Technical Datasheet

DERAKANE™ 451-400 Epoxy Vinyl Ester Resin

DERAKANE 451-400 resin is a low viscosity, unpromoted novolac epoxy vinyl ester. It is the same as HETRON 980 resin. DERAKANE 451-400 resin allows the use of standard MEKP, exhibits excellent exotherm control and industry-leading storage stability.

- Exceptional hot water resistance
- Excellent solvent and acid resistance
- Good caustic resistance
- Excellent impact strength
- High heat resistance
- High tensile elongation

APPLICATIONS AND USE

DERAKANE 451-400 resin is recommended for hand lay-up and spray-up, filament winding, flake glass and filled linings and coating compounds. Recommendations for specific services and environments can be provided by contacting us at derakane@ashland.com.

TYPICAL LIQUID RESIN PROPERTIES

Property(1) at 25°C (77°F)	Value	Unit
Viscosity, Brookfield #2 spindle @ 30 rpm	425	mPa·s (cps)
Percent Solids	58	%
Specific Gravity	1.05	g/ml

(1) Properties are typical values based on material tested in our laboratories. Results may vary from sample to sample. Typical values should not be construed as a guaranteed analysis of any specific lot or as specification items.

TYPICAL CURING CHARACTERISTICS

MEKP Cure System

Typical(1) gel times with Methylethyl Ketone Peroxide (MEKP) catalyst, 6% Cobalt (Co 6%), and Dimethylaniline (DMA).

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Gel time at 18°C (65°F)	MEKP (phr) (2)	Co 6% (phr)	DMA (phr)
15 minutes	1.25	0.30	0.10
25 minutes	1.25	0.30	0.05
35 minutes	1.25	0.30	0.03

Gel time at 25°C (77°F)	MEKP (phr)	Co 6% (phr)	DMA (phr)
15 minutes	1.25	0.30	0.05
25 minutes	1.25	0.30	0.02
35 minutes	1.25	0.30	0.01

Gel time at 30°C (85°F)	MEKP (phr)	Co 6% (phr)	DMA (phr)
15 minutes	1.25	0.30	0.02
25 minutes	1.25	0.20	0.01
35 minutes	1.25	0.20	---

Gel time at 35°C (95°F)	MEKP (phr)	Co 6% (phr)	DMA (phr)
15 minutes	1.25	0.30	0.01
25 minutes	1.25	0.25	---
35 minutes	1.25	0.015	---

BPO Cure System

Typical(1) gel times with 50% Benzyl Peroxide (BPO) paste catalyst and Dimethylaniline (DMA).

Gel time at 25°C (77°F)	BPO paste (phr)	DMA (phr)
15 - 19 minutes	2.0	0.20
19 - 23 minutes	2.0	0.15
30 - 40 minutes	1.0	0.10

(2) phr=parts per hundred resin

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Effect of Copper Naphthenate (Cu-nap 8%)(3)

Exotherm Control Formulations - When laminates require a lower exotherm, copper (4) may be incorporated to achieve the desired reduction. High hydrogen peroxide catalysts should be used to avoid dramatic moves in gel times.

Temperature / Cu-nap 8%	Co 6% (phr)	DMA (phr)	MEKP (phr)	Gel Time (mins.)	Gel-peak (mins.)	Peak Exo °C (°F)
18°C (65°F) / 0 phr	0.3	0.03	1.25	25	14	157 (315)
18°C (65°F) / 0.04 phr	0.3	0.03	1.25	25	24	74 (165)
25°C (77°F) / 0 phr	0.3	0.02	1.25	25	17	163 (325)
25°C (77°F) / 0.04 phr	0.3	0.02	1.25	25	25	54 (130)
30°C (85°F) / 0 phr	0.3	0.01	1.25	25	22	160 (320)
30°C (85°F) / 0.04 phr	0.3	0.01	1.25	30	22	46 (115)
35°C (95°F) / 0 phr	0.25	---	1.25	25	29	155 (310)
35°C (95°F) / 0.04 phr	0.25	---	1.25	35	30	38 (100)

Effect of Copper Levels at 25°C(77°F)

Copper Naphthenate (Cu-nap 8%) will influence Gel Time, Gel-to-Peak and Peak Exotherm at 25°C (77°F). Catalyst used is MEKP at 1.25 phr.

CAUTION: Thoroughly mix promoters with resin before adding catalyst.

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Cu-naphthenate 8% (phr)	Co 6% (phr)	DMA (phr)	Gel Time (minutes)	Gel-Peak (minutes)	Peak Exo (°C(°F))
0	0.3	0.02	24	17	160 (320)
0.01	0.3	0.02	23	27	127 (260)
0.02	0.3	0.02	22	26	66 (150)
0.03	0.3	0.02	22	26	60 (140)
0.04	0.3	0.02	24	25	54 (130)

(3) Can be acquired by OMG Borchers GmbH, www.borchers.de
(4) More than 500 ppm of 8% copper may be detrimental to cure

TYPICAL MECHANICAL PROPERTIES

Casting Properties

Property(1) of cured casting(5) at 25°C (77°F)	Value (SI)	Value (US)	Method
Barcol Hardness	35	35	ASTM D2583
Tensile Strength	90 MPa	13,000 psi	ASTM D638
Tensile Modulus	3.3 GPa	4.8 psi x 10^5	ASTM D638
Tensile Elongation	5.6%	5.6%	ASTM D638
Flexural Strength	138 MPa	20,000 psi	ASTM D790
Flexural Modulus	3.5 GPa	5.0 psi x 10^5	ASTM D790
Heat Distortion Temperature	120°C	248°F	ASTM D648

(5) Catalyzed with 1.0% BPO, cured two hours at 70°C (160°F), then one hour at 95°C (200°F), post-cured two hours at 140°C (280°F).

CERTIFICATES AND APPROVALS

The manufacturing, quality control and distribution of products, by Ashland Performance Materials, comply with one or more of the following programs or standards: Responsible Care, ISO 9001, ISO 14001 and OHSAS 18001.

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STANDARD PACKAGE	Non-Returnable Drum with Net Weight of 205 Kgs (452 Lbs) DoT Label Requirement: Flammable Liquid
COMMERCIAL WARRANTY	Nine months from date of manufacture, when stored in accordance with the conditions stated below.

STORAGE

Drums - Store at temperatures below 25°C (77°F). Storage life decreases with increasing storage temperature. Avoid exposure to heat sources such as direct sunlight or steam pipes. To avoid contamination of product with water, do not store outdoors. Keep containers sealed to prevent moisture pick-up and monomer loss. Mild mixing is recommended after prolonged storage. Rotate stock.

Bulk - See Ashland's Bulk Storage and Handling Manual for Polyesters and Vinyl Esters. A copy of this may be obtained from Ashland Performance Materials at +1.614.790.3333 or 800.523.6963.

All other conditions being equal, higher storage temperatures will reduce product stability and lower storage temperatures will extend product stability.

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Since the user's product formulations, specific use applications and conditions of use are beyond the control of Ashland, Ashland makes no warranty or representation regarding the results which may be obtained by the user. It shall be the sole responsibility of the user to determine the suitability of any of the products mentioned for the user's specific application.

Ashland requests that the user reads, understands and complies with the information contained herein and the current Material Safety Data Sheet.

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