



TC410 Resin System

PRODUCT TYPE

Tencate's newest generation
250°F (121°C) Cure Toughened
Cyanate Ester Resin System

TYPICAL APPLICATIONS

- Satellite Structure
- Optical Benches
- Reflectors
- High Dimensional
Stability Space Structures
- Ideal for Radomes and
Radar Transparent Structures

CURE SCHEDULE

3 hours at 250°F (121°C) optional
post cure at 350°F (177°C) for 2 hours
for higher Tg.

PRODUCT DESCRIPTION

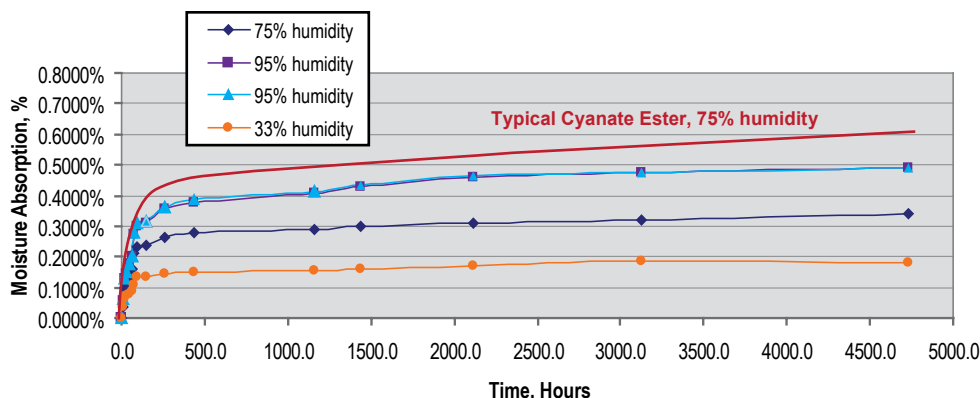
TC410 is Tencate's newest high performance cyanate ester resin system designed specifically for the latest generation of radomes and satellite structures. TC410 is unique in that it allows for low stress cures at 250°F (121°C) while achieving extremely low moisture absorption and high conversion levels. The lower cure temperature allows for lower stress in part fabrication. TC410 possesses all the key attributes for satellite use with good resistance to atomic radiation, low microcracking and excellent resistance to process moisture. TC410 possesses low dielectric and loss tangents for radome usage.

TC410 PRODUCT BENEFITS

- Low stress free cure temperature capable
- Resin is low in moisture sensitivity
- Passes and exceeds space requirements for outgassing
- Low CTE and CME
- Extremely low moisture absorption. Resin is asymptotic after 200 days with less than 0.35% moisture absorption in a 75% RH environment.
- Good dielectric and loss tangent

TYPICAL NEAT RESIN PROPERTIES

Density	1.16 g/cc
	1.14 g/cc after 350°F (177°C Post Cure)
Dry Tg by DMA	234°F (112°C) cured at 260°F (127°C)
Wet Tg by DMA	253°F (123°C) cured at 260°F (127°C)
	conditioned at 160°F (71°C), 85% RH for 21 days
Dry Tg by DMA	358°F (181°C) post cured at 350°F (177°C) for 2 hours
Wet Tg by DMA	349°F (176°C) post cured at 350°F (177°C) for 2 hours
	conditioned at 160°F (71°C), 85% RH for 21 days
Outgassing (ASTM E595) ⁽¹⁾	TML 0.29 %
	CVCN <0.01 %
	WVR 0.17 %
	TML-WVR 0.12 %
Dimensional Stability ⁽¹⁾	CTE 32.475 µin/in/°F
	CME 1205 µin/in/%



TC410 neat resin moisture absorption at room temperature at humidity soaks ranging from 33% to 95% demonstrating TC410's superior resistance to moisture uptake. ⁽¹⁾

TECHNICAL DATA



TENCATE ADVANCED COMPOSITES USA, INC.

TC410 Mechanical Performance on M55J, 90 gsm

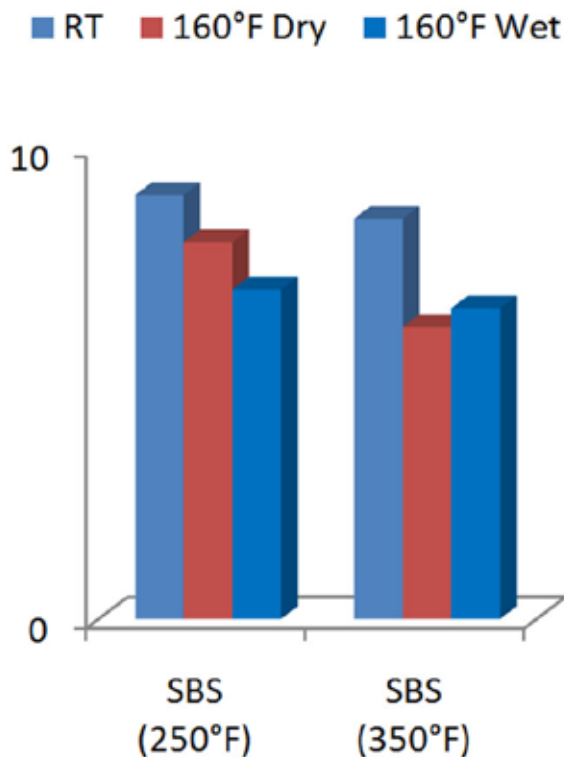
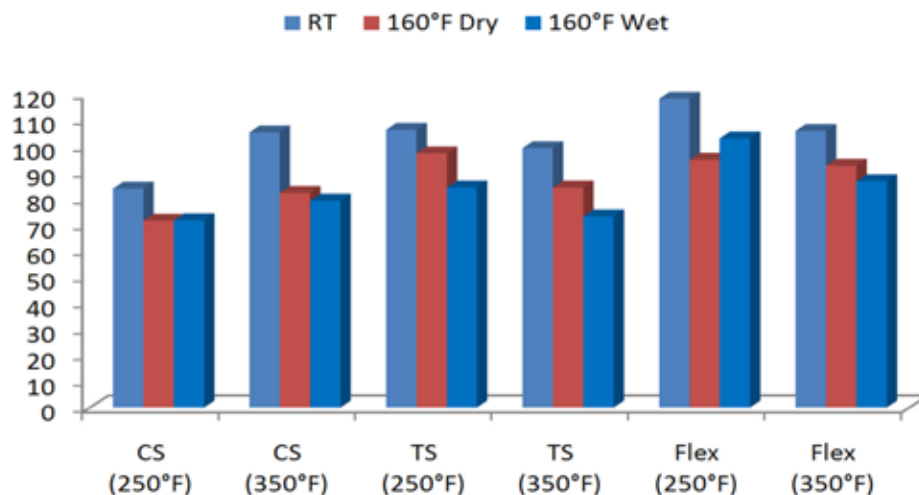
Test Details

250°F = 3 hr 250°F cure

350°F = 2 hr 350°F cure

Wet Conditioning = 160°F,
85% RH for 21 days

Data normalized to
60% fiber volume



TECHNICAL DATA



TENCATE ADVANCED COMPOSITES USA, INC.

TC410 Resin System

LAMINATE TYPE: TORAY M55J, 90 gsm, 0° UNIDIRECTIONAL

Properties	Condition	Method	Results	
			350°F (177°C) Cure	250°F (121°C) Cure
Tensile Strength 0°	RTD	ASTM D 3039	319 ksi (2201 MPa)	304 ksi (2096 MPa)
Tensile Modulus 0°	RTD	ASTM D 3039	45 Msi (307 GPa)	39 Msi (269 GPa)
Tensile Strength 0°	ETD	ASTM D 3039	283 ksi (1951 MPa)	289 ksi (1993 MPa)
Tensile Modulus 0°	ETD	ASTM D 3039	41 Msi (283 GPa)	43 Msi (296 GPa)
Tensile Strength 0°	ETW	ASTM D 3039	282 ksi (1944 MPa)	297 ksi (2048 MPa)
Tensile Modulus 0°	ETW	ASTM D 3039	47 Msi (324 GPa)	45 Msi (310 GPa)
Compression Strength 0°	RTD	ASTM D 6641	138 ksi (951 MPa)	148 ksi (1020 MPa)
Compression Modulus 0°	RTD	ASTM D 6641	47 Msi (323 GPa)	46 Msi (317 GPa)
Compression Strength 0°	ETD	ASTM D 6641	122 ksi (841 MPa)	130 ksi (896 MPa)
Compression Modulus 0°	ETD	ASTM D 6641	48 Msi (118 GPa)	46 Msi (317 GPa)
Compression Strength 0°	ETW	ASTM D 6641	100 ksi (689 MPa)	108 ksi (745 MPa)
Compression Modulus 0°	ETW	ASTM D 6641	45 Msi (307 GPa)	50 Msi (345 GPa)
Flexural Strength 0°	RTD	ASTM D 7264	147 ksi (1016 MPa)	153 ksi (1055 MPa)
Flexural Modulus 0°	RTD	ASTM D 7264	37 Msi (258 GPa)	38 Msi (262 GPa)
Flexural Strength 0°	ETD	ASTM D 7264	125 ksi (862 MPa)	121 ksi (834 MPa)
Flexural Modulus 0°	ETD	ASTM D 7264	37 Msi (255 GPa)	38 Msi (262 GPa)
Flexural Strength 0°	ETW	ASTM D 7264	120 ksi (827 MPa)	116 ksi (800 MPa)
Flexural Modulus 0°	ETW	ASTM D 7264	36 Msi (248 GPa)	TBD
Interlaminar Shear Strength SBS 0°	RTD	ASTM D 2344	8.5 ksi (58 MPa)	8.5 ksi (58 MPa)
Interlaminar Shear Strength SBS 0°	ETD	ASTM D 2344	7.7 ksi (53 MPa)	6.9 ksi (48 MPa)
Interlaminar Shear Strength SBS 0°	ETW	ASTM D 2344	6.9 ksi (47 MPa)	6.4 ksi (44 MPa)

Cure Parameters: Autoclave cure at 85 psi, 3 hours at 250°F (121°C). Post cure is 350°F (177°C) for 2 hours. ETD is 160°F (71°C). ETW is 160°F (71°C), 85% RH, 21 days. Data normalized to 60% fiber volume.

⁽¹⁾ Data provided by ITT Space Systems Division.

TECHNICAL DATA



TENCATE ADVANCED COMPOSITES USA, INC.

TC410 Resin System

Mechanical Performance on 4581 AQIII

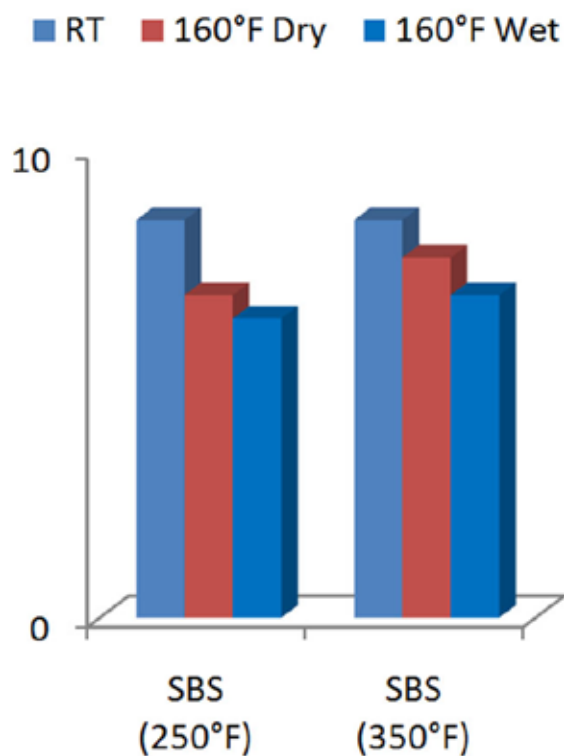
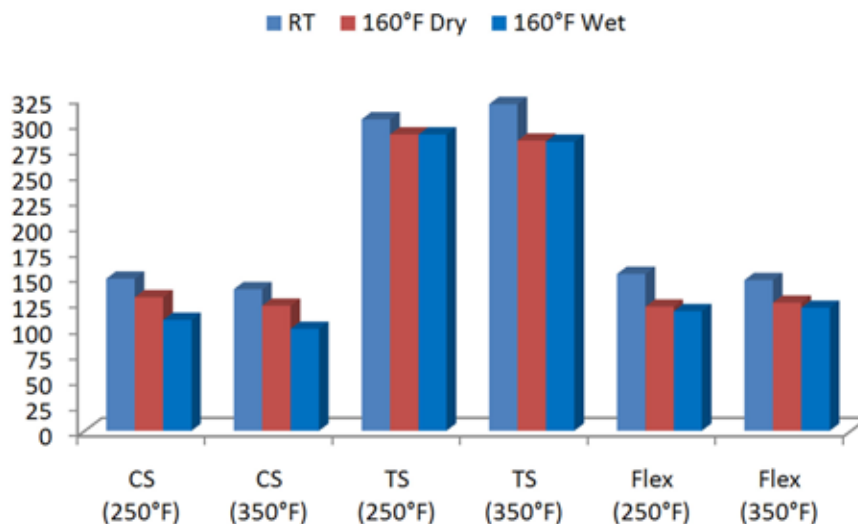
Test Details

250°F = 3 hr 250°F cure

350°F = 2 hr 350°F cure

Wet Conditioning = 160°F,
85% RH for 21 days

Data normalized to
55% fiber volume



TECHNICAL DATA



TENCATE ADVANCED COMPOSITES USA, INC.

TC410 Resin System

LAMINATE TYPE: ASTROQUARTZ 4581 AQ III, FAW 284 gsm, 38 ± 3% RESIN CONTENT

Properties	Condition	Method	Results	
			350°F (177°C) Cure	250°F (121°C) Cure
Tensile Strength	RTD	ASTM D 3039	99 ksi (688 MPa)	106 ksi (731 MPa)
Tensile Modulus	RTD	ASTM D 3039	3.2 Msi (22 GPa)	4 Msi (28 GPa)
Tensile Strength	ETD	ASTM D 3039	84 ksi (578 MPa)	97 ksi (669 MPa)
Tensile Modulus	ETD	ASTM D 3039	3.6 Msi (25 GPa)	4 Msi (27 GPa)
Tensile Strength	ETW	ASTM D 3039	73 ksi (503 MPa)	84 ksi (579 MPa)
Tensile Modulus	ETW	ASTM D 3039	3.3 Msi (23 GPa)	4 Msi (28 GPa)
Compression Strength	RTD	ASTM D 6641	105 ksi (725 MPa)	84 ksi (577 MPa)
Compression Modulus	RTD	ASTM D 6641	4 Msi (30 GPa)	4 Msi (28 GPa)
Compression Strength	ETD	ASTM D 6641	82 ksi (567 MPa)	71 ksi (493 MPa)
Compression Modulus	ETD	ASTM D 6641	4 Msi (30 GPa)	4 Msi (28 GPa)
Compression Strength	ETW	ASTM D 6641	79 ksi (546 MPa)	71 ksi (492 MPa)
Compression Modulus	ETW	ASTM D 6641	4 Msi (29 GPa)	4 Msi (27 GPa)
Flexural Strength	RTD	ASTM D 7264	106 ksi (727 MPa)	118 ksi (814 MPa)
Flexural Modulus	RTD	ASTM D 7264	3 Msi (21 GPa)	3.7 Msi (25 GPa)
Flexural Strength	ETD	ASTM D 7264	92 ksi (634 MPa)	95 ksi (652 MPa)
Flexural Modulus	ETD	ASTM D 7264	3 Msi (21 GPa)	3.6 Msi (25 GPa)
Flexural Strength	ETW	ASTM D 7264	86 ksi (596 MPa)	103 ksi (708 MPa)
Flexural Modulus	ETW	ASTM D 7264	3 Msi (21 GPa)	3.5 Msi (24 GPa)
Interlaminar Shear Strength SBS	RTD	ASTM D 2344	9 ksi (63 MPa)	8.5 ksi (58 MPa)
Interlaminar Shear Strength SBS	ETD	ASTM D 2344	8 ksi (54 MPa)	6.2 ksi (43 MPa)
Interlaminar Shear Strength SBS	ETW	ASTM D 2344	7 ksi (48 MPa)	6.6 ksi (46 MPa)

Cure Parameters: Autoclave cure at 100 psi, 3 hours at 250°F (121°C). Post cure is 350°F (177°C) for 2 hours. ETD is 160°F (71°C). ETW is 160°F (71°C), 85% RH, 21 days. Data normalized to 55% fiber volume.

⁽¹⁾ Flow measured was 25%.

Dry T_g by DMA with 250°F (121°C) cure for 3 hours..... 241°F (116°C)

Dry T_g by DMA with 350°F (177°C) post cure for 2 hours 354°F (179°C)

Wet T_g by DMA with 250°F (121°C) cure 235°F (113°C)

Wet T_g by DMA with 350°F (177°C) post cure 336°F (169°C)

TECHNICAL DATA



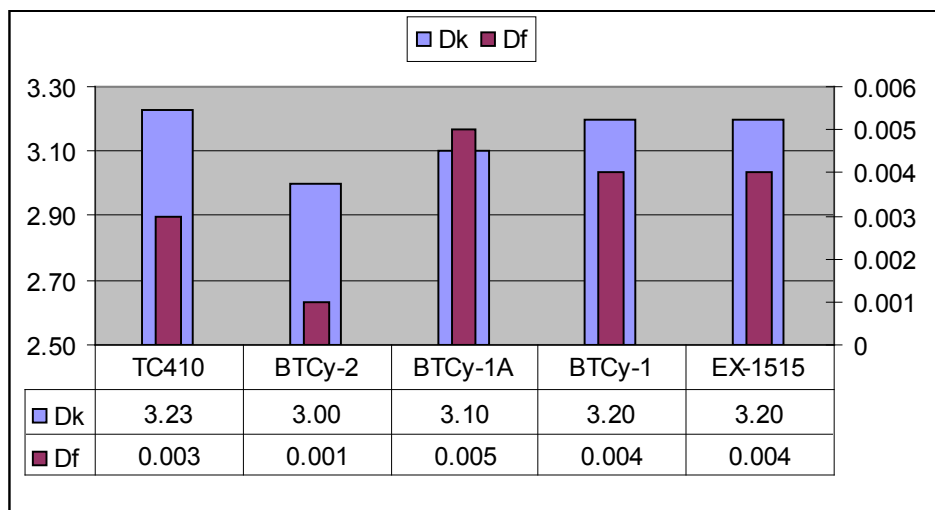
TENCATE ADVANCED COMPOSITES USA, INC.

TC410 Resin System

Dielectric Constant/ Loss Tangent - Quartz Laminate

DIELECTRIC DATA ON QUARTZ LAMINATE AT 10 GHz

Properties	Method	Results	
		350°F (177°C) Cure	250°F (121°C) Cure
Dielectric Constant (Dk)	ASTM D 2520	3.23	3.26
Loss Tangent (Df)	ASTM D 2520	0.0034	0.0057



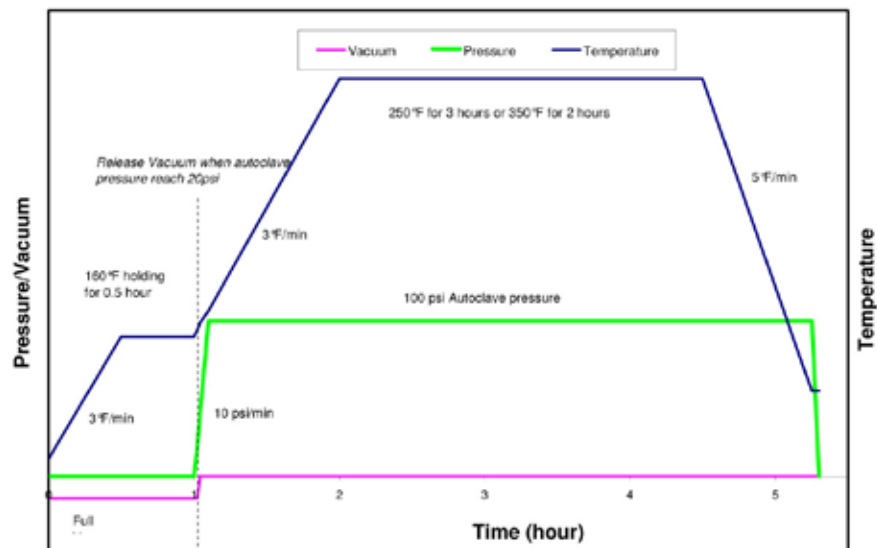
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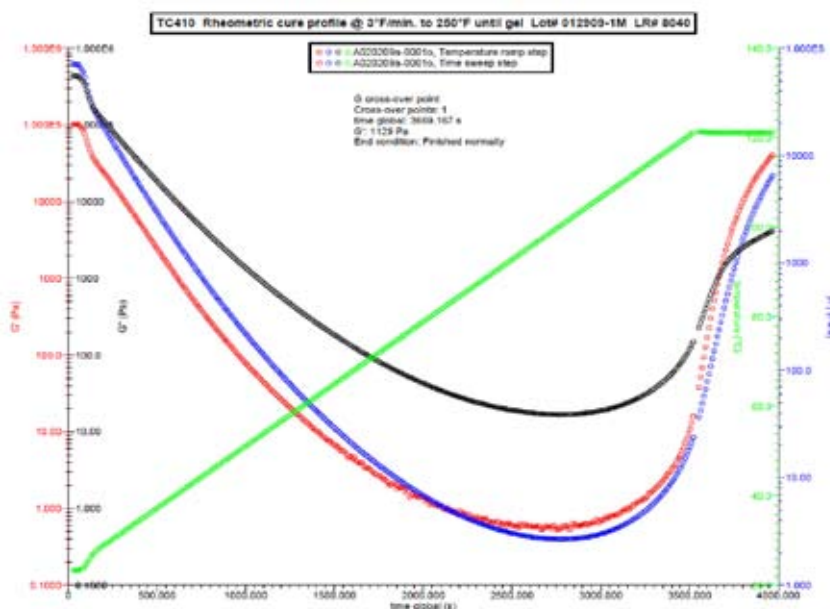
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TC410 Resin System

CURING PROFILE



DYNAMIC VISCOSITY



Temperature profile: 3°F/min to 250°F, holding until gel

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All data given is based on representative samples of the materials in question. Since the method and circumstances under which these materials are processed and tested are key to their performance, and TenCate Advanced Composites USA, Inc. has no assurance of how its customers will use the material, the corporation cannot guarantee these properties.

DS_TC410

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