



Information Sheet

CYCOM®5320**Toughened Epoxy for Structural Applications
Out-of-Autoclave Manufacturing****Description**

CYCOM®5320 is a toughened epoxy resin prepreg system designed for out-of-autoclave manufacturing of primary structural applications. Because of its lower temperature curing capability, it is also suitable for prototyping where low cost tooling or vacuum-bag-only curing is required.

CYCOM®5320 handles like standard prepreg, yet can be vacuum bag cured to produce autoclave quality parts having very low porosity. It offers mechanical properties equivalent to other 350°F (177°C) autoclave-cured toughened epoxy prepreg systems after a 350°F (177°C) freestanding post cure.

Features and Benefits

- Developed for primary structure
- No autoclave required for cure
- Excellent hot/wet properties
- Mechanical properties equivalent to autoclave-cured toughened epoxy systems
- Very low void content
- Suitable for producing complex parts
- Enables low cost tooling
- Flexible cure cycles

Physical Properties

Properties	
Shelf life:	1 year at < 10°F (-12 °C)
Tack Life:	2 weeks at RT
Shop Life:	3 weeks at RT
Gel Time (250°F or 121°C):	30 minutes
Cured Resin Density:	1.31 g/cm ³

Cure Cycles

CYCOM®5320 also offers flexible cure cycle capability.

	Cure Cycle A	Cure Cycle B	Combined
Ramp Rate:	1-5 °F/minute (0.6 – 2.8 °C/minute)	1-5 °F/minute (0.6 – 2.8 °C/minute)	1-5 °F/minute (0.6 – 2.8 °C/minute)
Cure Temperature:	200 ±10°F (93 ± 6°C)	250 ±10°F (121 ± 6°C)	250 ±10°F / 350 ±10°F (121 ± 6°C / 177 ± 6°C)
Cure Time:	8 hours (1)	2 hours	1 hour / 2 hours
Free-Standing Post Cure:	2 hours at 350°F (177 °C)	2 hours at 350°F (177 °C)	N/A (2)

Notes:

- (1) Degree of cure after initial 200°F (93°C) /8 hr cure is 52%. This allows for handling and free standing post cure.
- (2) A combined cure and post cure on the tool may be performed by ramping to 250°F (121°C), hold for 1 hour, ramp to 350°F (177°C) and hold for 2 hours.

Debulking

Vacuum debulking cycles are not required to eliminate voids for flat or mildly contoured parts. Vacuum debulking should be performed only as necessary to eliminate wrinkles and bridging of materials in highly contoured or very thick parts.

Vacuum Requirements

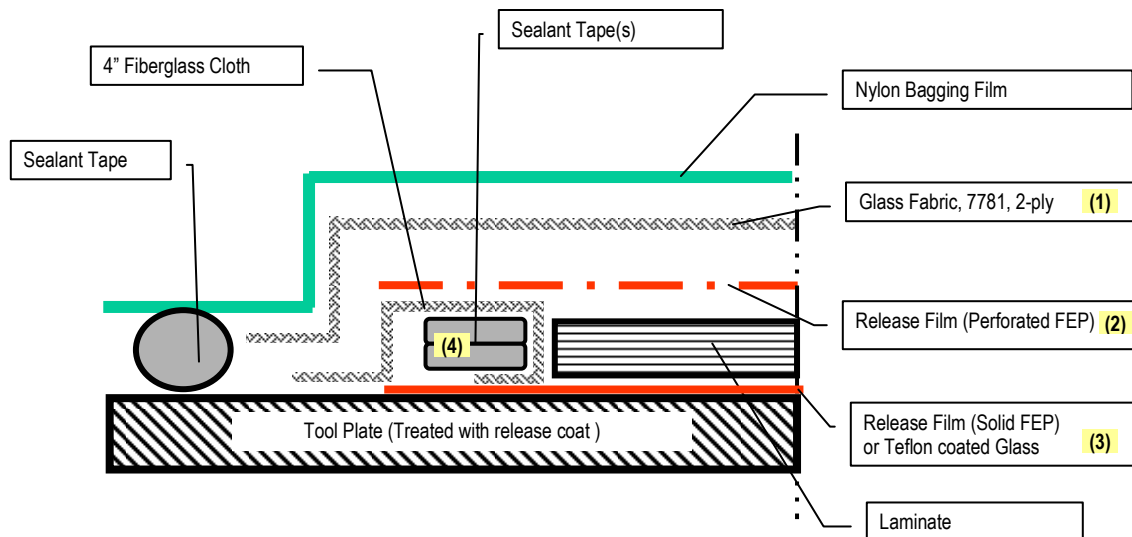
Prior to heating a vacuum hold at full vacuum (minimum 28 in Hg or 711 torr at sea level) is required. Full vacuum should be within 2 in Hg (50 torr) of absolute vacuum for the given altitude.

Vacuum hold times will depend on the part size and complexity, but general recommendations are 4 hours minimum hold for any uniform thickness parts smaller than 2 ft x 2 ft (0.6 m x 0.6 m) and 16 hours minimum hold for larger or more complex parts.

Leak Check

A vacuum leak check should be performed prior to cure and heat-up. The test should not show more than a 2 in Hg (50 torr) vacuum loss in 5 minutes.

Vacuum Bag Scheme



Bagging Material Notes:

- (1) Any breather material may be used (i.e. - N10 Airweave, 120 glass) as long as it effectively removes the air and can withstand temperatures and pressures.
- (2) Release film could be solid with small holes just at the corners so that air does not get trapped along the top surface. Perforated release film gives better laminate quality with perforation density ranging from 2" (5 cm) centers to 0.1" (0.25 cm) centers.
- (3) A release film is not required if the tool is smooth and has a sufficient amount of release on it or if a surfacing ply is used.
- (4) The sealant tape and fiberglass cloth can be exchanged for cork, silicon or any other type of stiff dam as long as there are sufficient strings against the edges of the laminate that connect to the breather. The strings should have a twist in them and be placed on all edges between the dam and the laminate. Also note that the edge dams need to be higher than the laminate thickness.

Mechanical Properties

IM Fiber Unidirectional Tape

Data Normalized to 0.0054" CPT (Nominal FAW 145 gsm; Nominal Resin Content 33% by wt.).

Properties	Test Method Lay Up	Condition	T40/800B
Cure Cycle			200°F (93°C) / 8 hrs + 350°F (177°C) / 2 hrs (vacuum bag cure)
Glass Transition Temperature °F (°C)	DMA, E'	WET¹	310 (154)
Moisture Uptake Weight %		WET¹	1.05
0° Tension, Strength, ksi (MPa) Modulus Msi (GPa) Poisson's Ratio	ASTM D3039 [0]8	-65°F (-54°C) DRY	402 (2773) 23.4 (161) 0.317
		RTA	419 (2892) 23.1 (159) 0.336
90° Tension Strength, ksi (MPa) Modulus Msi (GPa)	ASTM D3039 [90]16	-65°F (-54°C) DRY	13.7 (94) 1.6 (11.0)
		RTA	13.2 (91) 1.4 (9.3)
90°/0° Tension Strength, ksi (MPa) Modulus Msi (GPa)	ASTM D3039 [90,0]4s	RTA	212 (1464) 12.3 (84.8)
Un-notched Tension Strength, ksi (MPa) Modulus Msi (GPa)	ASTM D3039 [45,90,-45,0]3s	-65°F (-54°C) DRY	136 (938) 8.6 (59.3)
		RTA	137 (946) 8.6 (59.3)
Open Hole Tension Strength, ksi	ASTM D5766 [45,90,-45,0]3s	RTA	81.2 (560)
		-65°F (-54°C) DRY	75.8 (523)
Filled Hole Tension Strength, ksi	ASTM D6742 [45,90,-45,0]3s	RTA	78.0 (538)
		-65°F (-54°C) DRY	76.9 (530)

¹Exposure: 48 hour water boil. Dry at 250°F (121°C) for 24 hours.

Mechanical Properties

IM Fiber Unidirectional Tape

Data Normalized to 0.0054" CPT (Nominal FAW 145 gsm; Nominal Resin Content 33% by wt.).

Properties	Test Method Lay Up	Condition	T40/800B
0° Compression Strength, ksi (MPa) Modulus Msi (GPa)	SACMA SRM01R94 [0]16	RTA	247 (1702) 21.0 (145)
		220°F (104°C)	204 (1407) 21.1 (146)
90° Compression Strength, ksi (MPa) Modulus Msi (GPa)	SACMA SRM01R94 [90]16	-65°F (-54°C) DRY	52.8 (364) 1.6 (11.2)
		RTA	49.8 (343) 1.7 (11.6)
		220°F (104°C)	35.6 (246) 1.3 (9.3)
		220°F (104°C) WET ¹	31.1 (214) 1.4 (9.5)
90°/0° Compression Strength, ksi (MPa) Modulus Msi (GPa)	SACMA SRM01R94 [90, 0]4s	RTA	167 (1149) 11.3 (77.8)
Un-notched Compression Strength, ksi (MPa) Modulus Msi (GPa)	ASTM D6641 [45, 90, -45, 0]	RTA	108 (745) 8.0 (55.0)
Compression After Impact Residual Strength, ksi (MPa)	ASTM D7137 or SACMA SRM02R94 [45,90,-45,0]4s	RTA	26.5 (183)
Open Hole Compression Strength, ksi (MPa)	ASTM D6484 D = 0.250, w/D = 6 [45,90,-45,0]3s	RTA	53.3 (368)
		220°F (104°C) WET ¹	43.4 (299)
Filled Hole Compression Strength, ksi (MPa)	ASTM D6742 [45,90,-45,0]3s	RTA	82.9 (572)

¹Exposure: 48 hour water boil. Dry at 250°F (121°C) for 24 hours.

Mechanical Properties

IM Fiber Unidirectional Tape

Data Normalized to 0.0054" CPT (Nominal FAW 145 gsm; Nominal Resin Content 33% by wt.).

Properties	Test Method Lay Up	Condition	T40/800B
Short Beam Shear Strength, ksi (MPa)	ASTM D2344 [0]16	-65°F (-54°C) DRY	22.9 (158)
		RTA	18.2 (126)
		220°F (104°C) WET ¹	9.1 (63)
Short Beam Shear Strength, ksi (MPa)	ASTM D2344 [0]30	RTA	16.4 (113)
		220°F (104°C) WET ¹	10.9 (76)
In-Plane Shear Strength, ksi (MPa) Modulus Msi (GPa) – 1500 – 5500 μ in/in Modulus Msi (GPa) – 500 – 3000 μ in/in	ASTM D3518 [+45, -45]2s	RTA	16.3 (112)
			0.77 (5.3)
			0.81 (5.6)
		220°F (104°C)	17.2 (119)
			0.65 (4.5)
			0.72 (5.0)
220°F (104°C) WET ¹	14.3 (99)		
	0.47 (3.2)		
0.57 (3.9)			
90° Flexure; Strength, ksi (MPa)	ASTM D790 [0]16	RTA	18.5 (128)

¹Exposure: 48 hour water boil. Dry at 250°F (121°C) for 24 hours.

Mechanical Properties

Cure Cycle Comparison – both cure cycles provide similar mechanical properties.

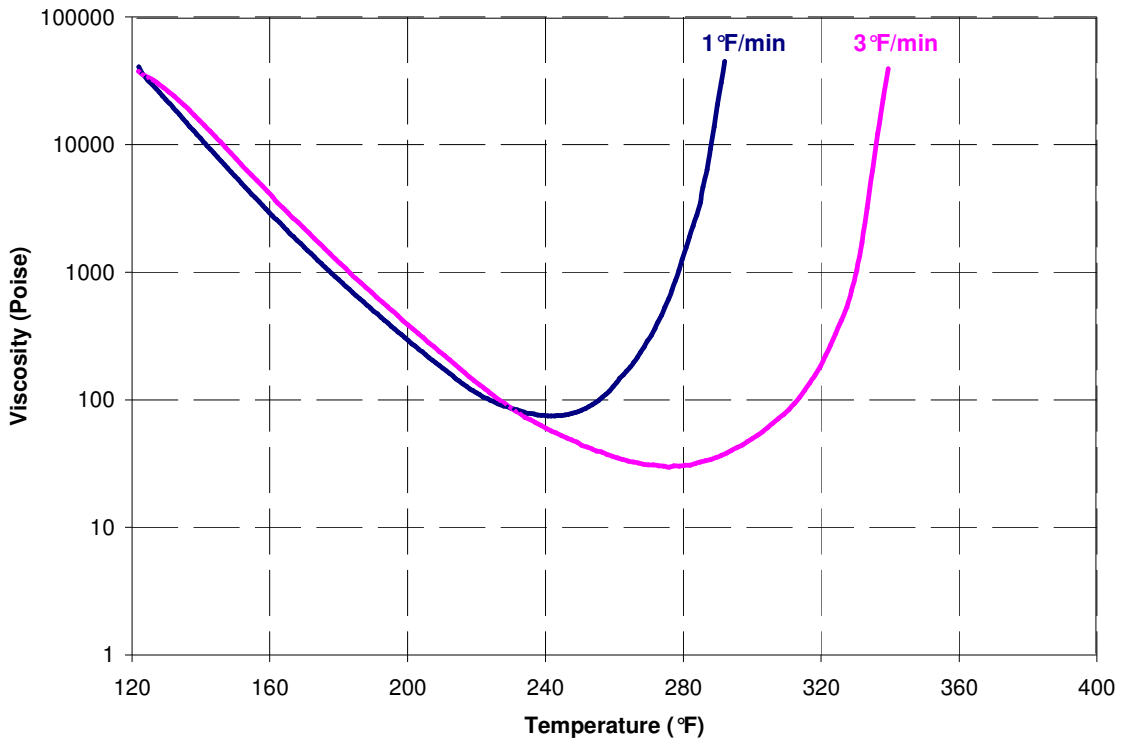
IM Fiber Unidirectional Tape – T40/800B

Data Normalized to 0.0054" CPT (Nominal FAW 145 gsm; Nominal Resin Content 33% by wt.).

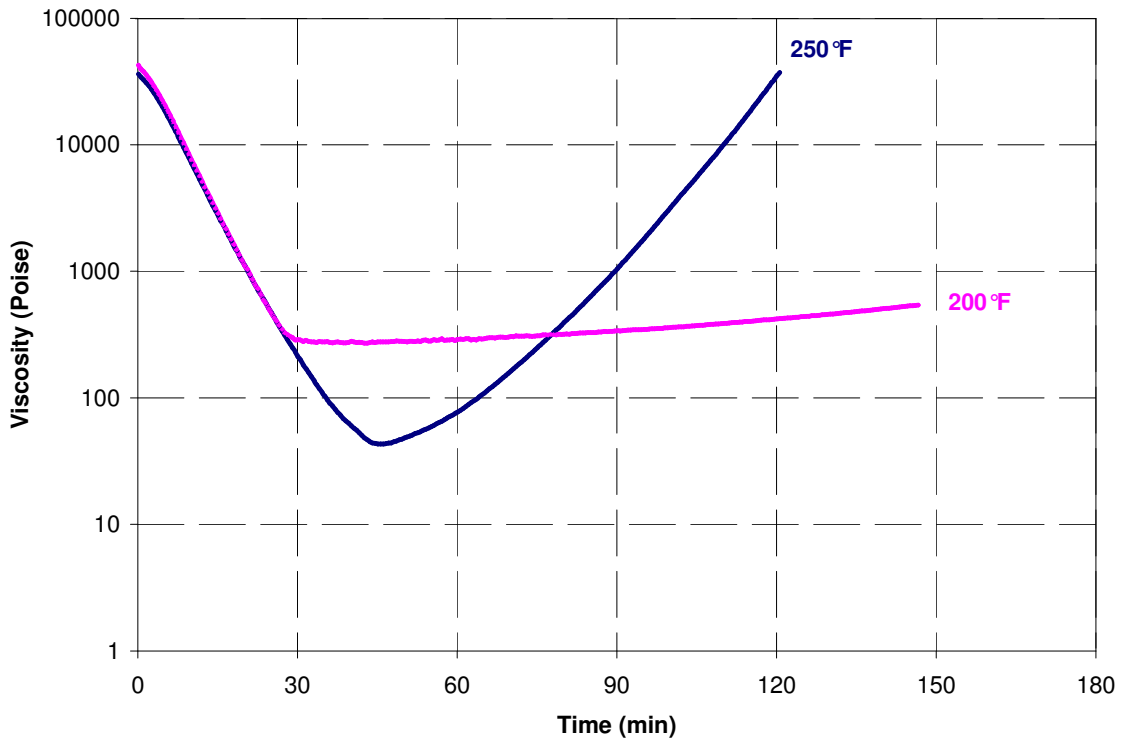
Properties	Test Method Lay Up Condition	Cure Cycle A	Cure Cycle B
Cure		200°F (93°C) / 8 hrs + 350°F (177°C) / 2 hrs (vacuum bag cure)	250°F (120°C) / 2 hrs + 350°F (177°C) / 2 hrs (vacuum bag cure)
Compression After Impact Residual Strength, ksi (MPa)	ASTM D7137 or SACMA SRM02R94 [45,90,-45,0]4s RTA	26.5 (183)	26.4 (182)
Filled Hole Tension Strength, ksi	ASTM D6742 [45,90,-45,0]3s RTA	78.0 (538)	76.7 (529)
Filled Hole Tension Strength, ksi	ASTM D6742 [45,90,-45,0]3s -65°F (-54°C) DRY	76.9 (530)	74.1 (511)
Open Hole Compression Strength, ksi (MPa)	ASTM D6484 [45,90,-45,0]3s RTA	53.3 (368)	52.6 (363)
Un-notched Compression Strength, ksi (MPa) Modulus Msi (GPa)	ASTM D6641 [45, 90, -45, 0] RTA	108 (745) 8.0 (55.0)	114 (786) 8.1 (55.9)
Short Beam Shear Strength, ksi (MPa)	ASTM D2344 [0]30 RTA	16.4 (113)	16.5 (114)
Short Beam Shear Strength, ksi (MPa)	ASTM D2344 [0]30 220°F (104°C) WET ¹	10.9 (75.2)	10.5 (72.4)
In-Plane Shear Strength, ksi (MPa) Modulus Msi (GPa) – 1500 – 5500 μ in/in Modulus Msi (GPa) – 500 – 3000 μ in/in	ASTM D3518 [+45, -45]2s RTA	16.3 (112) 0.77 (5.3) 0.81 (5.6)	17.1 (118) 0.77 (5.3) 0.81 (5.6)
In-Plane Shear Strength, ksi (MPa) Modulus Msi (GPa) – 1500 – 5500 μ in/in Modulus Msi (GPa) – 500 – 3000 μ in/in	ASTM D3518 [+45, -45]2s 220°F (104°C) WET ¹	14.3 (99) 0.47 (3.2) 0.57 (3.9)	14.8 (102) 0.49 (3.4) 0.60 (4.2)

¹Exposure: 48 hour water boil. Dry at 250°F (121°C) for 24 hours.

Dynamic Viscosity – Ramp to Gel (1°F/min = 0.56°C/min; 3°F/min = 1.7°C/min)



Dynamic Viscosity – Ramp to Hold - 3°F (1.7°C)/min (250°F = 121°C; 200°F = 93°C)



Product Handling and Safety

Cytec Engineered Materials recommends the wearing of clean gloves when working with prepreg materials in order to reduce skin contact and to avoid contamination of the product.

Materials Safety Data Sheets (MSDS) and product labels are available upon request and can be obtained from any Cytec Engineered Materials Office.

Disposal of Scrap Material

Disposal of scrap material should be in accordance with local, state and federal regulations.

DISCLAIMER: The data and information provided in this document have been obtained from carefully controlled samples and are considered to be representative of the product described. Because the properties of this product can be significantly affected by the fabrication and testing techniques employed and since Cytec Engineered Materials (CEM) does not control the conditions under which its products are tested and used, CEM cannot guarantee that the properties provided will be obtained with other processes and equipment. CEM has the right to change any data or information when deemed appropriate.

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