Technical Datasheet

INEOS Composites

DERAKANE™ 515-400 Epoxy Vinyl Ester Resin

DERAKANE 515-400 resin is a low viscosity, unpromoted, flame retardant(1) epoxy vinyl ester resin. It is the same as HETRON™ FR 998/35 resin. This product allows the use of standard MEKP, exhibits excellent exotherm control, and industry leading storage stability. Laminates made with DERAKANE 515-400 resin have achieved a flame spread of <25 (ASTM E-84) without antimony trioxide. DERAKANE 515-400 resin contains less than <35% styrene.

Equipment fabricated with DERAKANE 515-400 resin exhibit:

- Excellent flame retardancy
- Excellent thermal shock resistance
- Excellent corrosion resistance to acids and oxidizers
- Excellent thermal properties
- Fast wet-out, low drainage

APPLICATIONS AND USE

DERAKANE 515-400 resin can be used for corrosion resistant, reinforced thermoset plastic equipment including filament wound, hand lay-up and spray-up tanks, pipes, ducts, stacks, scrubbers, linings or other equipment handling corrosive gases, vapors or liquids where a high degree of flame retardancy is required. The product is well suited for caustic/chlorine and power industry applications.

DERAKANE 455-400 epoxy vinyl ester resin is a non-flame retardant product suitable for many similar environments. Recommendations for specific services and environments can be provided by contacting us at derakane@ineos.com.

TYPICAL LIQUID RESIN PROPERTIES

Property(2) at 25°C (77°F)	Value	Unit
Viscosity, Brookfield # 2 spindle @ 30 rpm	475	mPas (cps)
Percent Solids	66	%
Color	<10	Gardner
Specific Gravity	1.21	g/ml

(1) DERAKANE fire retardant vinyl ester resins will burn if provided with a sufficient amount of heat and oxygen. The degree of flame retardancy of the cured resin is characterized by the ASTM E-84

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tunnel test. This test is performed under strictly controlled conditions where a flame spread rating is assigned according to comparisons with test set-point materials. The behavior of the cured composite under these controlled conditions can vary from an actual fire situation.
(2) Properties are typical values based on material tested in our laboratories. 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(2) geltimes at different temperatures using Cobalt Naphthenate-6 (Co-nap6%) and Dimethylaniline (DMA)(3) and curing with a high quality MEKP-50 type peroxide.

CAUTION: Thoroughly mix promoters with resin before adding catalyst.

Temperature / MEKP-50 type catalyst (phr)	DMA (phr)	Co-nap6% (phr)	Gel Time (min.)
18°C (65°F) / 1.25	0.05	0.2	11
	0.025	0.2	15
	0.01	0.2	27
25°C (77°F) / 1.25	0.05	0.25	6
	-	0.3	22
	-	0.15	35
30°C (85°F) / 1.25	-	0.3	19
	-	0.2	22
	-	0.1	41

BPO/DMA Cure System

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Temperature / BPO Paste 50% (phr)	DMA (phr)	Gel Time (min.)
18°C (65°F) / 2.0	0.2	20
	0.15	27
	0.1	43
25°C (77°F) / 2.0	0.2	14
	0.15	20
	0.1	31
30°C (85°F) / 2.0	0.15	12
	0.1	18
	0.05	46

(3) All levels are based on parts per hundred resin (phr)

Effect of Copper Naphthenate

Exotherm control formulations - When laminates require a lower exotherm, Copper Naphthenate(4) (Cu-nap8%) may be incorporated to achieve the desired reduction. High hydrogen peroxide catalysts should be used to avoid dramatic moves in gel times. The catalyst used below is MEKP at 1.25 phr.

CAUTION: Thoroughly mix promoters with resin before adding catalyst.

Temperature / Cu-nap8% (phr)	Co-nap6% (phr)	Gel Time (min.)	Gel-Peak (min.)	Peak Exo
18°C (65°F) / 0	0.3	31	13	163°C (325°F)
18°C (65°F) / 0.04	0.3	35	30	132°C (270°F)

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25°C (77°F) / 0	0.25	26	13	160°C (320°F)
25°C (77°F) / 0.04	0.25	35	25	132°C (270°F)
30°C (85°F) / 0	0.2	25	13	160°C (320°F)
30°C (85°F) / 0.04	0.2	33	25	132°C (270°F)
35°C (95°F) / 0	0.1	38	15	160°C (320°F)
35°C (95°F) / 0.04	0.1	45	21	132°C (270°F)

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

Effect of Copper Levels at 25°C (77°F)

Copper Naphthenate (Cu-nap8%) will influence Gel Time, Gel-to-Peak and Peak Exotherm at 25°C (77°F). Catalyst used below is MEKP at 1.25 phr.

CAUTION: Thoroughly mix promoters with resin before adding catalyst.

Cu-nap8% (phr)	Co-nap6% (phr)	Gel Time (min.)	Gel-Peak (min.)	Peak Exo
0	0.25	28	14	160°C (320°F)
0.01	0.25	32	15	155°C (310°F)
0.02	0.25	33	17	143°C (290°F)
0.03	0.25	33	22	138°C (280°F)
0.04	0.25	35	25	132°C (270°F)

For all surfaces that will be exposed to air during fabrication (top-coating, lining, patching, exterior

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surfaces, etc.) the addition of 0.4% paraffin wax to the final resin layer is recommended. A waxed surface may interfere with secondary bonding adhesion.

Flame retardant vinyl ester resins do not demonstrate ultraviolet stability equivalent to non-halogenated vinyl ester resins. Ultraviolet stability may be improved by adding 1.0% CYASORB(5) UV-9 ultraviolet screener to the exterior exposed surfaces where aesthetic appearance is desired.

TYPICAL MECHANICAL PROPERTIES

Property(2) of a cured casting(6) at 25°C (77°F)	Value (SI)	Value (US)	Method
Barcol Hardness	40	40	ASTM D2583
Tensile Strength	93 MPa	13,500 psi	ASTM D638
Tensile Modulus	3.7 GPa	5.4 psi x 10^5	ASTM D638
Tensile Elongation at break	4.0%	4.0%	ASTM D638
Flexural Strength	152 MPa	22,000 psi	ASTM D790
Flexural Modulus	3.9 GPa	5.7 psi x 10^5	ASTM D790
Heat Distortion Temperature	135°C	275°F	ASTM D648

(5) Registered trademark of Cytec Industries
(6) 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).

TYPICAL FLAME RETARDANCY OF LAMINATES(7)

Tested Material	Class	ASTM E-84 Flame Spread
DERAKANE 515-400 resin laminate without 3% antimony trioxide	I	<25
Cement Asbestos Board (control)	I	0
Red Oak (control)	III	100

(7) Properties are typical values, based on material tested in our laboratories, but varies from sample to sample. Typical values should not be construed as a guaranteed analysis of any specific

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lot or as specification items. Laminate thickness = 3.18 mm (0.125 in.) with approximately 27% glass content.

CERTIFICATES AND APPROVALS

The manufacturing, quality control and distribution of products, by INEOS Composites, comply with one or more of the following programs or standards: ISO 9001, ISO 14001 and OHSAS 18001.

STANDARD PACKAGE

Non-Returnable Drum with Net Weight of 230 Kgs (507 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 INEOS Composites's Bulk Storage and Handling Manual for Polyesters and Vinyl Esters. A copy of this may be obtained from INEOS Composites 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.

Notice

All information presented herein is believed to be accurate and reliable, and is solely for the user's consideration, investigation and verification. The information is not to be taken as an express or implied representation or warranty for which INEOS Composites assumes legal responsibility. Any warranties, including warranties of merchantability, fitness for use or non-infringement of intellectual property rights of third parties, are herewith expressly excluded.

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Since the user's product formulations, specific use applications and conditions of use are beyond the control of INEOS Composites, INEOS Composites 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.

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

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