

Advanced Materials**Araldite[®] EPN 1179 /
Araldite[®] EPN[®] 1180**

EPOXY PHENOL NOVOLAC RESINS

Description

Araldite[®] EPN 1179 and Araldite[®] EPN 1180 epoxy phenol novolac resins contain more than two epoxy groups per molecule and can be described as multifunctional epoxy resins. Due to the increased epoxy functionality, EPN resins provide a high cross-link density when properly cured. Systems based on Araldite[®] EPN 1179 epoxy phenol novolac resins or Araldite[®] EPN 1180 epoxy phenol novolac resins possess better chemical and high temperature resistance than those based on standard bisphenol A epoxy resins.

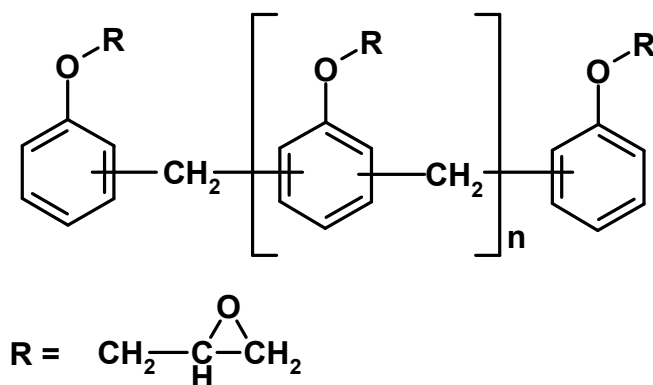
EPN resins are recommended for high-performance applications requiring good chemical and solvent resistance. When combined with suitable curing agents (i.e. polyamines, novolacs and anhydrides), they can be used as the sole resins, or in blends with bisphenol A and F epoxy resins, to upgrade the performance of the latter.

EPN resins can be used in two-component, room-temperature cure, forced-cure or heat-cure systems. Solvent-containing, high solids, solvent-free or waterborne coatings can be formulated.

The heat-curable systems produce the ultimate performance (chemical and thermal resistance). This is due to more complete reactions with the curing agents at higher temperatures, and overcoming the steric hindrance of the multifunctional epoxy resins.

Chemical Description

Epoxy phenol novolac

Chemical Structure

Applications	<ul style="list-style-type: none"> • Adhesives • Prepregs • Maintenance and marine coatings • General industrial coatings • Tank linings • Floorings • Pipe coatings • Automotive primers • Coil coating primers
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Advantages	<ul style="list-style-type: none"> • Good solvent resistance • Good chemical resistance • Good heat resistance • Compliant with FDA listings in 21CFR 175.300
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Typical Properties

(are based on Huntsman's test methods. Copies are available upon request)

	Araldite[®] EPN 1179 epoxy resin	Araldite[®] EPN 1180 epoxy resin
Visual Appearance	Clear, no contamination	
Color, Gardner, max.	2	3
Viscosity, mPa s (cPs)		
@ room temperature	70.000 - 80.000	Semi-solid
@ 52°C (125°F)	1.100 - 1.700	20,000 - 50,000
@ 65°C (150°F)	---	5.000
Epoxy Value, eq/kg	5.6 - 5.8	5.5 - 5.7
Epoxy Equivalent Weight, g/eq	172 - 179	175 - 182
Density @ 25°C (77°F), g/cm ³ (lb/gal.)	1.21 (10.1)	1.22 (10.2)
Flash Point, °C (°F)	>200 (>392)	>200 (>392)

Formulations

The high viscosity of EPN resins requires reduction for most coating applications. Viscosity can be reduced in a number of ways:

- by use of solvents (see below)
- by blending with low viscosity bisphenol A type epoxy resins.
- by blending with bisphenol F epoxy resins, ex. Araldite[®] GY 282, Araldite[®] GY 285.
- by heating.

Viscosity in Toluene @ 25°C / 77°F**Araldite EPN 1180**

Solids	Viscosity, cPs
70%	127
80%	1,000

At practical concentrations, Araldite[®] EPN 1180 epoxy resin is insoluble in heptane and isopropanol. Solubility of Araldite[®] EPN 1179 epoxy resin is similar to that of Araldite[®] EPN 1180 epoxy resin.

**Formulations
(continued)**

Formulation 1

Room Temperature Curing Systems

**Araldite® EPN 1179 epoxy resin cured with Aradur® 2964,
a Modified Cycloaliphatic Polyamine**

Araldite® EPN 1179 epoxy resin was combined with Aradur® 2964, a modified cycloaliphatic polyamine, (Formulation 1) and Aradur® 943, an aliphatic polyamine adduct, (Formulations 2 and 3) to produce room temperature curing coatings. The cured films exhibited outstanding resistance to 30% ammonia solution and aggressive organic solvents, such as methanol, trichloroethylene, and butyl acetate. The solvent resistance, much superior to that produced by an unmodified liquid bisphenol A epoxy resin control, is further enhanced by force cure (80°C/176°F). Araldite® EPN 1179/Aradur® 943 coating (Formulations 2 and 3) passed two-weeks immersion tests at 65°C (149°F) in hydrochloric acid, 10%, sulphuric acid, 10%, sodium hydroxide, 10%, concentrated ammonia and boiling water.

**Formulations
(continued)**

Composition

Araldite® EPN 1179 epoxy resin	100
Aradur® 2964	54

Parts by weight

Properties

Gardner viscosity of resin / hardener mix	
@ 25°C (77°F)	V
Pot life	
@ 23°C (73°F), hr:min	0:30
Film thickness, mils	12 - 16
Dry time	
@ 23°C (73°F), hr:min	
Dust-dry	2:00
Through-cure	4:15

Performance

Film appearance	Clear, colorless, no blushing or exudation
Pencil hardness	3H
Impact resistance direct/reverse, in-lb	24/0
Crosscut adhesion	Fair
MEK rubs, single	>500

Chemical Resistance

Substrate	Sandblasted hot rolled steel
Cure	10 days @ 23°C (73°F)
Force cure	10 hr. @ 80°C (176°F)

Reagents

Days to failure

	R.T. Cured	Force Cured
36% HCl	89	60
10% Acetic acid	12	60
30% NH ₄ OH	150	60
Acetone	<2	60
MEK	<2	150

Butyl acetate	40	>150
Trichloroethylene	<2	>150
95% Ethanol	26	120
Methanol	<2	7
Skydrol 500B (Monsanto)	>360	--

**Formulation
(continued)**

Formulations 2 and 3

**Araldite® EPN 1179 cured with Aradur® 943,
an Aliphatic Polyamine Adduct**

Parts by weight

Formulation	2	3
Araldite® EPN 1179	100	76
Araldite® ECN 1235	-	24
Aradur® 943	22	21
MIBK	-	6
Toluene	-	3

Properties

Gardner viscosity of resin/ hardener mix @ 25°C (77°F)	Z ₆ - Z ₇	Z ₂ - Z ₃
Pot life @ 23°C (73°F), hr:min	0:13	0:19
Film thickness, mils	12 - 16	
Dry time @ 23°C (73°F), hr:min		
Dust-dry	1:20	2:40
Through-cure	1:30	3:00

Performance

	R.T. Cured	Force Cured @ 80°C (176°F)	R.T. Cured	Force Cured @ 80°C (176°F)
Film appearance	Slight exudation or blushing	Clear, no exudation	Slight exudation	Clear, no exudation or blushing
Pencil hardness	2H	6H	2H	3H
Impact resistance, direct/reverse, in-lb	16/0	12/0	12/0	8/10
Crosscut				
Adhesion	Excellent	Excellent	Excellent	Very good
MEK rubs, single	>500	>500	>500	>500

Chemical Resistance

Substrate	Sandblasted hot rolled steel
Cure	10 days @ 23°C (73°F)

Formulations (continued)	Reagents Formulation	Days to failure	
		2	3
	36% HCl	210	>360
	10% Acetic Acid	7	20
	30% NH ₄ OH	210	>360
	Butyl acetate	>360	>360
	Trichloroethylene	5	>360
	95% Ethanol	>270	>300
	Methanol	150	5
	Skydrol 500 B	>360	>360
	Boiling water 2 wks	Passed	---
	HCl, 10%, 2wks @ 65°C (149°F)	Passed	---
	H ₂ SO ₄ , 10%, 2wks @ 65°C (149°F)	Passed	---
	NaOH, 10%, 2wks @ 65°C (149°F)	Passed	---
	NH ₄ OH, conc., @ 65°C (149°F)	Passed	---
	Force Cure	10 hr @ 80°C (176°F)	
	Reagents	Days to failure	
	Formulation	2	3
	36% HCl	>360	>360
	10% Acetic Acid	150	120
	30% Acetic Acid	20	---
	30% NH ₄ OH	>360	>360
	Acetone	<2	9
	MEK	9	>360
	Butyl acetate	>360	>360
	Trichloroethylene	>360	>360
	95% Ethanol	>270	>300
	Methanol	>360	15
	Skydrol 500B	>360	360

Storage Araldite® EPN 1179 and Araldite® EPN 1180 are supplied in 484 pounds steel drums. These products should be stored in a dry place, in the sealed original container, at temperatures between +2°C and +40°C (+35.6°F and 104°F). Under these storage conditions the shelf life is 3 years. These products should not be exposed to direct sunlight.

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First Aid!

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