
Compressive Yield Strength		psi	16,200	13,100	11,500	11,100	9,200	15,500
Izod Impact – notch	ASTM D256	ft.•lb./in.	0.45	0.50	0.57	0.44	0.47	0.48

Weight Loss, 24 hrs. @ 150 °C		%	0.24	0.65	1.09	0.90	1.41	0.24
Percent Absorbtion [2]								
Water		%						
24 hrs.			0.16	018	018	0.20	0.26	0.10
1 week			0.38	0.45	0.50	0.57	0.73	0.25
5% Acetic Acid		%						
24 hrs.			0.21	0.49	0.69	0.79	1.07	0.10
1 week			0.58	1.29	1.90	2.25	2.78	0.25
Solvent [3]		%						
24 hrs.			0.02	0.08	0.49	4.58	795	0.18
1 week			0.05	0.42	2.55	Sample Erosion		0.75
Dielectric Constant [4]	ASTM D150		3.91	3.78	3.75	3.66	3.62	3.31
Dissipation Factor [4]			0.031	0.026	0.025	0.016	0.019	0.012
Volume Resistivity		ohm•cm						
at 25 °C			2.3 (10^{15})	–	2.4 (10^{15})	2.1 (10^{15})	4.0 (10^{15})	>10^{16}
at 66 °C			6.1 (10^{13})	–	1.1 (10^{13})	2.8 (10^{12})	2.5 (10^{12})	4.3 (10^{15})
at 93 °C			2.4 (10^{12})	–	3.2 (10^{11})	1.4 (10^{10})	6.4 (10^{10})	2.4 (10^{15})
at 130 °C			3.6(10^{9})	–	< 10^{9}	< 10^{9}	<10^{9}	1.8 (10^{14})

[1] Determined on 0.125 inch thick specimens at 23 °C. System A, System B and System C cured 16 hours at 25 °C, plus 2 hours at 100 °C. System D and System E cured 14 days at 25 °C. System F cured 2 hours at 98 °C, plus 2 hours at 200 °C.

[2] Weight gain of 3 in. x 1 in. x 0.125 in. (specimens totally immersed in reagent at 25 °C).

[3] 50:50 by weight mix of isopropanol and xylene.

[4] Determined at 106 hertz.

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.

HELOXY Modifier 116 should be stored in tightly sealed containers, in a dry location at room temperature. Some epoxy materials can crystallize during storage. The tendency to do so is affected by storage conditions, composition and other factors. Should crystallization occur, it may be converted to liquid by

opening the drum bung and gently warming to temperatures not to exceed 50 °C (122 °F).

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 Specialty Chemicals, 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.

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