Advanced Composite Material Portfolio

Selector Guide

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TORAY

Toray Advanced Composites

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Advanced Composite Materials Selector Guide

Introduction to Toray Advanced Composites

Materials Technology and Capabilities

Market-Leading Technology and Capabilities

Toray Advanced Composites is a global leader in the development and manufacture of a wide range of advanced composite material solutions for aerospace, satellite, communications, and high performance industrial markets. Our goal is to increase our customers' advantage with our market-leading product portfolio, a world-class technical support team, and award-winning customer service.

Toray Advanced Composites operates five prepreg manufacturing sites globally, with three facilities in North America and two in Europe. Three of our facilities offer true carbon-free areas to serve the sensitive radome and communication industries with low dielectric constant and low-loss materials. Our major production sites operate aerospace-quality systems and are certified to ISO9001:2015 and/or AS9100D.

Toray Advanced Composites is unique in the industry, offering a broad spectrum of thermoplastic and thermoset prepreg systems, with particular expertise in high performance thermoplastic composites (under the brand name Toray Cetex®). Our broad product portfolio supports programs from prototyping through to high-volume manufacture of parts.

AmberTool®

Cetex®

MicroPly™

Your Global Partner

Our state-of-the-art manufacturing facilities around the world allow Toray to efficiently supply composite materials to global customers.
Ongoing investments in facilities and personnel ensure production excellence to meet today's requirements and tomorrow's demand. Stop by and see for yourself. We welcome customer visits and look forward to the opportunity to work with you on your next project.

Innovation

Investing in innovation for over 45 years, our strong customer focus on tailored systems, combined with our comprehensive laboratory and testing capabilities, allows for rapid development, customization, and database development. Our experience in thermoset and thermoplastic resins, various composite fibers, and part design allows us to rapidly innovate to customer needs. Recognized in the industry for providing optimized fiber and resin solutions, we deliver advanced customer-oriented products to the market.

For more product information such as product data sheets, case studies, or technical papers, please use the following resources:

Search for the **Toray TAC Product Selector**

www.toraytac.com
Go to our online resource center for case studies and technical papers

Thermoset Epoxy

Advanced Composite Prepreg Product Selector

✔ *Toray MicroPly™ product properties are not fire-retardant*
✔ *Minimum cure temperature applies to ensure product performance*
✔ *Toray MicroPly™ products compatible with the resin matrix indicated*

Since each application and material combination is unique, the customer is responsible for performing their own evaluations for specific uses of the Toray MicroPly™ products in their own applications.

	RESIN MATRIX	NEAT RESIN DRY T_g ONSET	CURE TEMPERATURE AND TIME	KEY PRODUCT CHARACTERISTICS	OUT LIFE # DAYS	FREEZER LIFE # MONTHS	PRODUCT FORMATS			PROCESSING					PRODUCT ATTRIBUTES									FILM ADH					SYNTACTICS						MARKET SEGMENTS						
							UD TAPE	WOVEN PREPREG	RTL LAMINATE	OOA/VBO	AUTOCLAVE	PRESS FORMING	AFP/ATL	POST CURABLE	TOUGHENED	FLAME RETARDANT	CHEMICAL RESISTANT	CORROSION RESISTANT	IMPACT RESISTANT	HIGH TEMPERATURE PERFORMANCE	LOW MOISTURE ABSORPTION	LOW TEMPERATURE CURE	LOW DIELECTRIC LOSS & CONSTANT	EF72	EF8020	RS-15H	TC263	TC310	EM-3	EM-5A	SC72A	SC8020	TCF4035	TCF4045	AEROSTRUCTURES	SPACE AND SATELLITE	LAUNCH	RADOMES	AIRCRAFT INTERIORS	ENGINES/HIGH TEMP	INDUSTRIAL
8020	Epoxy	121°C (250°F)	80°C (176°F) 5.5 hours	▸ Flexible cure schedules 70–130°C (158–266°F) ▸ Post curable for higher T_g applications	30	12	○	○		○	○	○			○		○	○				○			✔						✔										○
8020-FR	FR Epoxy	121°C (250°F)	80°C (176°F) 5.5 hours	▸ Good adhesive properties to honeycomb core ▸ Fire resistant under FAR 25.853 Appendix F material test criteria	30	12		○		○	○	○			○	○	○	○				○			✔																○
BT250E-1	Epoxy	125°C (257°F)	121°C (250°F) 60 minutes	▸ Aerospace flight qualified ▸ MIL-R-9300 qualified ▸ Flame-retardant version available	30	12	○	○		○	○	○				○	○	○					○				✔		✔				✔		○			○			
BT250E-6	Epoxy	131°C (268°F)	127°C (260°F) 2 hours	▸ Aerospace flight qualified ▸ High modulus system for rotor blades ▸ Complete FAA-accepted database on four product forms	30	12	○	○		○	○	○					○	○									✔		✔				✔		○						
E650	Epoxy	121°C (250°F)	70°C (158°F) 3.5 hours	▸ Easier lamination due to medium tack level	5	12		○		○	○	○			○		○	○				○			✔						✔										○
E720	Epoxy	110°C (230°F)	120°C (248°F) 60 minutes	▸ Honeycomb bondable	60	12	○	○		○	○	○			○		○	○						✔							✔										○
E721-FR	FR Epoxy	120°C (248°F)	120°C (248°F) 60 minutes	▸ Direct lamination to honeycomb without the use of resin film ▸ Fire resistant under FAR 25.853 Appendix F material test criteria (ii) ▸ MicroPly™ SC72A cure at 125°C minimum	60	12	○	○		○	○	○			○	○	○	○									✔		✔		✔		✔						○		○
E722	Modified Epoxy	120°C (248°F)	120°C (248°F) 60 minutes	▸ Excellent drapeability ▸ General purpose component prepreg	60	12	○	○		○	○	○			○		○	○						✔							✔										○
E726	Modified Epoxy	105°C (221°F)	120°C (248°F) 60 minutes	▸ Controlled flow ▸ Good surface finish	60	12	○	○		○	○	○			○		○	○						✔							✔										○
E731	Epoxy	140°C (284°F)	125°C (257°F) 60 minutes	▸ Enhanced resin clarity for cosmetic components	14	12	○	○		○	○	○			○		○	○						✔							✔										○
E732	Epoxy	170°C (338°F)	160°C (230°F) 4 minutes	▸ Hot-in hot-out press processing ▸ Short cure cycles 120–160°C (248–320°F)	21	6	○	○		○	○	○			○		○	○						✔							✔										○
E745	Epoxy	118°C (244°F)	135°C (275°F) 60 minutes	▸ High toughness and impact properties	60	12	○	○		○	○	○			○		○	○	○																						○
E750	Epoxy	148°C (298°F)	135°C (275°F) 60 minutes	▸ Flexible cure schedules 80–180°C (176–356°F) ▸ Structural applications with F1 ▸ MicroPly™ SC72A cure at 125°C minimum	60	12	○	○		○	○	○			○		○	○				○					✔					✔										○
E760	Epoxy	204°C (399°F)	180°C (356°F) 2 hours	▸ High temperature resistance and high mechanical performance ▸ Exceptional high temperature performance	21	12	○	○		○	○	○			○		○	○		○									✔												○
EX-1522	Modified Epoxy	180°C (356°F)	177°C (350°F) 2 hours	▸ Fire retardant, V-0 level ▸ Low moisture absorption ▸ Low outgassing, low dielectric constant and loss	21	12	○	○			○	○			○	○	○	○			○		○						✔		✔				✔	○	○		○			
RS-1	Epoxy	107°C (225°F)	93°C (200°F) 90 minutes	▸ Excellent balance of mechanical properties, toughness, and modulus	30	6	○	○		○	○	○										○				✔												○			○
RS-17B	Epoxy	171°C (340°F)	177°C (350°F) 2 hours	▸ Flexible cure system (135°C–177°C) ▸ Extensive space flight heritage	30	12	○	○			○	○		○	○		○	○			○								✔		✔				✔		○				

Thermoset Epoxy

Advanced Composite Prepreg Product Selector

✔ *Toray MicroPly™ products compatible with the resin matrix indicated*

Since each application and material combination is unique, the customer is responsible for performing their own evaluations for specific uses of the Toray MicroPly™ products in their own applications.

	RESIN MATRIX	NEAT RESIN DRY T_g ONSET	CURE TEMPERATURE AND TIME	KEY PRODUCT CHARACTERISTICS	OUT LIFE # DAYS	FREEZER LIFE # MONTHS	PRODUCT FORMATS			PROCESSING					PRODUCT ATTRIBUTES									FILM ADH					SYNTACTICS							MARKET SEGMENTS AEROSPACE						
							UD TAPE	WOVEN PREPREG	RTL LAMINATE	OOA/VBO	AUTOCLAVE	PRESS FORMING	AFP/ATL	POST CURABLE	TOUGHENED	FLAME RETARDANT	CHEMICAL RESISTANT	CORROSION RESISTANT	IMPACT RESISTANT	HIGH TEMPERATURE PERFORMANCE	LOW MOISTURE ABSORPTION	LOW TEMPERATURE CURE	LOW DIELECTRIC LOSS & CONSTANT	EF72	EF8020	RS-15H	TC263	TC310	EM-3	EM-5A	SC72A	SC8020	TCF4035	TCF4045	AEROSTRUCTURES	SPACE AND SATELLITE	LAUNCH	RADOMES	AIRCRAFT INTERIORS	ENGINES/HIGH TEMP	INDUSTRIAL
RS-36 & RS-36-1	Epoxy	181°C (358°F)	177°C (350°F) 90 minutes	▸ Lower cost resin system compared to cyanate esters ▸ RS-36-1 is the higher T_g version	30	12	○	○		○	○	○			○		○	○			○							✔					✔			○					
TC250	Epoxy	140°C (285°F) 180°C (356°F) with post cure	130°C (265°F) 2 hours post cure 180°C (356°F) 2 hours	▸ Aerospace flight qualified ▸ Toughened system ▸ Post curable for higher T_g ▸ Flame-retardant version available ▸ NCAMP database on fabric version	30	12	○	○		○	○	○		○	○	○	○	○					○				✔		✔				✔		○		○	○			
TC264-1	Epoxy	124°C (255°F)	118-127°C (245-260°F) 90 minutes	▸ Ideal for flame retardancy applications ▸ Ideal for ducting and composite panels	30	12	○	○		○	○	○			○	○	○	○																					○		
TC275-1	Epoxy	164°C (327°F) 183°C (362°F) with post cure	135°C (275°F) 6 hours post cure (optional) 177°C (350°F) 2 hours	▸ Aerospace flight qualified ▸ Low moisture uptake, high T_g retention ▸ Ideal system for large structures ▸ OOA/VBO processable	14	12	○	○		○	○	○	○	○	○		○	○	○		○							✔	✔	✔				✔		○	○	○				
TC275-1E	Epoxy	168°C (334°F)	135°C (275°F) 6 hours post cure (optional) 177°C (350°F) 2 hours	▸ Longer out time version of TC275-1 ▸ Allows construction of thick or larger composites structures ▸ OOA/VBO processable	21	12	○	○		○	○	○	○	○	○		○	○	○		○							✔	✔	✔				✔		○	○	○				
TC346 NEW	Epoxy	221°C (430°F)	180°C (356°F) 2 hours post cure 200°C (392°F)	▸ Structural values retained at high temperatures ▸ High temperature resistance ▸ SFI 56.1 flame retardancy at 1-ply thickness and UL94 V0 flame retardancy at 2 mm thickness (200g 2x2 Twill HM63 12K 42% RC)	21	12	○	○			○			○	○	○	○	○		○									✔													○
TC350-1	Epoxy	191°C (376°F)	177°C (350°F) 2 hours	▸ Industry standard 177°C epoxy ▸ Good hot/wet properties ▸ Good CAI properties 221 MPa (32 ksi)	45	12	○	○		○	○	○	○		○		○	○	○	○	○								✔					✔		○		○				
TC380	Epoxy	201°C (394°F)	180°C (356°F) 2 hours	▸ Aerospace flight qualified ▸ Excellent balance of OHC and CAI properties ▸ Excellent hot/wet strength retention	28	12	○	○		○	○		○		○		○	○	○	○	○								✔					✔		○		○				
TC522	Modified Epoxy	189°C (372°F)	180°C (356°F) 2 hours	▸ Outstanding compression after impact ▸ Low dielectric constant and loss ▸ Outstanding hot/wet properties	21	12	○	○		○	○				○		○	○	○		○		○						✔		✔				✔					○			
TC750 NEW	Epoxy	160°C (320F)	180°C (356F) 2 hours	▸ Versatile cure schedules—80°C (176°F) to 180°C (356°F) ▸ Toughened system with good balance of mechanical properties ▸ Optimized tack and drape	60	12	○	○			○			○	○				○	○									✔					✔	✔							○

Thermoset Cyanate Ester

Advanced Composite Prepreg Product Selector

✔ *Toray MicroPly™ products compatible with the resin matrix indicated*

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	RESIN MATRIX	NEAT RESIN DRY T_g ONSET	CURE TEMPERATURE AND TIME	KEY PRODUCT CHARACTERISTICS	OUT LIFE # DAYS	FREEZER LIFE # MONTHS	PRODUCT FORMATS			PROCESSING					PRODUCT ATTRIBUTES									TORAY MICROPLY™									MARKET SEGMENTS						
																								FILM ADH					SYNTACTICS				AEROSPACE						
							UD TAPE	WOVEN PREPREG	RTL LAMINATE	OOA/VBO	AUTOCLAVE	PRESS FORMING	AFP/ATL	POST CURABLE	TOUGHENED	FLAME RETARDANT	CHEMICAL RESISTANT	CORROSION RESISTANT	IMPACT RESISTANT	HIGH TEMPERATURE PERFORMANCE	LOW MOSITURE ABSORPTION	LOW TEMPERATURE CURE	LOW DIELECTRIC LOSS & CONSTANT	EX-1516	EX-1543	RS-4A	SF-5	TC4015	EM-5A	TCF4001	TCF4035	TCF4050	AEROSTRUCTURES	SPACE AND SATELLITE	LAUNCH	RADOMES	AIRCRAFT INTERIORS	ENGINES/HIGH TEMP	INDUSTRIAL
BTCy-1	Cyanate Ester	190°C (374°F) 238°C (461°F) with post cure	177°C (350°F) 90 minutes post cure (optional) 232°C (450°F) 2 hours	▸ Low moisture absorption ▸ Low dielectric constant and loss	14	12	○	○			○			○			○	○		○	○		○		✔		✔		✔							○			
BTCy-1A	Cyanate Ester	185°C (365°F) 207°C (405°F) with post cure	177°C (350°F) 2 hours at post cure (optional) 204°C (400°F) 60 minutes	▸ Toughened version of BTCy-1 ▸ Low void content with lower pressure cures ▸ Ideal for satellite or radome applications	30	12	○	○			○			○	○		○	○			○		○		✔		✔		✔					○		○			
BTCy-2	Cyanate Ester	191°C (375°F)	177°C (350°F) 90 minutes	▸ Toray lowest dielectric loss prepreg ▸ Ideal for high-energy radomes	14	6	○	○			○						○	○		○	○		○		✔		✔		✔							○			
EX-1515	Cyanate Ester	121°C (249°F) 174°C (345°F) with post cure	121°C (250°F) 3 hours post cure (optional) 177°C (350°F) 2 hours	▸ 121°C (250°F) curing cyanate ester system for low-residual cure stresses ▸ Post curable for higher T_g	21	12	○	○			○			○	○		○	○			○		○	✔							✔			○		○			
RS-3/ RS-3C	Cyanate Ester	191°C (375°F) 254°C (490°F) with post cure	177°C (350°F) 2 hours post cure (optional) 232°C (450°F) 60 minutes	▸ Industry standard prepreg system for satellite structures ▸ Low dielectric constant and loss	30	12	○	○		○	○			○	○		○	○		○	○		○			✔	✔							○		○			
TC410	Cyanate Ester	112°C (234°F) 181°C (358°F) with post cure	121°C (250°F) 3 hours post cure (optional) 177°C (350°F)	▸ Lowest CTE, CME, outgassing ▸ Ideal system for stable structures	7	6	○	○			○			○	○		○	○			○		○	✔							✔			○					
TC420	Cyanate Ester	176°C (349°F) 348°C (658°F) with post cure	177°C (350°F) 3 hours post cure (optional) 260°C (500°F)	▸ Toray's highest temperature cyanate ester ▸ Excellent thermal stability ▸ Epoxy-like processing with T_g of BMI ▸ Used on heatshields and supersonic leading edges	21	12	○	○		○	○			○	○		○	○		○	○		○					✔	✔	✔		✔	○	○	○	○		○	○

Thermoset High Temperature Polyimide and BMI

Advanced Composite Prepreg Product Selector

✔ *Toray MicroPly™ products compatible with the resin matrix indicated*

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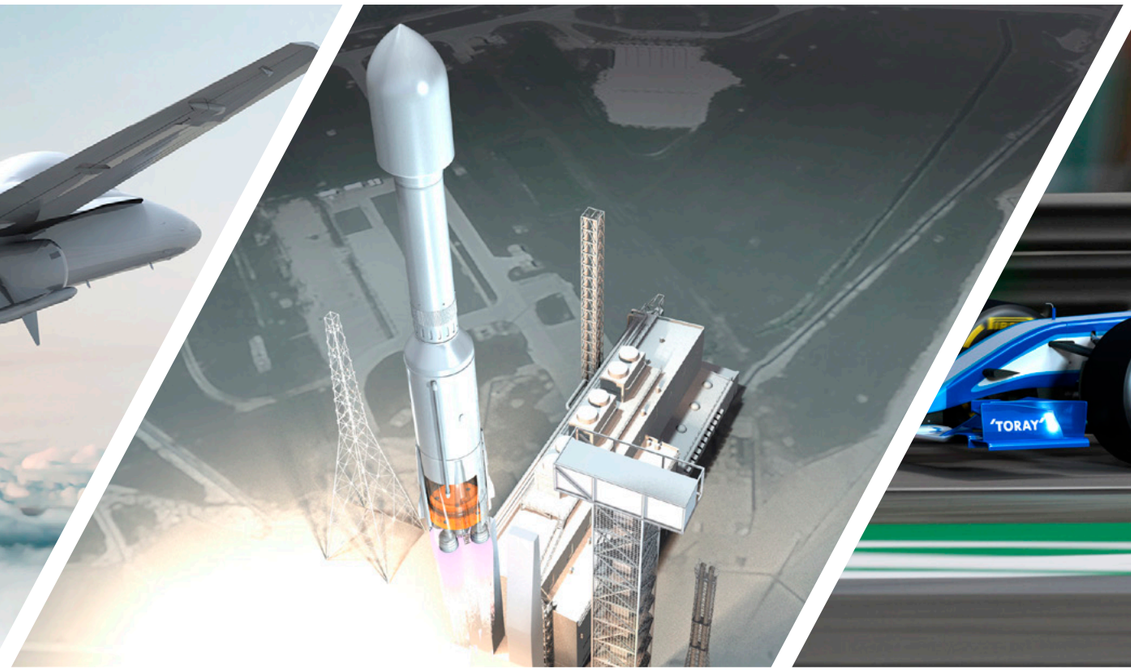
	RESIN MATRIX	NEAT RESIN DRY T_g ONSET	CURE TEMPERATURE AND TIME	KEY PRODUCT CHARACTERISTICS	OUT LIFE # DAYS	FREEZER LIFE # MONTHS	PRODUCT FORMATS			PROCESSING					PRODUCT ATTRIBUTES								TORAY MICROPLY™		MARKET SEGMENTS						
																							FILM ADH	SYNTACTICS	AEROSPACE						
							UD TAPE	WOVEN PREPREG	RTL LAMINATE	OOA/VBO	AUTOCLAVE	PRESS FORMING	AFP/ATL	POST CURABLE	TOUGHENED	FLAME RETARDANT	CHEMICAL RESISTANT	CORROSION RESISTANT	IMPACT RESISTANT	HIGH TEMPERATURE PERFORMANCE	LOW MOSITURE ABSORPTION	LOW TEMPERATURE CURE	DS77	SF-44	AEROSTRUCTURES	SPACE AND SATELLITE	LAUNCH	RADOMES	AIRCRAFT INTERIORS	ENGINES/HIGH TEMP	INDUSTRIAL
RS-8HT	BMI	203°C (397°F) 285°C (545°F) with post cure	204°C (400°F) 2 hours followed by 250°C (482°F) 6 hours	▸ Excellent high temperature thermal stability ▸ Good moisture resistance ▸ Moderate toughness	30	6	○	○			○	○	○	○			○	○		○				✔	○		○	○		○	
RS-51	Polyimide AFR-PE-4	366°C (690°F)	Call for cure details	▸ Ultra-high service temperature for jet engine applications	10	6	○	○			○						○	○		○			✔		○			○		○	
TC890	Polyimide 900HT	454°C (850°F)	Call for cure details	▸ Non-MDA PMR-15 replacement ▸ Short-term service temperature capability of 538°C (1000°F)	30	12	○	○			○						○	○		○			✔		○			○		○	
NRPE	Polyimide	371°C (700°F)	Call for cure details	▸ Better hot/wet properties versus AFR-PE-4E ▸ Lower pressure cure processing ▸ More robust processing of thick components versus AFR-PE-4E ▸ Post cure not required	30	12	○	○			○						○	○		○			✔		○		○	○		○	



Thermoset

Toray Cetex® Thermoplastic

Advanced Composite Prepreg and Laminate Product Selector

Cetex®

T_m *Melting point temperature; only shown for semi-crystalline (PAEK family) thermoplastic products*

Thermoplastic

	POLYMER	MELTING TEMPERATURE T_m	PROCESSING TEMPERATURE T_p	KEY PRODUCT CHARACTERISTICS	PRODUCT FORMATS			PROCESSING				PRODUCT ATTRIBUTES								MARKET SEGMENTS						
																				AEROSPACE						
					UDTAPE	WOVEN PREPREG	RTL LAMINATE	WELDABLE/JOINTING	AUTOCLAVE	PRESS FORMING	AFP/ATL	DURABILITY/ TOUGHNESS	FLAME RETARDANT	CHEMICAL RESISTANT	CORROSION RESISTANT	IMPACT RESISTANT	HIGH TEMPERATURE PERFORMANCE	LOW MOSITURE ABSORPTION	MECHANICAL PERFORMANCE	AEROSTRUCTURES	SPACE AND SATELLITE	LAUNCH	RADOMES	AIRCRAFT INTERIORS	AERO ENGINES	INDUSTRIAL
TC910	PA6 Nylon 6	220°C (428°F)	249–271°C (480–520°F)	▸ Temperature and solvent resistant ▸ Use as a preform insert for compression and overmolding to improve part performance	○			○	○	○	○	○		○	○	○			○							○
TC915 NEW	PA+™ High-Performance Polyamide	243°C (469°F)	260–300°C (500–572°F)	▸ Exceptional mechanical properties higher than typical polyamide-based composites and Nylon materials. ▸ Excellent resistance to water absorption for better solvent resistance. ▸ Excellent producibility and formability	○					○	○	○		○		○			○							○
TC940	PET Polyethylene-Terephthalate	215°C (419°F)	240–270°C (435–518°F)	▸ Good impact resistance for recreational and low cost applications	○			○	○	○	○	○		○	○	○		○								○
TC960	PP Polypropylene	160°C (320°F)	199–216°C (390–421°F)	▸ High toughness for vehicle and low cost applications	○			○	○	○	○	○		○	○	○		○								○
TC1000 Design	PEI Polyetherimide	Amorphous	320–350°C (608–662°F)	▸ Laminates are available to customer specifications ▸ Excellent FST performance ▸ Lower cost option than Premium where OEM specifications are not required		○	○	○	○	○		○	○	○	○	○	○	○	○					○		○
TC1000 Premium	PEI Polyetherimide	Amorphous	320–350°C (608–662°F)	▸ Excellent FST performance (OSU < 15/15) ▸ Moderate solvent resistance ▸ Widely used in aircraft interiors, qualified to OEM specifications		○	○	○	○	○		○	○	○	○	○	○	○	○	○				○	○	○
TC1100	PPS Polyphenylenesulfide	280°C (536°F)	300–330°C (572–626°F)	▸ Microcrack free ▸ Low flammability, achieves 35/35 for OSU performance ▸ Good CAI properties 229 MPa (33.2 ksi) ▸ Ideal for leading edges, beams, clips, and floor panels	○	○	○	○	○	○	○	○	○	○	○	○		○	○	○				○	○	○
TC1200	PEEK Polyetheretherketone	343°C (649°F)	370–400°C (698–752°F)	▸ Good high temperature properties ▸ Very good CAI properties 265 MPa (38.4 ksi) ▸ Ideal for structural applications	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○				○	○	○
TC1225	LMPAEK Low-Melt Polyaryletherketone	305°C (581°F)	340-385°C (644-725°F)	▸ Lower processing temperature with good high temperature performance ▸ May be overmolded with PEEK for final part ▸ Very good CAI properties 282 MPa (40.9 ksi) ▸ Ideal for structural applications	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○				○	○	○
TC1320	PEKK Polyetherketoneketone	337°C (639°F)	370–400°C (698–752°F)	▸ Outstanding solvent and impact resistance ▸ Very high CAI properties 337 MPa (48.9 ksi) ▸ Ideal for structural applications ▸ Lower processing temperature material	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○					○	

Thermoplastic

Toray MicroPly™ Film Adhesives Thermoset

Advanced Composite Film Adhesive Product Selector

MicroPly™

Since each application and material combination is unique, the customer is responsible for performing their own evaluations for specific uses of the Toray MicroPly™ products in their own applications.

	RESIN MATRIX	NEAT RESIN DRY T_g ONSET	CURE TEMPERATURE AND TIME	KEY PRODUCT CHARACTERISTICS	OUT LIFE # DAYS	FREEZER LIFE # MONTHS	PROCESSING					PRODUCT ATTRIBUTES								MARKET SEGMENTS						
																				AEROSPACE						
							OOA / VBO	AUTOCLAVE	PRESS FORMING	AFP/ATL	POST CURABLE	TOUGHENED	FLAME RETARDANT	CHEMICAL RESISTANT	CORROSION RESISTANT	IMPACT RESISTANT	HIGH TEMPERATURE PERFORMANCE	LOW MOSITURE ABSORPTION	LOW TEMPERATURE CURE	AEROSTRUCTURES	SPACE AND SATELLITE	LAUNCH	RADOMES	AIRCRAFT INTERIORS	ENGINES/HIGHTEMP	INDUSTRIAL
Toray MicroPly™ Film Adhesives Epoxy																										
EF72	Epoxy	112°C (234°F)	120°C (248°F)—60 minutes	▸ High strength ▸ Excellent filleting to honeycomb core	30	12	○	○	○			○		○	○											○
EF8020	Epoxy	102°C (215°F)	80°C (176°F)—5.5 hours Alternate cures are available	▸ Flexible cure schedules 70–130°C (158–266°F) ▸ Ideal for metal or composite bonding	30	12	○	○	○			○		○	○				○							○
RS-15H	Epoxy	99°C (211°F)[1]	93°C (200°F)—6 hours Alternate cures are available	▸ Low temperature curing adhesive	30	12	○	○	○			○		○	○				○	○	○		○			
TC263	Epoxy	110°C (230°F)	121°C (250°F)—2 hours	▸ High peel strength ▸ Ideal for metal or composite bonding	21	12	○	○	○			○		○	○					○	○	○	○	○		
TC310	Epoxy	157°C (315°F)	177°C (350°F)—2 hours	▸ Ideal composite bonding film adhesive	21	12	○	○	○			○		○	○					○	○	○	○		○	
Toray MicroPly™ Film Adhesives Cyanate Ester																										
EX-1516	Cyanate Ester	126°C (258°F)	121°C (250°F)—5 hours	▸ Compatible with Toray EX-1515 prepreg	21	12	○	○	○		○	○		○	○			○			○		○			
EX-1543	Cyanate Ester	191°C (376°F) 211°C (412°F) with post cure	177°C (350°F)—2 hours post cure (optional) 204°C (400°F)—2 hours	▸ Low-shrinkage cyanate ester film adhesive ▸ Low outgassing	14	6	○	○	○		○	○		○	○			○			○		○			
RS-4A	Cyanate Ester	195°C (383°F) 238°C (460°F) with post cure	177°C (350°F)—2 hours post cure (optional) 232°C (450°F) 1.5–2 hours	▸ Moisture-resistant cyanate ester film adhesive ▸ Compatible with 177°C (350°F) curing cyanate ester prepregs	14	6	○	○	○		○	○		○	○			○			○		○			
TC4015	Cyanate Ester	176°C (349°F) 321°C (610°F) with post cure	177°C (350°F)—2 hours post cure (optional) 232°C (450°F)—> 60 min	▸ Excellent high temperature properties ▸ Compatible with TC420	14	6	○	○	○		○	○		○	○		○	○		○	○	○	○		○	○

1 - T_g estimated from base resin data

Toray MicroPly™ Film Adhesives High Temperature Polyimide

	RESIN MATRIX	DRY T_g ONSET	CURE TIME AND TEMPERATURE	KEY PRODUCT CHARACTERISTICS	OUT LIFE # DAYS	FREEZER LIFE # MONTHS	PRODUCT FORMATS			PROCESSING					PRODUCT ATTRIBUTES								MARKET SEGMENTS						
																							AEROSPACE						
							UD TAPE	WOVEN PREPREG	RTL LAMINATE	OOA / VBO	AUTOCLAVE	PRESS FORMING	AFP/ATL	POST CURABLE	TOUGHENED	FLAME RETARDANT	CHEMICAL RESISTANT	CORROSION RESISTANT	IMPACT RESISTANT	HIGH TEMPERATURE PERFORMANCE	LOW MOSITURE ABSORPTION	LIGHTNING STRIKE PROTECTION	AEROSTRUCTURES	SPACE AND SATELLITE	LAUNCH	RADOMES	AIRCRAFT INTERIORS	ENGINES/HIGHTEMP	INDUSTRIAL
DS77	Polyimide	310–360°C (590–680°F) depending on final cure temperature	327–371°C (620–700°F)—2 hours minimum	▸ Compatible with RS-51 (AFRPE), NRPE, TC890 (900HT), 635LM, PMR-15 ▸ 260–288°C (500°–550°F) service capability ▸ Does not contain MDA ▸ Available as a film, supported or unsupported	14	6	○	○	○		○						○	○		○			○			○		○	

Ancillary Composite Materials

Toray MicroPly™ Syntactics Thermoset

Advanced Composite Syntactic Product Selector

MicroPly™

Since each application and material combination is unique, the customer is responsible for performing their own evaluations for specific uses of the Toray MicroPly™ products in their own applications.

Toray MicroPly™ Surfacing Films Epoxy

	RESIN MATRIX	NEAT RESIN DRY T_g ONSET	CURE TEMPERATURE AND TIME	KEY PRODUCT CHARACTERISTICS	TACK LIFE # DAYS	FREEZER LIFE # MONTHS	PROCESSING					PRODUCT ATTRIBUTES								MARKET SEGMENTS						
																				AEROSPACE						
							OOA / VBO	AUTOCLAVE	PRESS FORMING	AFP/ATL	POST CURABLE	TOUGHENED	FLAME RETARDANT	CHEMICAL RESISTANT	CORROSION RESISTANT	IMPACT RESISTANT	HIGH TEMPERATURE PERFORMANCE	LOW MOSITURE ABSORPTION	LIGHTNING STRIKE PROTECTION	AEROSTRUCTURES	SPACE AND SATELLITE	LAUNCH	RADOMES	AIRCRAFT INTERIORS	ENGINES/HIGHTEMP	INDUSTRIAL
TC235SF-1	Epoxy Surfacing Film	119°C (246°F)	121°C (250°F) 60 minutes	▸ Excellent protective surface finish ▸ Available with embedded lightning strike foils ▸ Reduces shop floor finishing for productivity savings ▸ Generally compatible with 120°C and 177°C curing epoxy resin prepreg systems	30	12	○	○	○			○		○	○				○	○						
TC248SF NEW	Epoxy	112°C (233°F)	120°C-135°C (248°F-275°F)	▸ Smooth, pin-free, sandable surface with minimum preparation for painting ▸ Excellent surface finish from autoclave processing ▸ Good tack and drape	30	12		○				○														○

Toray MicroPly™ Syntactics Epoxy

	RESIN MATRIX	NEAT RESIN DRY T_g ONSET	CURE TEMPERATURE AND TIME	KEY PRODUCT CHARACTERISTICS	OUT LIFE # DAYS	FREEZER LIFE # MONTHS	PRODUCT FORMATS			PROCESSING					PRODUCT ATTRIBUTES								MARKET SEGMENTS						
																							AEROSPACE						
							FILM	PASTE	EXPANDING	OOA / VBO	AUTOCLAVE	PRESS FORMING	AFP/ATL	POST CURABLE	TOUGHENED	FLAME RETARDANT	CHEMICAL RESISTANT	CORROSION RESISTANT	IMPACT RESISTANT	HIGH TEMPERATURE PERFORMANCE	LOW MOSITURE ABSORPTION	LOW TEMPERATURE CURE	AEROSTRUCTURES	SPACE AND SATELLITE	LAUNCH	RADOMES	AIRCRAFT INTERIORS	ENGINES/HIGH TEMP	INDUSTRIAL
EM-3	Epoxy	116°C (240°F)[1]	121°C (250°F) 60 minutes	▸ High expansion (8–10 x) 0.64 g/cc (40 pcf) density	14	12	○		○		○				○		○	○					○	○		○			
ES72A-2	Epoxy	114°C (237°F)	Minimum 125°C (257°F) 60 minutes	▸ Density/strength tailored by changing cure pressure/limiting volume available for expansion	30	12	○		○	○	○						○	○											○
SC72A	Epoxy	106°C (222°F)	120°C (248°F) 60 minutes	▸ Low density ▸ Easily contoured and shaped	30	12	○			○	○				○		○	○											○
SC8020A	Epoxy	106°C (222°F)	80°C (176°F)— 5.5 hours Alternate cures are available	▸ Low density ▸ Flexible cure schedules 70–130°C (158–266°F)	30	12	○			○	○				○		○	○				○							○
TCF4035	Epoxy	140°C (284°F)	130°C (265°F) 2 hours	▸ Low density 0.64 g/cc (40 pcf) ▸ Compatible with 121–135°C (250–275°F) curing materials e.g., TC250 ▸ Post curable for higher T_g	21	12	○			○	○			○	○		○	○					○		○	○			
TCF4045	Modified Epoxy	180°C (356°F)	179°C (355°F) 3 hours	▸ Excellent low dielectric loss and constant ▸ Density of 0.61 g/cc (38.5 pcf)	14	6	○			○	○				○		○	○					○			○			

1 - T_g estimated from base resin data

Ancillary Composite Materials

Toray MicroPly™ Syntactics Thermoset

Advanced Composite Syntactic Product Selector

MicroPly™

Since each application and material combination is unique, the customer is responsible for performing their own evaluations for specific uses of the Toray MicroPly™ products in their own applications.

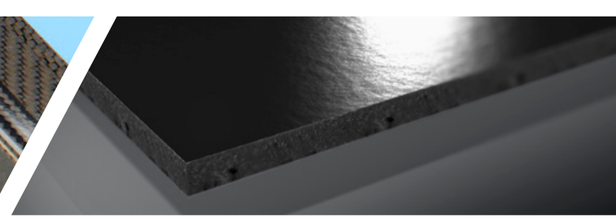
Toray MicroPly™ Syntactics Cyanate Ester

	RESIN MATRIX	NEAT RESIN DRY T_g ONSET	CURE TEMPERATURE AND TIME	KEY PRODUCT CHARACTERISTICS	OUT LIFE # DAYS	FREEZER LIFE # MONTHS	PRODUCT FORMATS			PROCESSING					PRODUCT ATTRIBUTES								MARKET SEGMENTS						
																							AEROSPACE						
							FILM	PASTE	EXPANDING	OOA / VBO	AUTOCLAVE	PRESS FORMING	AFP/ATL	POST CURABLE	TOUGHENED	FLAME RETARDANT	CHEMICAL RESISTANT	CORROSION RESISTANT	IMPACT RESISTANT	HIGH TEMPERATURE PERFORMANCE	LOW MOSITURE ABSORPTION	LOW TEMPERATURE CURE	AEROSTRUCTURES	SPACE AND SATELLITE	LAUNCH	RADOMES	AIRCRAFT INTERIORS	ENGINES/HIGH TEMP	INDUSTRIAL
EM-5A	Cyanate Ester	204°C (400°F) post cure (optional)	177°C (350°F)—2 hours	▸ Expansion ratio of 4 x	28	12	○		○	○	○			○	○		○	○						○		○			○
EX-1541	Cyanate Ester	227°C (441°F) 240°C (464°F) with post cure	177°C (350°F)—2 hours post cure 232°C (450°F)—2 hours	▸ Density of 0.16–0.38 g/cc (10–24 pcf) ▸ Good structural properties ▸ Low dielectric constant and loss	14	6		○			○	○		○						○	○			○		○	○	○	
SF-5	Cyanate Ester	193°C (379°F) 254°C (490°F) with post cure	177°C (350°F)–2 hours post cure 249°C (480°F)—2 hours	▸ Density of 0.61 g/cc (38 pcf) ▸ Low dielectric constant and loss ▸ Compatible with Toray RS-3	14	6	○			○	○	○		○	○					○	○		○	○		○		○	
TCF4001	Cyanate Ester	176°C (349°F) post cure (optional)	177°C (350°F)—2 hours post cure 232°C (450°F) 60–90 minutes	▸ Low density 0.38 g/cc (24 pcf) ▸ Compatible with TC420 prepregs	14	6		○		○	○			○			○	○		○	○		○	○		○		○	○
TCF4050	Cyanate Ester	176°C (349°F) 232°C (450°F) with post cure	177°C (350°F)—2 hours post cure 232°C (450°F) 60 minutes	▸ Expanding syntactic film/core splice ▸ Density of 0.28–0.55 g/cc (17–35 pcf) ▸ Compatible with TC420 prepregs	7	6	○		○	○	○			○	○		○	○		○	○		○	○		○		○	○

Toray MicroPly™ Syntactics Other Thermoset Matrices

	RESIN MATRIX	NEAT RESIN DRY T_g ONSET	CURE TEMPERATURE AND TIME	KEY PRODUCT CHARACTERISTICS	OUT LIFE # DAYS	FREEZER LIFE # MONTHS	PRODUCT FORMATS			PROCESSING					PRODUCT ATTRIBUTES								MARKET SEGMENTS						
																							AEROSPACE						
							FILM	PASTE	EXPANDING	OOA / VBO	AUTOCLAVE	PRESS FORMING	AFP/ATL	POST CURABLE	TOUGHENED	FLAME RETARDANT	CHEMICAL RESISTANT	CORROSION RESISTANT	IMPACT RESISTANT	HIGH TEMPERATURE PERFORMANCE	LOW MOSITURE ABSORPTION	LOW TEMPERATURE CURE	AEROSTRUCTURES	SPACE AND SATELLITE	LAUNCH	RADOMES	AIRCRAFT INTERIORS	ENGINES/HIGH TEMP	INDUSTRIAL
SF-4	BMI	295°C (563°F)	204°C (400°F)— 2 hours post cure 250°C (482°F)— 6 hours	▸ Low density 0.62 g/cc (39 pcf) ▸ Compatible with RS-8HT and other BMI systems	14	6	○		○	○	○			○			○	○		○			○	○		○		○	



Resin Transfer Molding and Bulk Molding Compounds

Advanced Composite RTM and BMC Product Selector

RTM Resins

	RESIN	NEAT RESIN DRY T_g ONSET	CURE TEMPERATURE AND TIME	KEY PRODUCT CHARACTERISTICS	POT LIFE	PRODUCT FORMATS			PROCESSING					PRODUCT ATTRIBUTES								MARKET SEGMENTS						
																						AEROSPACE						
						1 PART	2 PART	RTL LAMINATE	OOA / VBO	AUTOCLAVE	PRESS FORMING	AFP/ATL	POST CURABLE	TOUGHENED	FLAME RETARDANT	CHEMICAL RESISTANT	CORROSION RESISTANT	IMPACT RESISTANT	HIGH TEMPERATURE PERFORMANCE	LOW MOISTURE ABSORPTION	LIGHTNING STRIKE PROTECTION	AEROSTRUCTURES	SPACE AND SATELLITE	LAUNCH	RADOMES	AIRCRAFT INTERIORS	ENGINES/HIGH TEMP	INDUSTRIAL
EX-1510	Cyanate Ester	200°C (392°F)	177°C (350°F) 2 hours	▸ Low viscosity at room temperature of 150 cPs ▸ Post curable	4 hrs		○				○		○						○	○		○	○				○	
EX-1545	Cyanate Ester	173°C (345°F)	177°C (350°F) 2 hours	▸ Toughened resin system with low viscosity of 140 cPs at 43°C (110°F) ▸ Long pot life for complex parts	24 hrs		○				○					○	○	○	○				○		○			
RS-16	Cyanate Ester	151°C (304°F) 252°C (486°F) with elevated post cure	135°C (275°F) 2 hours	▸ Low temperature cure resin system ▸ Post curable for higher T_g	4 hrs		○				○		○	○		○	○		○				○		○			
RS-50	Epoxy	203°C (397°F)	177°C (350°F) 2 hours	▸ Toughened epoxy for structural applications ▸ Low minimum viscosity of 23 cPs	4 hrs	○					○			○		○	○	○				○		○				

BMC Thermoset

	RESIN MATRIX	NEAT RESIN DRY T_g ONSET	CURE TEMPERATURE AND TIME	KEY PRODUCT CHARACTERISTICS	OUT LIFE # DAYS	FREEZER LIFE # MONTHS	FIBER TYPE			PROCESSING					PRODUCT ATTRIBUTES								MARKET SEGMENTS						
																							AEROSPACE						
							SM	IM	HM	OOA / VBO	AUTOCLAVE	PRESS FORMING	AFP/ATL	POST CURABLE	TOUGHENED	FLAME RETARDANT	CHEMICAL RESISTANT	CORROSION RESISTANT	IMPACT RESISTANT	HIGH TEMPERATURE PERFORMANCE	LOW MOISTURE ABSORPTION	LIGHTNING STRIKE PROTECTION	AEROSTRUCTURES	SPACE AND SATELLITE	LAUNCH	RADOMES	AIRCRAFT INTERIORS	ENGINES/HIGH TEMP	INDUSTRIAL
MS-1A	Epoxy	164°C (327°F)	138°C (280°F)—15–30 min post cure 177°C (350°F)—1–2 hours	▸ Chopped fiber epoxy BMC with high modulus (HM) fiber	14	6			○			○		○			○	○				○	○	○	○				○
MS-1H	Epoxy	191°C (375°F)	138°C (280°F)—15–30 min post cure 177°C (350°F)—1–2 hours	▸ Chopped fiber epoxy BMC with high modulus (HM) fiber	14	6		○				○		○			○	○				○	○	○					○
MS-4H	Epoxy	191°C (375°F)	138°C (280°F)—15–30 min post cure (free standing) 177°C (350°F)—1–2 hours	▸ Chopped fiber epoxy BMC with standard modulus (SM) fiber	14	6	○					○		○			○	○				○	○	○	○		○		○

BMC Toray Cetex®

	RESIN MATRIX	MELTING TEMP T_m	PROCESSING TEMPERATURE	KEY PRODUCT CHARACTERISTICS	FIBER TYPE			PROCESSING				PRODUCT ATTRIBUTES								MARKET SEGMENTS						
																				AEROSPACE						
					SM	IM	HM	OOA / VBO	AUTOCLAVE	PRESS FORMING	AFP/ATL	TOUGHENED	FLAME RETARDANT	CHEMICAL RESISTANT	CORROSION RESISTANT	IMPACT RESISTANT	HIGH TEMPERATURE PERFORMANCE	LOW MOISTURE ABSORPTION	LIGHTNING STRIKE PROTECTION	AEROSTRUCTURES	SPACE AND SATELLITE	LAUNCH	RADOMES	AIRCRAFT INTERIORS	ENGINES/HIGH TEMP	INDUSTRIAL
MC1100	PPS	280°C (536°F)	330°C (626°F)	▸ PPS-based BMC with SM and IM fibers ▸ Fire retardant	○					○		○	○	○	○	○		○	○	○	○	○		○		○
MC1200	PEEK	343°C (649°F)	385°C (725°F)	▸ PEEK-based BMC with SM and IM fibers ▸ Fire retardant	○					○		○	○	○	○	○	○	○	○	○	○	○		○		○
MC1322	PEKK	331°C (628°F)	380°C (715°F)	▸ PEKK-based BMC with SM fibers	○					○		○	○	○	○	○	○	○		○				○		○

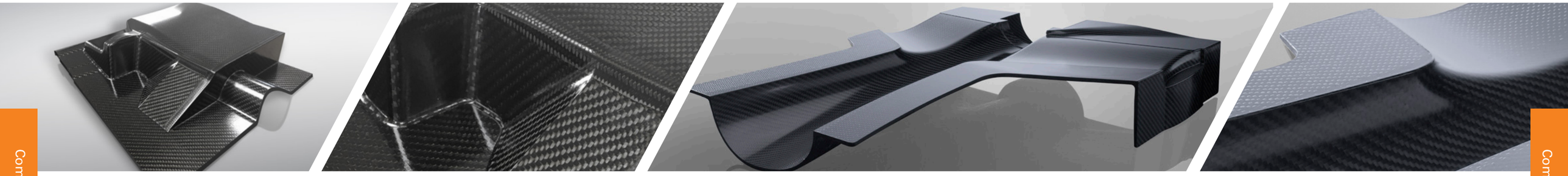
RTM & BMC

Toray AmberTool® Composite Tooling Prepregs

AmberTool®

Advanced Composite Tooling Prepreg Product Selector

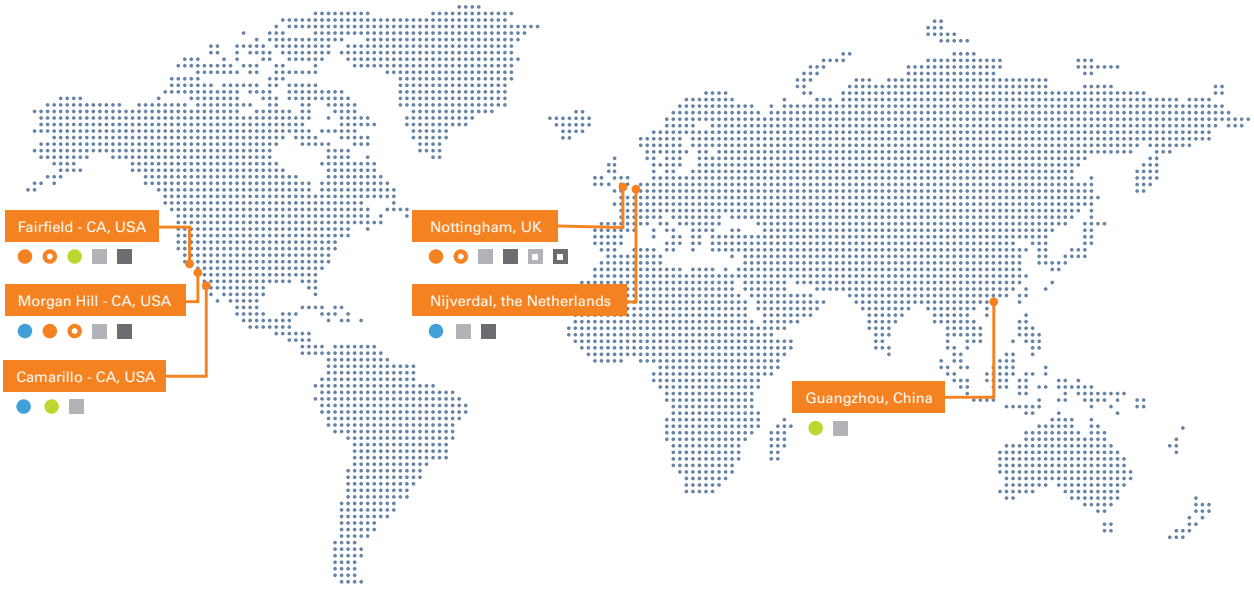
									PROCESSING					PRODUCT ATTRIBUTES								MARKET SEGMENTS						
																						AEROSPACE						
	RESIN	NEAT RESIN DRY T_g ONSET	T_g PEAK	TYPICAL CURE TEMPERATURE AND TIME	KEY PRODUCT CHARACTERISTICS		OUT LIFE # DAYS	FREEZER LIFE # MONTHS	OOA / VBO	AUTOCLAVE	PRESS FORMING	AFP/ATL	POST CURABLE	TOUGHENED	FLAME RETARDANT	CHEMICAL RESISTANT	CORROSION RESISTANT	IMPACT RESISTANT	HIGH TEMPERATURE PERFORMANCE	LOW MOISTURE ABSORPTION	LOW TEMPERATURE CURE	AEROSTRUCTURES	SPACE AND SATELLITE	LAUNCH	RADOMES	AIRCRAFT INTERIORS	ENGINES/HIGH TEMP	INDUSTRIAL
HX40	Epoxy	203°C (397°F)	229°C (444°F)	65°C (149°F) 12 hours	▸ Extended out life for larger scale tooling applications ▸ High temperature end use performance ▸ Versatile curing options 50–75°C (122–167°F)		8	12		○			○			○	○				○	○	○	○	○			○
HX42	Epoxy	219°C (426°F)	234°C (453°F)	60°C (140°F) 8 hours	▸ Proven system for aerospace ▸ Shorter cure schedule at lower temperatures ▸ Available in carbon reinforcements from 205gsm to 990gsm ▸ Excellent surface finish ▸ 210°C (410°F) end use temperature		5	12		○			○			○	○				○	○	○	○	○			○
HX56	Epoxy	185°C (365°F)	209°C (408°F)	55°C (131°F) 6 hours	▸ Fast cure and excellent surface finish ▸ Improved handleability ▸ Available in carbon reinforcements from 205gsm to 990gsm ▸ Excellent drape for complex shapes ▸ 180°C (356°F) end use temperature		60 hours	6		○			○			○	○				○							○



Locations and Capabilities

SOLUTIONS
- Thermoplastic composites
- Thermoset composites
- Carbon-free manufacturing
- Parts manufacture

CERTIFICATIONS
- ISO 9001:2015
- AS9100D
- ISO 14001:2015
- ISO 45001:2018



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TORAY_CompositeSelectorGuide_V2.5_2024-02-14