UF3376 TCR Resin System

Technical Data Sheet

UF3376 is a solvent-free, controlled flow epoxy-based resin. UF3376 is chemically similar to TCR's UF3369 resin system, but with reduced flow during cure and an increased glass transition temperature. The UF3376 prepreg system has excellent mechanical properties, and demonstrates exceptional performance in COPV applications utilizing Type 3 and Type 4 liners.

Available Prepreg Product Formats
- Tow (roving)
- Woven form/fabric

Typical Applications
- High pressure COPV tanks
- Rocket motor cases
- Sporting goods

Shelf Life
- 18 months at -18°C (0°F)
- 3 months at 24°C (75°F)
- 1.5 months at 32°C (90°F)

Benefits/ Features
- Low cure temperature
- High fiber strength translation in pressure vessel (COPV) applications with fibers possessing tensile strengths greater than 700 kpsi
- Tailored flow and tack levels
- Excellent outgas performance

Cure Conditions
Curing cycle for composite parts <6.35 mm or 0.25 inches in thickness

- Ramp ≤ 2.78°C/min to 121°C (250°F)
- Hold for 4 hours at 121°C
- Ramp ≤ 2.78° to ≤ 66°C (150°F)

Thick composite parts (>6.35 mm or 0.25 inches) will require a modified cure cycle. Please contact TCR Composites for more information.

Cured Neat Resin Physical Properties*

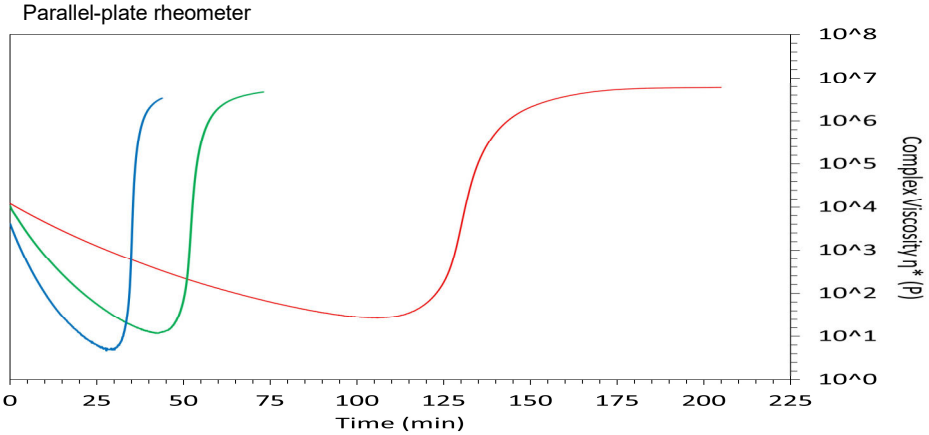
Properties	Metric	English	Test Method
Density	1.18 g/cc	0.0426 lbs/in^3	ASTM D 792
Tensile Strength	97.2 MPa	14.1 kpsi	ASTM D 638
Tensile Modulus	3.3 GPa	478 kpsi	ASTM D 638
Strain (% Elongation)	6.3%		ASTM D 638
Poisson's Ratio	0.32		ASTM D 638
Fracture Toughness – K_{IC}	0.67 MPa*m$^{1/2}$	610 psi*in$^{1/2}$	ASTM D 5045
DMA – Dry Glass Transition			
Glass Transition – E" Peak	139°C	283°F	ASTM E 1640
Glass Transition – E' Onset	134°C	273°F	ASTM E 1640
Glass Transition – Tan δ Peak	147°C	296°F	ASTM E 1640
DMA – Wet Glass Transition**			
Glass Transition – E" Peak	83°C	181°F	ASTM E 1640
Glass Transition – E' Onset	79°C	175°F	ASTM E 1640
Glass Transition – Tan δ Peak	125°C	257°F	ASTM E 1640
Water Absorption**	4.0%		ASTM D 570

*Cure cycle: 4 hours at 121°C

**DMA wet glass transition and water absorption measured after 24-hour water boil

Resin Cure Viscosity

Parallel-plate rheometer



0.56°C (1°F)/min—Min η*: 26.74 P, 97°C (207°F)

1.67°C (3°F)/min—Min η*: 11.71 P, 109°C (228°F)

2.78°C (5°F)/min—Min η*: 4.63 P, 115°C (239°F)

(η*) Time to Viscosity Minimum: {(Min η* Temperature (°C/°F) – (38°C/100°F)} ÷ {(°C/°F)/min}

TCR Composites **219 North 530 West, Ogden, Utah 84404 USA** **1-800-827-3746** **1-801-622-3800**

sales@tcrcomposites.com | www.tcrcomposites.com

Composite Properties

Reinforcement: Intermediate modulus 24K tow carbon fiber: T800SC-24K-10E.
Composite properties normalized to 60% fiber volume and expressed to two significant figures.
Cure cycle: 4 hours at 121°C (250°F) via vacuum bag oven cure, tests conducted at 22°C (72°F)

Properties	Metric	English	Test Method
0° Tensile Strength	3.4 GPa	$5.0x10^2$ kpsi	ASTM D3039
0° Tensile Modulus	190 GPa	28 Mpsi	ASTM D3039
0° Tensile Percent Strain	1.8%		ASTM D3039
0° Tensile Poisson's Ratio	0.25		ASTM D3039
90° Tensile Strength	31 MPa	4.5 kpsi	ASTM D3039
90° Tensile Modulus	7.6 GPa	1.1 Mpsi	ASTM D3039
0° Compressive Strength	1.2 GPa	180 kpsi	SACMA SRM 1R-94
0° Compression Modulus	76 GPa	11 Mpsi	SACMA SRM 1R-94
90° Compression Strength	140 MPa	21 kpsi	SACMA SRM 1R-94
90° Compression Modulus	8.3 GPa	1.2 Mpsi	SACMA SRM 1R-94
Short Beam Strength	63 MPa	9.2 kpsi	ASTM D2344
Flexural Strength	2.1 GPa	310 kpsi	ASTM D790

Composite Properties

Reinforcement: 7781 E Glass Fabric, 8 harness satin weave 8.81 oz/yd^2.
Composite properties are normalized to 60% fiber volume and expressed to two significant figures.
Cure cycle: 4 hours at 121°C (250°F), tests conducted at 22°C (72°F)

Properties	Metric	English	Test Method
0° Tensile Strength	480 MPa	7.0x10^1 kpsi	ASTM D3039
0° Tensile Chord Modulus	26 GPa	3.8 Mpsi	ASTM D3039
0° Tensile Percent Strain	2.2%		ASTM D3039
Max In-Place Shear Stress	1.0x10^2 MPa	15 kpsi	ASTM D3518
In-Plane Shear Stress @ 5% Strain	55 MPa	8.0 kpsi	ASTM D3518
In-Plane Shear Modulus	3.8 GPa	0.55 Mpsi	ASTM D3518
Flexural Shear Strength	58 MPa	8.4 kpsi	ASTM D2344
0° Compressive Strength	5.0x10^2 MPa	73 kpsi	ASTM D6641
0° Compressive Modulus	31 GPa	4.5 Mpsi	ASTM D6641

Reinforcement: 6781 S Glass Fabric, 8 harness satin weave 8.92 oz/yd^2.
Composite properties are normalized to 60% fiber volume and expressed to two significant figures.
Cure cycle: 4 hours at 121°C (250°F), tests conducted at 22°C (72°F)

Properties	Metric	English	Test Method
0° Tensile Strength	670 MPa	97 kpsi	ASTM D3039
0° Tensile Chord Modulus	3.0x10^2 GPa	4.3 Mpsi	ASTM D3039
0° Tensile Percent Strain	2.3%		ASTM D3039
Max In-Place Shear Stress	1.0x10^2 MPa	15 kpsi	ASTM D3518
In-Plane Shear Stress @ 5% Strain	57 MPa	8.3 kpsi	ASTM D3518
In-Plane Shear Modulus	3.7 GPa	540 kpsi	ASTM D3518
Flexural Shear Strength	48 MPa	7.0 kpsi	ASTM D2344
0° Compressive Strength	410 MPa	6.0x10^1 kpsi	ASTM D6641
0° Compressive Modulus	31 GPa	4.5 Mpsi	ASTM D6641

Composite Outgas Properties-Reinforcement: T700SC-12K-50C

Requirement	Result	Limit	Pass/Fail	Test Method
TML	0.23%	<1.00%	Pass	ASTM E595
CVCM	<0.01 %	<0.1%	Pass	
WVR	0.22	N/A	Pass	

TML	CVCM	WVR
Total Mass Loss	Collected Volatile Condensable Material	Water Vapor Recovered

Cure Profiles

Option	Ramp Up	Hold Temperature	Hold Time (hours)	Ramp Down
1	≤2.78°C/min (5°F/min)	121°C (250°F)	4	≤2.78°C/min (5°F/min) to 66°C (150°F) or less
2*		121°C (250°F)	1.5	
3		110°C (230°F)	6	
4		99°C (210°F)	24	

*This cure cycle does not produce the maximum Tg; but will be suitable for well-cured, highly cross-linked and solidified resin. Expected Tg value of 133°C (271°F). Highest performance is obtained with a 4-hour hold at 121°C (250°F).

All values presented within this technical data sheet are expected ranges based on actual test data. Since values are dependent on specimen preparation and test method, TCR Composites cannot guarantee that these properties will be obtained in all cases. Data should be used only as an indication, since part or component properties are highly dependent on user process and design. It is recommended that end users determine the suitability of this material for each application through their own testing and evaluation.