HexPly® F655™
resin systems for advanced composites

HEXCEL®

Product Data Sheet

Description
HexPly® F655™ is a bismaleimide resin that cures via an addition reaction in a toughened two-phase thermoset matrix with no condensation by-products. HexPly® F655™ is a controlled flow polyimide resin system designed for alternative processing capabilities such as co-curing over honeycomb core, compression molding, as well as standard autoclave processing.

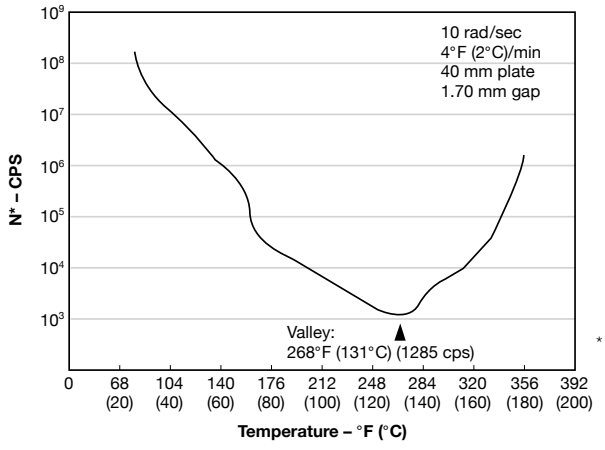
Features
Uncured
- Controlled flow
- Process working life greater than 20 days

Cured
- High laminate mechanical strengths and strains
- High strength retention at 450°F (232°C) dry and 350°F (177°C) wet
- Improved compression after impact properties
- Void-free thick laminate processability
- Void-free thick laminate co-cure processing over honeycomb core
- Long-term service life to 400°F (204°C)
- Excellent electrical properties

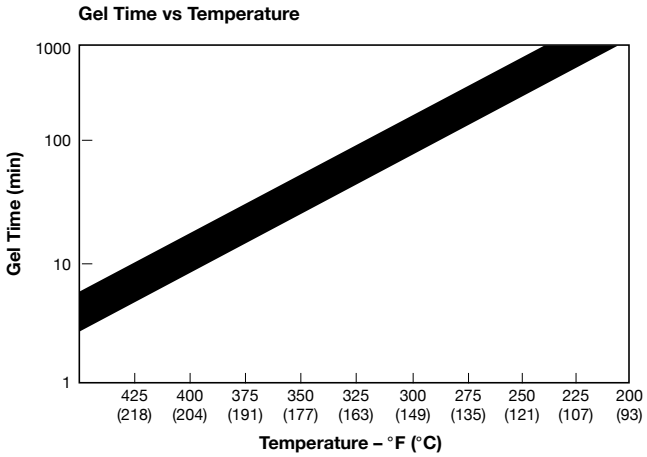
Neat Resin Properties

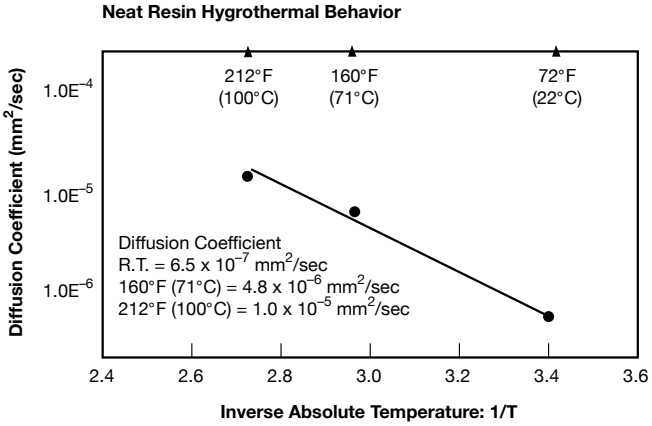
Specific gravity	1.25
T_g dry*	550°F (288°C)
T_g wet*	> 400°F (204°C)
Equilibrium moisture absorption	4.1%
Coefficient of thermal expansion	
Temperature range	75–482°F = 2.66 x 10^{-5} in/in/°F
	24–250°C = 4.78 x 10^{-5} mm/mm/°C
Temperature range	347–482°F = 3.55 x 10^{-5} in/in/°F
	175–250°C = 6.32 x 10^{-5} mm/mm/°C
Fracture toughness, K_{1C}	1.25 ksi $\sqrt{in}$ (1.37 MPa $\sqrt{m}$)

Dynamic Viscosity Analysis



* Test method: DMTA, **E"** peak





Cure Procedure

Thin Laminates: ≤ 0.50" (1.27 cm)

A. Apply vacuum of 22 inches Hg (74 kPa) minimum.

B. Heat to 270 ± 5°F at 2–4°F/minute (132°C at 1.2–2.4°C/minute). Apply 85 ± 5 psig (586 kPa).

C. Dwell at 270 ± 5°F (132°C ± 3°C) for 30 ± 5 minutes. Release vacuum.

D. Heat to 375°F at 2–4°F/minute (191°C at 1.2–2.4°C/minute); cure 4 hours.

E. Cool to 150°F at 5°F/minute (66°C at 3°C/minute) before releasing pressure.

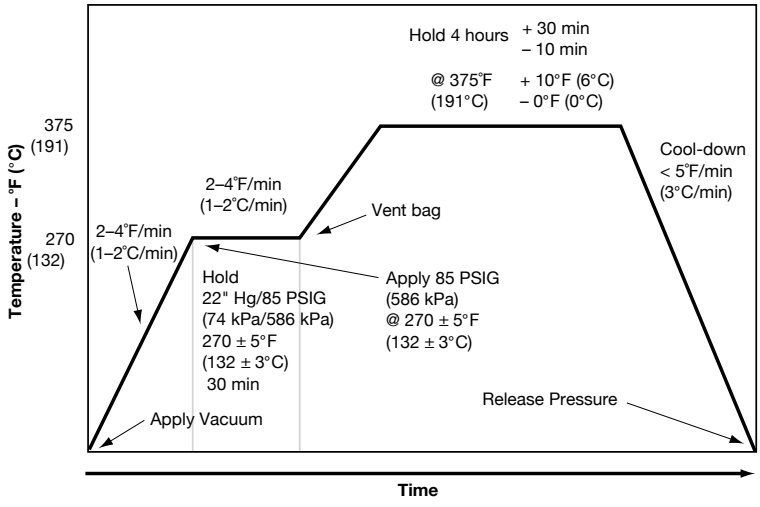
Thick Laminates: > 0.50" (1.27 cm)

Laminates may be cured with modified cure cycle.

Postcure Procedure

- Postcure 16 hours at 450°F (232°C) (free-standing oven).
- Raise temperature from ambient to 375°F at a rate of 5–10°F/minute (191°C at a rate of 3–6°C/minute) and at a rate of 1–2°F/minute (0.6–1.2°C/minute) above 375°F (191°C).

Note: Alternate postcure cycle: 6 hrs at 470°F (243°C) using same rates as standard.



Availability

Form	Hexcel Designation	Fiber	Fiber Areal Wt. g/m²	Weave	Count Warp x Fill	Width Available in (cm)
Carbon Tape	T2T145-12"-F655	T300–12K	145	n/a		2"–24" (5.08–60.96 cm)
	T9A145-12"-F655	IM7–12K	145	n/a		2"–24" (5.08–60.96 cm)
Carbon Fabrics	W3T282-42-F655 Plain Weave	T300–3K	194	Plain	12.5 x 12.5	42" (106.68 cm)
	F3T584-42-F655 8 H.S.	T300–3K	370	8 H.S.	24 x 24	42" (106.68 cm)

Note: Carbon tapes may be produced with various carbon fiber types and tow sizes. In designating tape, the second digit represents tow size and the third digit represents fiber source. Consult your nearest Hexcel Sales Representative for additional information.

Physical Properties

	Property	Carbon Tape	Carbon Fabric
Prepreg	Material description	T2T145	T9A145 (IM7)
	% Volatile content	< 2	< 2
	% Resin content (dry)	33–37	33–37
Laminate	Cured thickness per ply: in (cm)	0.0053–0.0061 (0.013–0.015 cm)	0.0053–0.0061 (0.013–0.015 cm)
	% Fiber volume	55–59	54–59
	Density (g/cm²)	1.53–1.56	1.53–1.56

Dielectric Properties

Material	Frequency (GHz)	Temperature °F (°C)	Dielectric Constant Accuracy ± 2%	Loss Tangent Accuracy ± 1/2 Significant Figure
F655 Resin Casting*	3	75 (24)	3.08	0.004
		300 (149)	3.14	0.005
		450 (232)	3.19	0.006
	9	75 (24)	3.04	0.005
		300 (149)	3.09	0.006
		450 (232)	3.15	0.007
	16	75 (24)	2.98	0.006
		300 (149)	3.04	0.007
		450 (232)	3.11	0.008
Astro Quartz II/F655 Dry	49	75 (24)	3.44	0.003
Astro Quartz II/F655 Wet	49	75 (24)	3.60	0.012
E-Glass/F655 Dry	49	75 (24)	4.44	0.0065
E-Glass/F655 Wet	49	75 (24)	4.65	0.0145

** Testing method: ASTM D2520*

Laminate Mechanical Properties

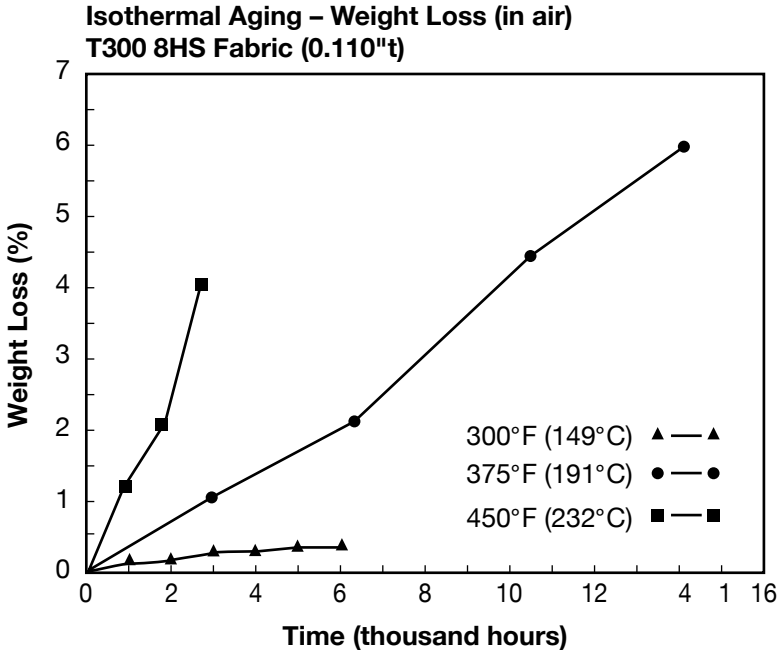
1.33 (9.2)

Properties	Carbon Tapes							
	T300 (6K)				IM7 (12K)			
Autoclave Cured	RT	350°F (177°C)	450°F (232°C)	350°F(W) (177°C)	RT	350°F (177°C)	450°F (232°C)	350°F(W) (177°C)
Tension $(0°)_8$								
Strength: ksi (MPa)	220.0 (1517)				396.0 (2730)		292.0 (2013)	300.0 (2068)
Modulus: msi (GPa)	20.70 (142.7)				23.3 (160.6)		23.7 (163.4)	23.9 (164.8)
Strain: %	1.04				1.61			
Tension $(90°)_{16}$								
Strength: ksi (MPa)					9.53 (66)		6.15 (42)	2.33 (16)
Modulus: msi (GPa)					1.33 (9.2)		1.14 (7.9)	0.871(6.0)
Strain: µ in/in					7668		6215	2875
Compression $(0°)_8$								
Strength: ksi (MPa)	242.4 (1671)	228.5 (1575)		164.3 (113.3	314.3 (2167)		171.3 (1181)	140.4 (968)
Flexure $(0°)_{16}$								
Strength: ksi (MPa)	308.5 (2127)	240.0 (1655	195.9 (1351)	161.0 (1110)				
Modulus: msi (GPa)	20.0 (137.9)	20.1 (138.6)	20.7 (142.7)	18.5 (127.6)				
Flexure $(90°)_{16}$								
Strength: ksi (MPa)	20.1 (138)	15.5 (107)	11.6 (80)	7.0 (48)				
Modulus: msi (GPa)	1.43 (9.9)	1.31 (9.0)	1.11 (7.7)	0.77 (5.3)				
Short Beam Shear $(0°)_{16}$								
Strength: ksi (MPa)	20.6 (142)	12.7 (88)	9.7 (67)	8.0 (55)	18.8 (130)		7.57 (52)	7.57 (52)
Tension $(\pm45°)_{2S}$								
Strength: ksi (MPa)	31.4 (216)	29.3 (202)		21.0 (148)				
Modulus: msi (GPa)	2.39 (16.5)	2.28 (15.7)		0.94 (6.5)				
Shear $(\pm45°)_{2S}$								
Strength: ksi (MPa)	15.7 (108)	14.6 (101)		10.5 (72) 18.2	18.2 (125)		11.5 (79)	10.8 (74)
Modulus: msi (GPa)	0.71 (4.9)	0.63 (4.3)			0.75 (5.2)		0.56 (3.9)	0.40 (2.8)
Edge Delamination $[(\pm25°)2/90°]_S$								
First crack stress: ksi (MPa)	50.0 (345)				35.1 (242)			
Post Impact Compression $(45°, 0°, -45°, 90°)_{4S}$								
Impact Energy 270 in-lb, class 1*								
Strength: ksi (MPa)	31.6 (218)				35.2 (243)			
Modulus: msi (GPa)	6.18 (42.6)				7.5 (51.7)			
Strain: µ in/in	5091				4665			
Damage area: in^2 (cm^2)	1.84 (11.9)				1.87 (12.1)			
Post Impact Compression $(45°, 0°, -45°, 90°)_{4S}$								
Impact energy Impact energy 1500 in-lb, class 2*								
Strength: ksi (MPa)	23.8 (164)				30.7			
Modulus: msi (GPa)	5.65 (38.9)				7.5			
Strain: µ in/in	4268				3672			
Damage area: in^2 (cm^2)	2.26 (14.6)				3.50 (22.6)			
Mode I Strain Energy Release Rate								
GIC in-lb/in^2 (kJ/m^2) – Dry $(0°)_{20}$					1.91 (0.34)			
Mode II Strain Energy Release Rate								
GIC in-lb/in^2 (kJ/m^2) – Dry $(0°)_{20}$					3.85 (0.68)			
Open Hole Compression $(+45°, 0°, -45°, 90°)_{2S}$								
Strength: ksi (MPa)					48.8 (336)		41.4 (285)	35.3 (243)

** BSS 7260, Rev. C*

Properties	Carbon Fabric – T300, Plain Weave				
	–75°F (–59°C)	RT (AMC)	450°F (232°C) (AMC)	450°F (232°C) (D)	350°F (177°C) (W)
Fill tensile strength, ksi (MPa)	83.3 (574)	96.5 (665)	84.0 (579)	92.6 (638)	83.1 (573)
Fill tensile modulus, msi (GPa)	9.4 (64.8)	8.9 (61.4)	8.7 (60.0)	–	8.8 (60.7)
Fill compression strength, ksi (MPa)	161.2 (1111)	129.9 (896)	64.6 (445)	–	60.9 (420)
Fill compression modulus, msi (GPa)	8.51 (58.7)	8.4 (57.9)	–	8.32 (57.4)	8.5 (58.6)
Fill SBS, ksi (MPa)	14.2 (97.88)	13.7 (94.41)	5.5 (37.90)	7.5 (51.68)	6.30 (43.41)

W = wet
D = dry



Storage

HexPly® F655™ prepreg should be sealed in a polyethylene bag and refrigerated, preferably below 32°F (0°C). Following removal from refrigerated storage, allow the prepreg to reach room temperature before opening the polyethylene bag to avoid moisture condensation. Shelf life: 12 months at 0°F (–18°C), 6 months at 40°F (4°C) *(maximum, from date of manufacture).*

Shipping

Prepreg fabric and tape are generally shipped in sealed polyethylene bags in insulated containers packed with dry ice.

Disposal of Scrap

Disposal of this material should be in a secure landfill in accordance with state and federal regulations.

Handling and Safety Precautions

Hexcel recommends that customers observe established precautions for handling polyimide resins and fine fibrous materials. Operators working with this product should wear clean, impervious gloves to reduce the possibility of skin contact and to prevent contamination of the material.

Airborne graphite as a result of sawing, grinding, etc., can present electrical shorting hazards; refer to NASA Technical Memorandum 78652. Safety Data Sheets (MSDS) have been prepared for all Hexcel products and are available to company safety officers on request from your nearest Hexcel Sales Office.

For more information

Hexcel is a leading worldwide supplier of composite materials to aerospace and industrial markets. Our comprehensive range includes:

- HexTow® carbon fibers
- HexForce® reinforcements
- HiMax® multiaxial reinforcements
- HexPly® prepregs
- HexMC®-i molding compounds
- HexFlow® RTM resins
- HexBond™ adhesives
- HexTool® tooling materials
- HexWeb® honeycombs
- Acousti-Cap® sound attenuating honeycomb
- Engineered core
- Engineered products
- Polyspeed® laminates & pultruded profiles
- HexAM® additive manufacturing

For U.S. quotes, orders and product information call toll-free 1-800-688-7734. For other worldwide sales office telephone numbers and a full address list, please go to:

https://www.hexcel.com/contact

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