Starting Formulation

SF 8001

Solventless, Pre-Preg Matrix System for Fiber Reinforced Composites
EPON™ Resin 828

Introduction This solventless epoxy binder is designed for prepreg graphite or glass tape and sheet stock subsequently compression molded into high performance composites required to perform on a long term basis at temperatures as high as 300 °F. A variation of this formulation utilizing MEK and BF3MEA accelerator is commonly used to produce printed circuit board laminates meeting the NEMA G-11 specification.

Features

- Pre-pregs exhibit good retention of tack and draping characteristics when stored at room temperature
- High interlaminar shear strengths and transverse tensile strengths
- Relatively short press cure required

Formula

Material	Supplier	Pounds	Gallons
Formulation			
EPON Resin 828	Hexion Specialty Chemical	100.0	10.38
4, 4' Diaminodiphenyl Sulfone	RSA Corp.	32.5	2.93
	Total Formulation	132.5	13.31

Compounding and Impregnation The DADPS curing agent is dissolved with agitation into EPON Resin 828 at a temperature of 275-300 °F. Once a clear solution has been obtained, the blend is reduced in temperature to 175-200 °F. Viscosity is sufficiently low in this temperature range for rapid wetting and impregnation of graphite tow or glass roving. Heating of guide rollers and squeeze rollers facilitates maximum impregnation.

The impregnated fiber may be "B"-staged to a tacky, drapable consistency by heating for a period of approximately 10 minutes in a forced draft oven or drying tower at a temperature of 250 °F. The prepreg should be sandwiched between release film for storage. The tack retention life of the prepreg should be approximately 4 weeks at 88 °F and in excess of 12 months at 0 °F.

Typical Handling Properties Table 1 / Handling Properties

	Units	Value
Viscosity, Brookfield		
at 140 °F	cP	2,000
at 200 °F	cP	180
Working Life		
at 140 °F	hrs	8
at 200 °F	hrs	5
Pounds/Gallon	lbs/gal	9.55
Pre-Cure at contact pressure [1]		
Time	hrs	<1.5
Platen or Autoclave Temperature	°F	275
Pressure Cure		

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	Initial	1 hour @ 275 °F and 100 psi
	Final	2 hours @ 350 °F and 100 psi
	Post Cure	
	Option 1	1 hour @ 400 °F
	Option 2	7 hours @ 350 °F

[1] The purpose of this step is to polymerize the binder almost to the gel point in order to prevent excessive squeeze-out when pressure is applied and to provide sufficient back pressure to expel any entrapped air. Thickening of the binder may be followed by probing an open end of the lay-up. This pre-cure step is usually shortened or eliminated when lower pressure molding techniques such as vacuum bagging are used to fabricate the composites.

Matrix Properties

Table 3 / Properties of Cast Matrix System[1]

	Units	Value
Physical Strength Properties		
Tensile Strength	psi	12,500
Tensile Elongation	%	3.2
Tensile Work [3]	in.•lbs/in.	409
Tensile Modulus	psi	$0.55x10^6$
Flexural Strength		
at 77 °F	psi	21,100
at 300 °F	psi	10,400
Flexural Modulus		
at 77 °F	psi	$0.56x10^6$
at 300 °F	psi	$0.32x10^6$
Compressive Yield Strength	psi	23,300
Thermal Properties		
Heat Deflection Temperature	°F	345
Weight Loss [2]		
30 days at 300 °F	%	0.24
30 days at 400 °F	%	2.90

[1] Cure schedule 2 hours at 300 °F plus 10 hours at 350 °F.

[2] Weight loss determined on 1/8" x ½" x 4" bars aged in a forced draft oven.

Graphite Properties

Table 4 / Properties of Graphite Composites[1]

Composite Property	Units	Morganite II	Celanese GY-70
Density	g/cm^3	1.57	1.63
Fiber Content, volume percent	Vol. %	69	69

Fiber Content, volume percent	Vol. %	65	65
Void Content, volume percent	Vol. %	<2	5
Tensile Strength, psi	psi	152,000	–
Flexure Strength 16:1			
at 77 °F	psi	240,000	101,000
at 180 °F	psi	218,000	–
at 250 °F	psi	132,000	97,000
at 350 °F	psi	82,000	63,000
Interlaminar Shear Strength, Short Beam 5:1			
at 77 °F	psi	11,200	6,300
at 180 °F	psi	10,900	–
at 250 °F	psi	7,400	5,700
at 350 °F	psi	4,700	———
Torsional at 77 °F		12,000	———
Torsional Shear Modulus, psi	psi	0.70×10^6	———
Transverse Tensile Strength, psi	psi	5,600	———
Flammability, per ASTM D-635		Self-extinguishing	Self-extinguishing
Burn Time	sec.	27	3

[1] 15-ply, unidirectional composites were prepared from heat treated Morganite II and Celanese GY-70 tow by pre-pregging and compression molding on a schedule of 2 hours at 275 °F plus 1.5 hours at 350 °F plus 1 hour at 400 °F.

Storage Recommendations regarding storage conditions can be obtained by visiting our web site at www.hexion.com

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