

PRODUCT DATA SHEET

DESCRIPTION

Toray TC420 is a flow-controlled high temperature cyanate ester resin, toughened to resist microcracking. TC420 is specifically formulated to facilitate production of large out-of-autoclave structures. It can act as a self-adhesive system and is resistant to microcracking. This resin represents a new family of next generation high temperature resins, film adhesives, syntactic paste and expanding foams for ultra-high temperature conditions. TC420 is easy to process, and yields low void laminates with a flexible cure cycle under vacuum-only pressure. This system is also autoclave processable. TC420 is an attractive alternative to bismaleimide (BMI) and polyimide resins.

FEATURES

- ▶ High temperature stability and resistance to microcracking
- ▶ Capable of 260°C (500°F) extended dry service with short-term capability to 316°C (600°F)
- ▶ Low void content with OOA/VBO cure
- ▶ Utilizes standard 177°C (350°F) cure temperature with optional freestanding post cure at 232–260°C (450–500°F) to develop full high temperature capability

PRODUCT TYPE

177°C (350°F) Cure Cyanate Ester
High Temperature Toughened Cyanate Ester Resin System

TYPICAL APPLICATIONS

- ▶ Heat shields
- ▶ Ablative structure
- ▶ Missile nose cones/nozzles
- ▶ Supersonic aircraft
- ▶ Very high temperature radomes
- ▶ Attractive alternative to BMI or polyimides

SHELF LIFE

Out Life: 21 days at 21°C (70°F) or below and 60% RH or lower

Frozen Storage Life: 6 months at -18°C (< 0°F) or below

Out life is the maximum time allowed at the conditions noted before cure, after a single frozen storage cycle in the original unopened packaging at -18°C (0°F) or below for a period not exceeding the frozen storage life noted above.

Out life tested by SBS on 16-ply 15 x 15 cm (6 x 6") laminate, cured via out-of-autoclave/vacuum-bag only (OOA/VBO) process with 914–918 mbar (27–28 inHg) of vacuum. Users may need to separately evaluate out life limits on thicker, larger, and more complex parts.

TYPICAL NEAT RESIN PROPERTIES[^]

Density	1.22 g/cc 177°C (350°F) Cure 1.20 g/cc 260°C (500°F) Post Cure
CTE	60 ppm/°C 177°C (350°F) Cure 55 ppm/°C 260°C (500°F) Post Cure

Dry T _g - 2 hours (177°C/350°F) Cure	176°C (349°F)
Wet T _g * - 2 hours (177°C/350°F) Cure	167°C (333°F)
Dry T _g - After post cure 1 hour (260°C/500°F)	348°C (658°F)
Wet T _g * - After post cure 1 hour (232°C/450°F)	289°C (552°F)

Tensile Modulus	3.93 GPa (0.57 Msi)	
Poissons' Ratio	0.38	
Shear Modulus	1.45 GPa (0.21 Msi)	
Outgassing (ASTM E595)	TML CVCM WVR	0.41 % < 0.01% 0.28 %

* 14 days water soak at 71°C (160°F)

[^] Resin T_g properties are reported based on loss modulus.



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ELECTRICAL PROPERTIES OF COMPOSITE LAMINATES

TC420/4581 Quartz	C/X Band 8–18 GHz	Ku/K Band 18–26.5 GHz	Ka Band 26.5–40 GHz	Q & U Band 40–60 GHz
Dielectric Constant	3.33	3.18*	3.24	3.27
Loss Tangent	< 0.010**	< 0.010**	< 0.010**	< 0.010**

* Tested per ASTM D 2520 method A, all other values tested via focused beam.

** The loss tangent under focused beam testing is only sensitive to 0.010. This material is less than 0.010 in all frequency bands noted. This material represents one of Toray's best for high temperature, high energy radome applications.

LAMINATE PROPERTIES

Property	Test Condition	Method	Results			
			1K Standard Modulus Plain Weave Graphite Fabric		1K Standard Modulus Satin Weave Fabric	
Tensile Strength 0°	RTD	ASTM D 3039	676 MPa	98 ksi	-	-
Tensile Modulus 0°	RTD	ASTM D 3039	72 GPa	10.5 Msi	-	-
Compressive Strength 0°	RTD	ASTM D 6641	607 MPa	88 ksi	-	-
Compressive Modulus 0°	RTD	ASTM D 6641	57 GPa	8.2 Msi	-	-
Short Beam Shear	RTD	ASTM D 2344	59 MPa	8.6 ksi	-	-
Compressive Strength ±22.5 QI	RTD	ASTM D 6641	386 MPa	56 ksi	494 MPa	72 ksi
Compressive Modulus ±22.5 QI	RTD	ASTM D 6641	59 GPa	8.6 Msi	-	-
Compressive Strength ±22.5 QI	ETD-350°F (177°C)	ASTM D 6641	335 MPa	48 ksi	-	-
Compressive Modulus ±22.5 QI	ETD-500°F (260°C)	ASTM D 6641	283 MPa	41 ksi	441 MPa	64 ksi

OOA/VBO cured at 177°C (350°F) for 120–180 minutes followed by freestanding post cure at 232°C (450°F) for 60–90 minutes. Tensile and compression results normalized to 55% fiber volume.

MECHANICAL PROPERTIES

Property	Condition	Method	Results			
			12k AS7 Plain Weave Graphite Fabric ⁽¹⁾	3k Standard Modulus Plain Weave Graphite Fabric ⁽²⁾	IM7 4 Harness Satin Weave Graphite Fabric ⁽²⁾	High Modulus 5 HS Satin Weave ⁽²⁾
Tensile Strength 0°	RTD	ASTM D 3039	986 MPa (143 ksi)	724 MPa (105 ksi)	903 MPa (131 ksi)	703 MPa (102 ksi)
Tensile Modulus 0°	RTD	ASTM D 3039	70 GPa (10.1 Msi)	72 GPa (10.5 Msi)	81 GPa (11.7 Msi)	148 GPa (21.5 Msi)
Compressive Strength 0°	RTD	ASTM D 6641	600 MPa (87 ksi)	648 MPa (94 ksi)	593 MPa (86 ksi)	338 MPa (49 ksi)
Compressive Strength 0°	RTD	ASTM D 6641	67 GPa (9.7 ksi)	63 GPa (9.2 ksi)	74 GPa (10.7 ksi)	149 GPa (21.6 Msi)
Short Beam Shear	RTD	ASTM D 2344	57 MPa (8.2 ksi)	-	-	-

Tensile and compression results normalized to 60% fiber volume fraction.

⁽¹⁾ OOA/VBO cured at 177°C (350°F) for 120–180 minutes followed by freestanding post cure at 232°C (450°F) for 60–90 minutes.

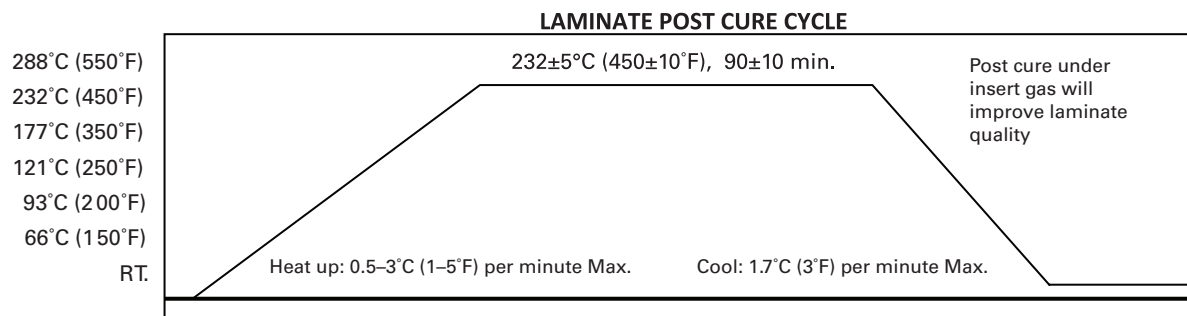
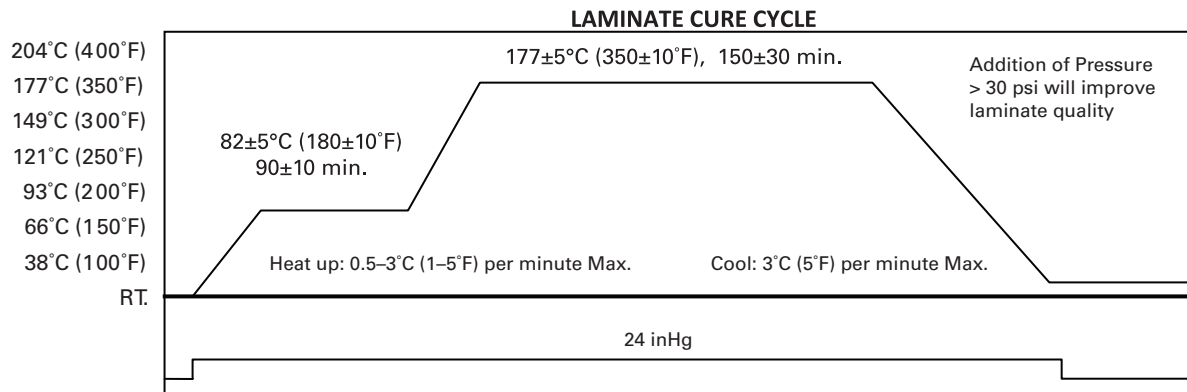
⁽²⁾ 30 psi autoclave cured at 177°C (350°F) for 120–180 minutes followed by freestanding post cure at 232°C (450°F) for 60–90 minutes.

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M46J-12K 195 FAW, 36% RESIN CONTENT UD TAPE

Property	Condition	Method	Results	
Tensile Strength 0°	RTD	ASTM D 3039	1630 MPa	236 ksi
Tensile Modulus 0°	RTD	ASTM D 3039	238 GPa	34.5 Msi
Tensile Strength 90°	RTD	ASTM D 3039	8.3 MPa	1.2 ksi
Tensile Modulus 90°	RTD	ASTM D 3039	6.2 GPa	0.9 Msi
Compressive Strength 0°	RTD	ASTM D 695	643 MPa	93 ksi
Compressive Modulus 0°	RTD	ASTM D 695	226 GPa	32.8 Msi
Compressive Strength 90°	RTD	ASTM D 695	156 MPa	22.6 ksi
Compressive Modulus 90°	RTD	ASTM D 695	6.9 GPa	1.0 Msi
Interlaminar Shear Strength	RTD ^(A)	ASTM D 2344	66.9 MPa	9.7 ksi
Interlaminar Shear Strength	RTD	ASTM D 2344	56.5 MPa	8.2 ksi
Open-hole Tensile Strength	RTD	ASTM D 5766	396 MPa	57.5 ksi
Open-hole Comp. Strength	RTD	ASTM D 6484	202 MPa	29.3 ksi

Cure cycle used was: 1°C (2°F) per minute to 82°C (180°F), for 90 minutes, followed by a (177°C) 350°F cure for 2–3 hours, under OOA/VBO conditions, no bleed. Laminates then underwent a freestanding postcure of 60–75 minutes at 260°C (500°F). Laminates were debulked every 4 plies. Values are normalized to 60% except for 90° values and interlaminar shear strengths. ^(A) Room temperature value without 260°C (500°F) postcure.



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TYPICAL COMPOSITE LAMINATE STACKING SEQUENCE

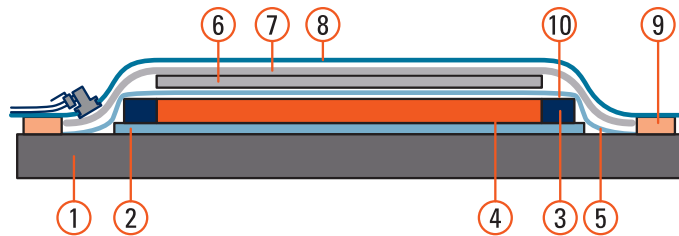
List of Materials

1. Tool—aluminum, steel, Invar, composite *(tool plates must be release coated or film covered). See the list below
2. Release coat or film—Frekote 700NC or 800NC, FEP¹, or TEDLAR²
3. Silicone edge dams for cure—slightly thicker than laminate
4. Laminate
5. FEP¹ or TEDLAR²
6. Caul plate—aluminum, steel, Invar, silicone rubber sheet (metal caul plates must be release coated or wrapped)
7. 2.2 oz/yd² polyester breather, 1 or more
8. Vacuum bag
9. Vacuum sealant
10. Glass yarn string (alternatively or additionally breather may wrap over top of dam to contact edge)

* Composite tools should be thoroughly dried before use.

¹ 260°C (500°F) max temp.

² 177°C (350°F) max temp.



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