

## PRODUCT DATA SHEET

### DESCRIPTION

Toray TC346 is a high temperature epoxy component prepreg developed for structural applications within Formula 1, NASCAR, and high performance automotive. Toray TC346 is designed to deliver enhanced compression properties to manufactured parts while maintaining a good fracture toughness. When exposed to elevated temperature environments, TC346 composites demonstrate excellent retention of mechanical performance.

Toray TC346 resin system meets SFI specification 56.1 and UL94 V-0 flame-retardancy tests,<sup>1</sup> further demonstrating how the system is ideally suited to satisfy the rigorous demands of the high performance automotive and motorsport markets.

### FEATURES

- ▶ **T<sub>g</sub> 208°C (406°F) after 180°C (356°F) cure cycle**
- ▶ **Structural system—mechanical performance optimized for compression, short-beam shear, fracture toughness**
- ▶ **Excellent retention of properties at elevated temperatures**
- ▶ **Toughened system—good interlaminar fracture toughness energy achieved without significant compromise of compression properties**
- ▶ **<sup>1</sup>Flame-retardant test material: TC346 HM0545 200gsm 2x2 Twill HM63 12K 42% Resin Content**
  - SFI 56.1 (1-ply thickness)
  - UL94 V-0 (2 mm thickness)
- ▶ **Controlled tack level to aid laminating**
- ▶ **Controlled resin flow during recommended cure cycle**
- ▶ **21-day out life at 20°C (68°F)**
- ▶ **12-month storage life at -18°C (0°F)**

### PRODUCT TYPE

135°C (275°F) to 180°C (356°F) Cure High Temperature Epoxy Component Prepreg

### TYPICAL APPLICATIONS

- ▶ Structural applications within Formula 1, NASCAR, and high performance automotive

### SHELF LIFE

<b>Out Life:</b>	21 days at 20°C (68°F)
<b>Storage Life:</b>	12 months at -18°C (0°F)

Out life is the maximum time allowed at room temperature before cure.

#### To avoid moisture condensation

Following removal from cold storage, allow the prepreg to reach room temperature before opening the polythene bag. Typically, the thaw time for a full roll of material will be 4 to 6 hours.

### TYPICAL NEAT RESIN PROPERTIES

Density (ASTM D792)	1.3 g/cm <sup>3</sup> (81.2 lbs/ft <sup>3</sup> )
T <sub>g</sub> (DMA) after 2 hrs at 180°C (356°F) (ASTM D7028)	Onset: 208°C (406°F); Peak tan δ: 228°C (442°F)
T <sub>g</sub> (DMA) after 2 hrs at 200°C (392°F) post cure (ASTM D7028)	Onset: 221°C (430°F); Peak tan δ: 236°C (457°F)
T <sub>g</sub> (DMA) after 3 hrs at 135°C (275°F) (ASTM D7028)	Onset: 156°C (313°F); Peak tan δ: 178°C (352°F)

### SPECIFICATIONS

<b><sup>1</sup>Flame-Retardancy</b>	
SFI 56.1	1-ply thickness
UL94 V-0	2 mm thickness
Test material: TC346 HM0545 200gsm 2x2 Twill HM63 12K 42% Resin Content	



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### MECHANICAL PROPERTIES

Intermediate Modulus 6K Carbon 200gsm 2x2 Twill 42% RC					
Property	Method	Test Temperature			
		RTD (Vf 52.6%)*		RTD Normalized to 55% Vf	
Tensile Strength 0°	BS EN ISO 527-4	1034 MPa	150.0 ksi	1081 MPa	156.8 ksi
Tensile Modulus 0°	BS EN ISO 527-4	72.1 GPa	10.46 Msi	75.4 GPa	10.93 Msi
Poisson's Ratio 0°	BS EN ISO 527-4	0.04		-	
Tensile Strength 90°	BS EN ISO 527-4	956 MPa	138.7 ksi	1000 MPa	145.0 ksi
Tensile Modulus 90°	BS EN ISO 527-4	72.7 GPa	10.54 Msi	76.0 GPa	11.03 Msi
Poisson's Ratio 90°	BS EN ISO 527-4	0.04		-	
Compression Strength 0°	prEN 2850	910 MPa	132.0 ksi	952 MPa	138.0 ksi
Compression Modulus 0°	prEN 2850	65.4 GPa	9.49 Msi	68.4 GPa	9.92 Msi
Compression Strength 90°	prEN 2850	866 MPa	125.6 ksi	906 MPa	131.3 ksi
Compression Modulus 90°	prEN 2850	62.0 GPa	8.99 Msi	64.8 GPa	9.40 Msi
In-Plane Shear Strength	ASTM D 3518 M	148 MPa	21.5 ksi	-	-
In-Plane Shear Modulus	ASTM D 3518 M	4.70 GPa	0.68 Msi	-	-
Poisson's Ratio	ASTM D 3518 M	0.78		-	-
Interlaminar Shear Strength 0°	ASTM D 2344 M	105.6 MPa	15.3 ksi	-	-
Interlaminar Shear Strength 90°	ASTM D 2344 M	105.7 MPa	15.3 ksi	-	-
Mode I Interlaminar Fracture Toughness (G <sub>IC</sub> Strain Energy Release Rate)	prEN 6033	935 J/m <sup>2</sup>		-	-

IM7 fiber  
 Room Temp Dry (RTD)  
 Cured 2 hrs at 180°C (356°F) at 2°C/min 90 psi autoclave cure cycle  
 \*Data is average of 2 batches

## PRODUCT DATA SHEET

### MECHANICAL PROPERTIES

High Modulus M46JB 12K Carbon 140gsm UD 34% RC					
Property	Method	Test Temperature			
		RTD (Vf 62.1%)		RTD Normalized to 60% Vf	
Tensile Strength 0°	BS EN ISO 527-5	1906 MPa	276.4 ksi	1842 MPa	267.1 ksi
Tensile Modulus 0°	BS EN ISO 527-5	258.9 GPa	37.55 Msi	250.1 GPa	36.28 Msi
Poisson's Ratio 0°	BS EN ISO 527-5	0.30		-	-
Tensile Strength 90°	BS EN ISO 527-5	35 MPa	5.1 ksi	-	-
Tensile Modulus 90°	BS EN ISO 527-5	7.4 GPa	1.07 Msi	-	-
Compression Strength 0°	prEN 2850 Type B	1057 MPa	153.3 ksi	1021 MPa	148.1 ksi
Compression Modulus 0°	prEN 2850 Type B	229.9 GPa	33.34 Msi	222.1 GPa	32.22 Msi
Compression Strength 90°	prEN 2850 Type B	256 MPa	37.1 ksi	-	-
Compression Modulus 90°	prEN 2850 Type B	7.7 GPa	1.12 Msi	-	-
In-Plane Shear Strength	ASTM D 3518 M	66 MPa	9.6 ksi	-	-
In-Plane Shear Modulus	ASTM D 3518 M	4.8 GPa	0.70 Msi	-	-
Poisson's Ratio	ASTM D 3518 M	0.80		-	-
Interlaminar Shear Strength 0°	ASTM D 2344 M	95.4 MPa	13.84 ksi	-	-
Flexural Strength 0°	BS EN ISO 14125	1650 MPa	239.3 ksi	1594 MPa	231.2 ksi
Flexural Modulus 0°	BS EN ISO 14125	234 GPa	33.9 Msi	226.1 GPa	32.8 Msi
Mode I Interlaminar Fracture Toughness (G <sub>IC</sub> Strain Energy Release Rate)	prEN 6033	193 J/m <sup>2</sup>		-	-
Room Temp Dry (RTD) Cured 2 hrs at 180°C (356°F) at 2°C/min 90 psi autoclave cure cycle					

## PRODUCT DATA SHEET

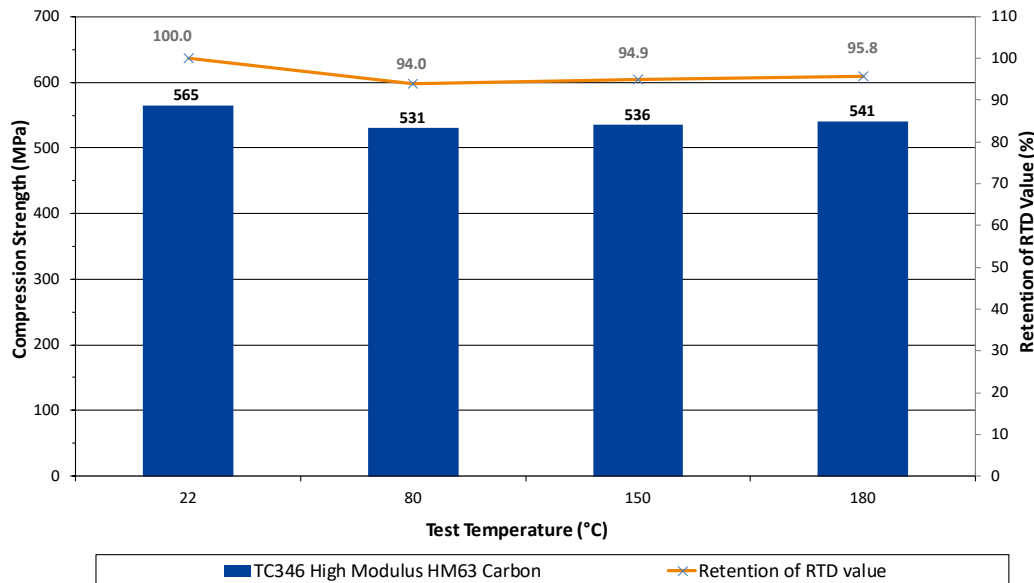
High Modulus M46JB 6K Carbon 200gsm 2x2 Twill 38% RC					
Property	Method	Test Temperature			
		RTD (Vf 55.65%)		RTD Normalized to 55% Vf	
Tensile Strength 0°	BS EN ISO 527-4	596 MPa	86.4 ksi	589 MPa	85.4 ksi
Tensile Modulus 0°	BS EN ISO 527-4	109.6 GPa	15.90 Msi	108.3 GPa	15.71 Msi
Poisson's Ratio 0°	BS EN ISO 527-4	0.01		-	-
Tensile Strength 90°	BS EN ISO 527-4	529 MPa	76.7 ksi	523 MPa	75.8 ksi
Tensile Modulus 90°	BS EN ISO 527-4	103.7 GPa	15.04 Msi	102.5 GPa	14.86 Msi
Poisson's Ratio 90°	BS EN ISO 527-4	0.02		-	-
Compression Strength 0°	prEN 2850 Type B	526 MPa	76.3 ksi	520 MPa	75.4 ksi
Compression Modulus 0°	prEN 2850 Type B	101.1 GPa	14.66 Msi	99.9 GPa	14.49 Msi
Compression Strength 90°	prEN 2850 Type B	493 MPa	71.5 ksi	487 MPa	70.7 ksi
Compression Modulus 90°	prEN 2850 Type B	97.1 GPa	14.08 Msi	96.0 GPa	13.92 Msi
In-Plane Shear Strength	ASTM D 3518 M	102 MPa	14.8 ksi	-	-
In-Plane Shear Modulus	ASTM D 3518 M	4.47 GPa	0.65 Msi	-	-
Poisson's Ratio	ASTM D 3518 M	0.90		-	-
Interlaminar Shear Strength 0°	ASTM D 2344 M	74.3 MPa	10.78 ksi	-	-
Interlaminar Shear Strength 90°	ASTM D 2344 M	75.6 MPa	10.96 ksi	-	-
Mode I Interlaminar Fracture Toughness (G <sub>IC</sub> Strain Energy Release Rate)	prEN 6033	503 J/m <sup>2</sup>		-	-

Room Temp Dry (RTD)  
Cured 2 hrs at 180°C (356°F) at 2°C/min 90 psi autoclave cure cycle

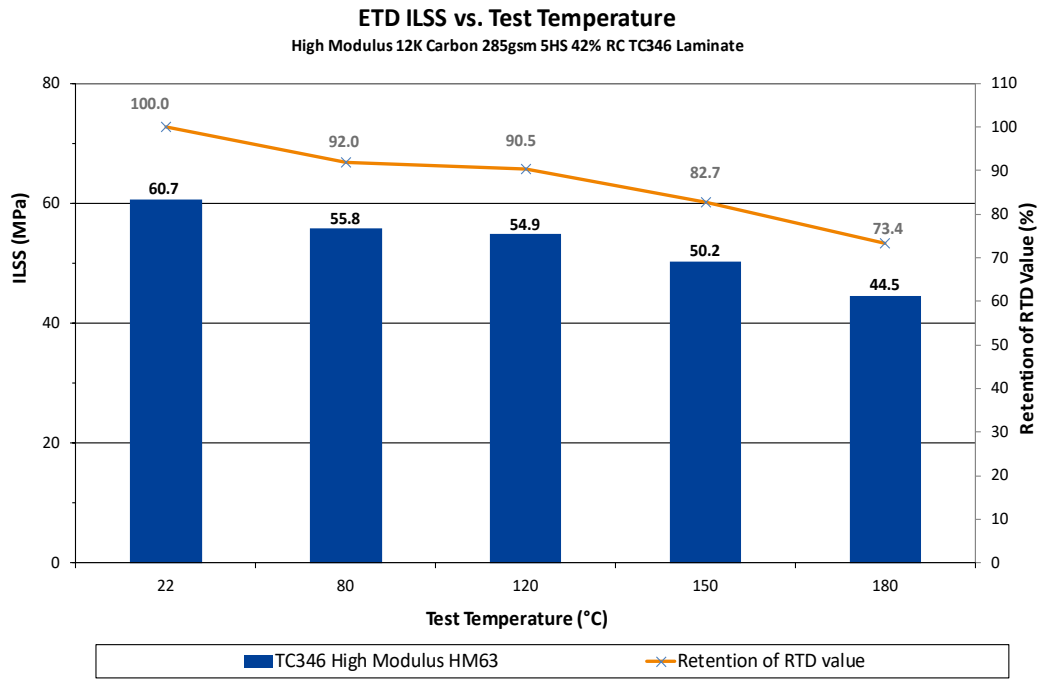
## RETENTION OF MECHANICAL PROPERTIES AT ELEVATED TEMPERATURES

Elevated Temperature Dry (ETD) Cured 2 Hrs at 180°C (356°F) at 2°C/min at 90 psi

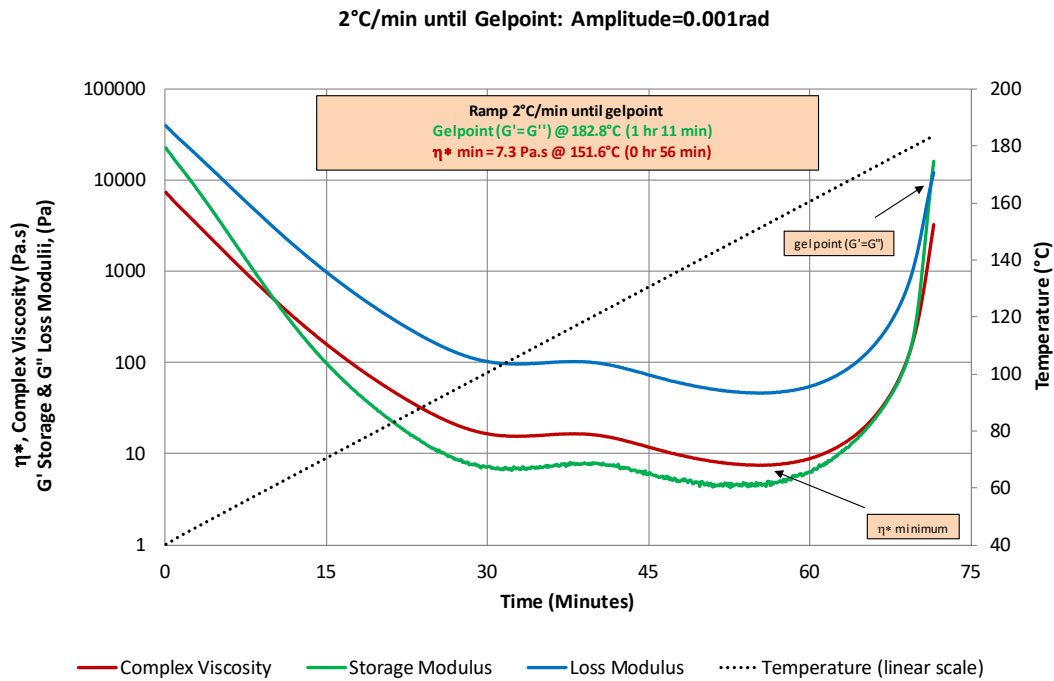
**ETD Compression Strength vs. Test Temperature**  
High Modulus 12K Carbon 285gsm 5HS 42% RC TC346 Laminate



## PRODUCT DATA SHEET



## RHEOLOGY



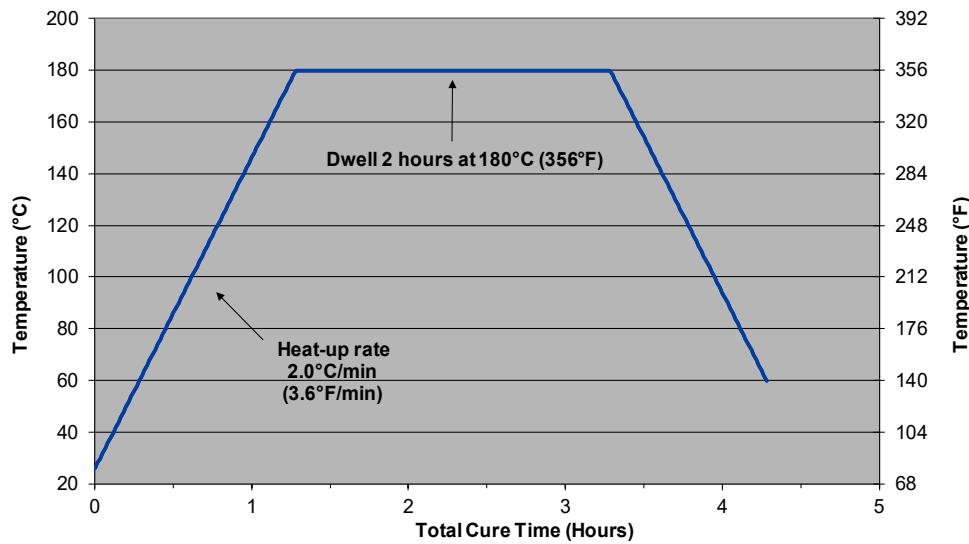
## PRODUCT DATA SHEET

### TYPICAL CURE PROFILE

180°C (356°F) Cure Temperature with 90 psi Pressure		
Ramp	2.0°C (3.6°F)/min to 180°C (356°F)	Dwell for 2 hrs
Cool	2.0°C (3.6°F)/min to 60°C (140°F)	Followed by demold
<b>Total time: 4 hours 30 minutes</b>		

### CURE SCHEDULE

Initial Minimum 180°C Cure Schedule



A 60-minute dwell at 107°C (225°F) may also be used.  
 An alternative cure cycle at 135°C (275°F) may be used followed by a 180°C (356°F) freestanding post cure.

135°C (275°F) Cure Temperature with 90 psi Pressure		
Ramp	2.0°C (3.6°F)/min to 135°C (275°F)	Dwell for 3 hrs
Cool	2.0°C (3.6°F)/min to 60°C (140°F)	Followed by demold
Followed by freestanding post cure for 2 hours at 180°C (356°F)		
<b>Total time: 4 hours 40 minutes</b>		

Alternative cure cycles and molding techniques may be employed. Please consult our technical support engineers for advice on your specific cure requirements.

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### EXOTHERM

In certain circumstances, such as the production of thick section laminates rapid heat-up rates or highly insulating masters, Toray TC346 can undergo exothermic heating leading to rapid temperature rise and component degradation in extreme cases. Where this is likely, a cure incorporating an intermediate dwell is recommended in order to minimize the risk.

### HANDLING SAFETY

Observe established precautions for handling epoxy resins and fibrous materials—wear gloves. For further information, refer to the Safety Data Sheet.

### PROCESSING

Following removal from refrigerated storage, allow the prepreg to reach room temperature before opening the polythene bag, to avoid moisture condensation. Typically, the thaw time for a full roll of material will be 4 to 6 hours. Cut patterns to size and lay-up the laminate in line with design instructions taking care not to distort the prepreg. If necessary, the tack of the prepreg may be increased by gentle warming with hot air. The lay-up should be vacuum debulked at regular intervals using a P3 (pinpricked) release film on the prepreg surface; a vacuum of 948 mbar (28 in Hg) is applied for 10 minutes.

For autoclave cures, use of a nonperforated release film on the prepreg surface trimmed to within 25–30 mm of the prepreg edge is recommended for the cure cycle and a vacuum bag should be installed using standard techniques.

TORAY\_TC346\_PDS\_v2\_2020-10-14 Page 7/7

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