

4000 Prepreg System Data Sheet

TORAY

Toray Composite Materials America, Inc.

PRODUCT NOTES

4000 prepreg system features a toughened bismaleimide (BMI) resin system specifically formulated for aerospace and defense primary structures demanding enhanced strength and toughness in high service temperature environments up to 450°F (232°C). It delivers up to 35% higher OHT and 40% higher CAI over conventional intermediate modulus fiber/BMI systems. The system is characterized by a controlled-flow resin system that enables easier manufacturing, handling, and curing.



Highly Toughened

High strength fiber is combined with Toray's proprietary toughening approach to reduce delamination leading to increased fracture toughness, while maintaining hygrothermal resistance.



High Heat Tolerance

High Tg and hot/wet performance enable retention of critical properties like open-hole compression to 250°F (121°C) without compromising material toughness.



Flexible Cure Methods

Proven flexibility in curing and consistency in mechanical properties with or without a freestanding post cure.



Optimized Interface

System features synergy with T1100G, capturing fiber's full capability and maximizing translation of carbon fiber strand strength.



Customizable Forms

Compatible with multiple applications, including AFP and hand layup. Multiple widths and roll configurations available.



Production Friendly

Toray has solved excessive flow characteristic of traditional BMI chemistries allowing for simplified bagging, along with a shorter cure cycle to enable higher production rates.

AVAILABLE PRODUCT FORMATS

The 4000 prepreg system has been tested using the following product forms, however customized configurations are possible with numerous types of TORAYCA™ unidirectional carbon fibers, woven carbon, or glass fabrics. Fiber Areal Weights (FAW) can range from 70 g/m² to 300 g/m² while Resin Content (RC %) by weight percent typically ranges from 24% to 40%. Requests for configurations beyond these ranges are possible.

Unidirectional products can be slit to widths between 1/8" and 60", and fabric products to widths between 6" and 60". Common product formats include 1/4", 1/2", 1", and 1.5" AFP spools (UD only); 6", 500mm, 9", and 12" ATL rolls; and 24" to full-width rolls for hand layup. Product widths narrower than 3" require additional lead time.

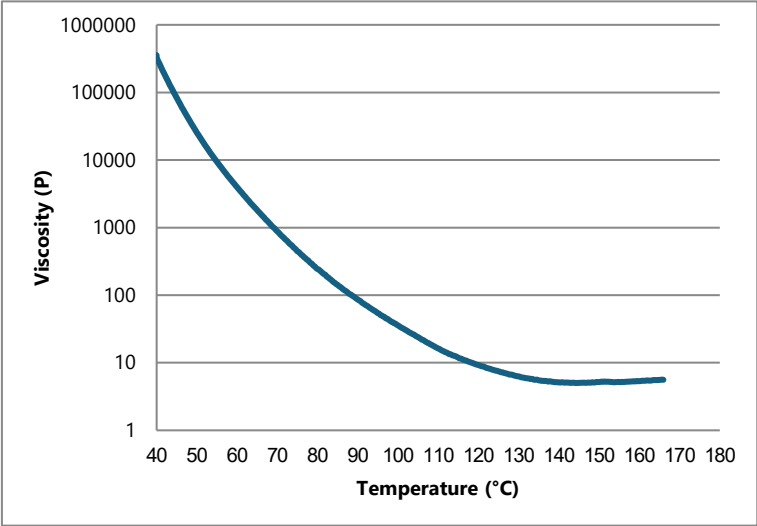
PART NUMBER	FIBER FORMAT	FIBER TYPE/STYLE	FAW (GSM)	RESIN CONTENT (%WT)	ROLL WIDTH (IN)
P17C1AG-145	Unidirectional	T1100G-12K	145	35	Up to 60

STORAGE LIFE

Out Time (Mechanical Life)	28 days @ < 77°F (25°C)
Freezer Life	1 year @ < 10°F (-12°C)

NEAT RESIN PROPERTIES

PROPERTY	METHOD	UNITS	VALUE
Density	ASTM D792	g/cm ³	1.260
Tg (Dry)	ASTM D7028	°F (°C)	521 (272)
Tg (Wet)	ASTM D7028	°F (°C)	389 (198)
Minimum Viscosity @ 3.6°F (2°C)/min	ASTM D4440	Poise @ °F (°C)	5 @ 286 (141)



LAMINA/LAMINATE MECHANICAL PROPERTIES: P17C1AG-145(T1100G UD/Gr 145)

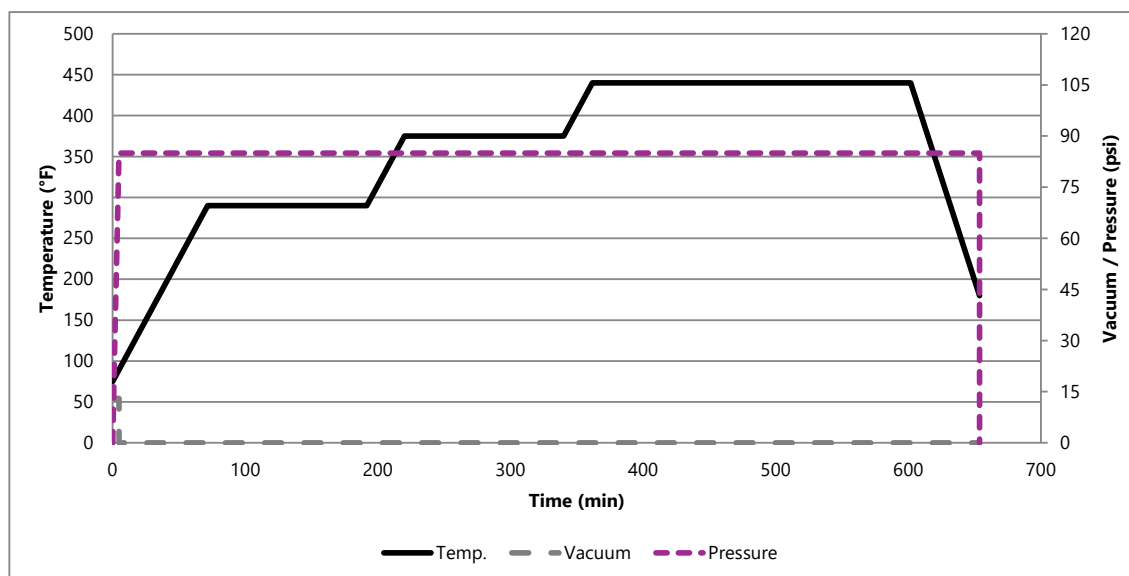
PROPERTY	SYMBOL	METHOD	UNITS	AUTOCLAVE CURE						
				CTA	RTA	ETW ¹	ETW ²	ETW ³	ETW ⁴	ETW ⁵
0° Tensile Strength	F _{1T}	ASTM D3039	Ksi (MPa)	415 (2861)	422 (2910)	431 (2972)				
90° Tensile Strength	F _{2T}	ASTM D3039	Ksi (MPa)	10.6 (73.1)	10.8 (74.5)		4.4 (30.3)			
0° Tensile Modulus	E _{1T}	ASTM D3039	Msi (GPa)	24.0 (165)	23.0 (159)	24.2 (167)				
90° Tensile Modulus	E _{2T}	ASTM D3039	Msi (GPa)	1.34 (9.2)	1.28 (8.8)		0.86 (5.9)			
0° Compressive Strength	F _{1C}	ASTM D6641	Ksi (MPa)	227 (1565)	224 (1544)	161 (1110)	154 (1062)			
0° Compressive Modulus	E _{1C}	ASTM D6641	Msi (GPa)	20.9 (144)	20.7 (143)	20.7 (143)	20.8 (143)			
In-Plane Shear Strength @ 5%	F _{12 @ 5%}	ASTM D5379	Ksi (MPa)	19.2 (132)	15.1 (104)	9.5 (66)	7.2 (50)			
In-Plane Shear Modulus	G ₁₂	ASTM D5379	Msi (GPa)	0.84 (5.8)	0.70 (4.8)	0.50 (3.5)	0.36 (2.5)			
Short Beam Strength	SBS	ASTM D2344	Ksi (MPa)		19.2 (132)	13.3 (92)	10.7 (74)	7.4 (51)	6.7 (46)	5.6 (39)
Open Hole Tensile Srength (QI: 25/50/25)	OHT	ASTM D5766	Ksi (MPa)	68.2 (470)	70.1 (483)	73.0 (503)				
Open Hole Compression Strength (QI: 25/50/25)	OHC	ASTM D6484	Ksi (MPa)	55.7 (384)	48.9 (337)	42.8 (295)	40.6 (280)	36.2 (250)	34.2 (236)	31.1 (214)
Compression After Impact @ 1500in-lb/in (QI: 25/50/25)	CAI	ASTM D7137	Ksi (MPa)		43.8 (302)					
Laminate Density	P	ASTM D792	g/cm3	1.547						
Fiber Volume	V _F	ASTM D3171	%	55.0						
Cured Ply Thickness	CPT	ASTM D3171	In. (mm)	0.0058 (0.147)						

- Notes:
- CTA: -65°F/-54°C, as received
 - RTA: 72°F/22°C, as received
 - ETW1: 180°F/82°C, two week soak
 - ETW2: 250°F/121°C, two week soak
 - ETW3: 350°F/176°C, two week soak
 - ETW4: 375°F/190°C, two week soak
 - ETW5: 400°F/204°C, two week soak
 - *Properties normalized to nominal Vf of 55.0%

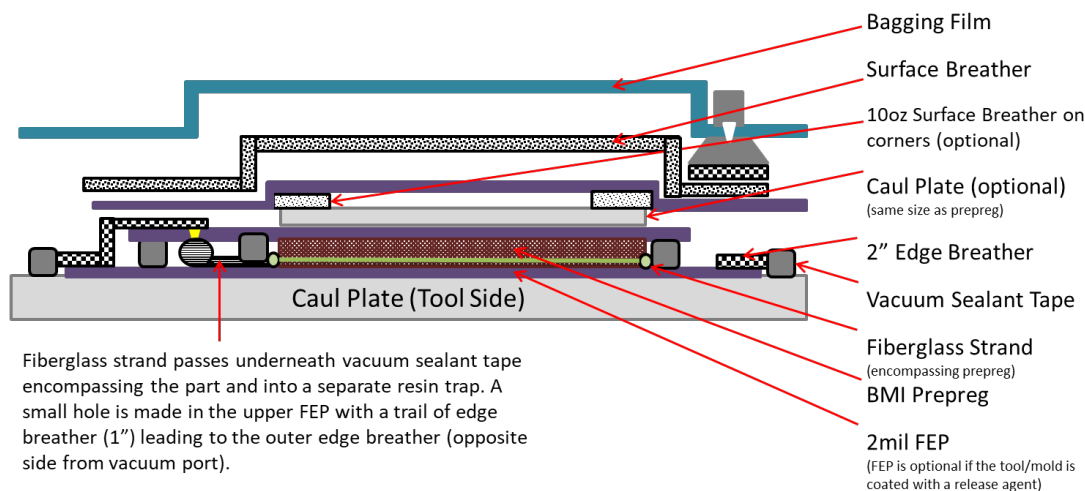
CURE CYCLE - AUTOCLAVE

1. Apply full vacuum* to the part.
2. Apply 85 +15/-0 psi (586 +100/-0 kPa) autoclave pressure.
3. Vent the vacuum bag when the autoclave pressure reaches 20psi (138kPa).
4. Ramp to 290 ± 10°F (143 ± 5°C) at a rate of 3.0 ± 2.0°F (1.7 ± 1.1°C) per minute, hold for 120 minutes.
5. Ramp to 355 ± 10°F (190 ± 5°C) at a rate of 3.0 ± 2.0°F (1.7 ± 1.1°C) per minute, hold for 120 minutes.
6. Ramp to 440 ± 10°F (227 ± 5°C) at a rate of 3.0 ± 2.0°F (1.7 ± 1.1°C) per minute, hold for 240 minutes.
7. Cool vessel to 180°F (80°C) or lower at a maximum rate of 5.0°F (2.8°C) per minute before releasing autoclave pressure.

*Ensure vacuum is within 2inHg of atmospheric pressure



BAGGING SCHEME



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