# Go Boldly into the New Space Age

Proven composite materials from orbit to beyond

'TORAY'

Innovation by Chemistry

# Space, Satellite, & Launch

## Introduction

### Our Objectives

| Connecting the planet | Furthering scientific understanding | Reducing weight | High reliability |
|---|---|---|---|

Credit: Airbus Defence and Space



## **SPACE TRANSFORMED:** THE NEW ERA OF PRIVATE LAUNCHES AND SATELLITES

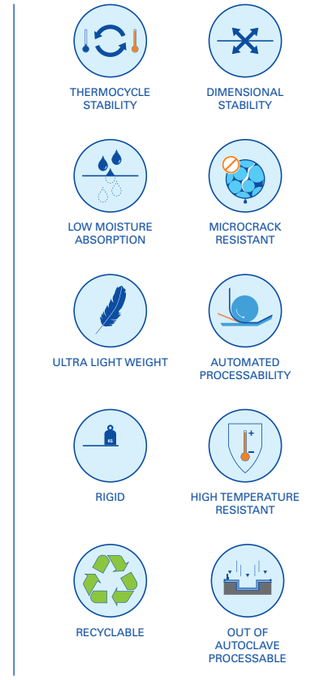
**The space industry is experiencing a transformative evolution fueled by cutting-edge technological innovation and the commercialization of launch services. As humanity looks to space as the next frontier, falling launch costs are unlocking unprecedented access, paving the way for advancements ranging from satellite mega-constellations and high-bandwidth communications to next-generation space infrastructure such as space stations, orbital refueling depots, and space-based drones. In this dynamic environment, reliability is crucial, and technical solutions must be both cost-effective and capable of withstanding the extreme conditions of space.**

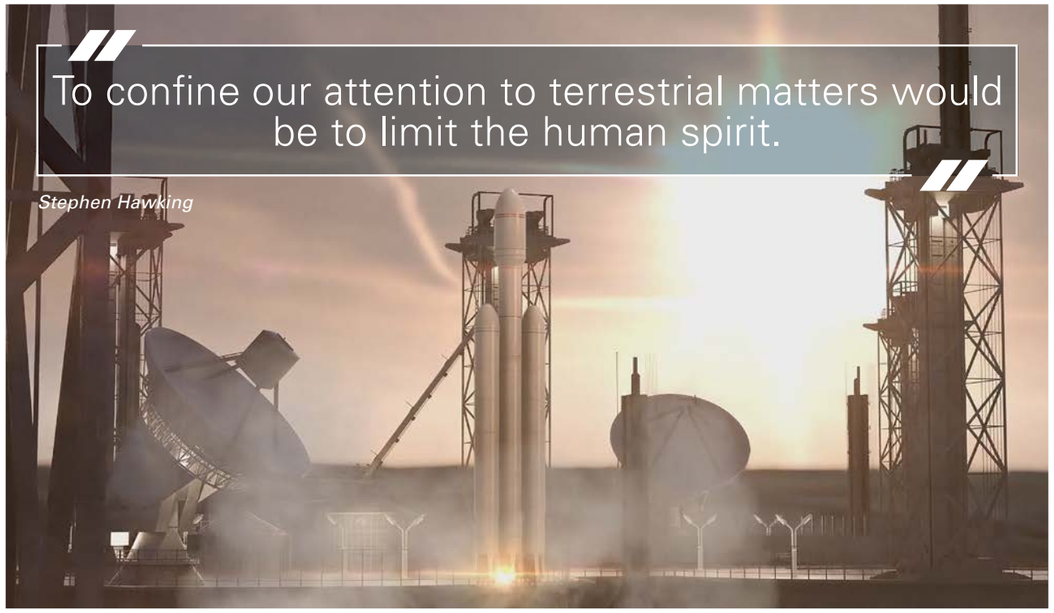
For over 30 years, Toray has been a trusted partner in the space and satellite sector, offering innovative resin and fiber solutions that meet rigorous spaceflight standards for outgassing, radiation resistance, and thermocycling. With our deep expertise, established heritage, and extensive database, we are equipped to tailor material solutions to your specific needs.

Collaborating closely with our customers and staying attuned to shifting market demands, we have built a comprehensive portfolio of advanced material technologies designed for the evolving space industry, including:

- Standard Modulus (SM), Intermediate Modulus (IM), Intermediate Modulus Plus (IM+), and High Modulus (HM) TORAYCA™ carbon fibers
- Toughened thermoset prepregs available in fabric, uni-directional, and slit tape formats
- Epoxy, cyanate ester, bismaleimide, and polyimide resins
- Toray Cetex® thermoplastic composite materials
- Bulk molding compounds and compression molded components

In space, pedigree matters. Failure in deployment is not an option. Our proven track record ensures that we can help you meet the challenges of space with confidence.



# Satellite
## Product Applications

**SUPPORTING EQUIPMENT**
Structural panels, deployable booms, struts and tubes hold cameras and antennas. Tight dimensional tolerance requirements enable accurate pointing, clear spacecraft communications and delivery of ultra high definition images of Earth and space.

STIFF | LOW OUTGASSING | DIMENSIONAL STABILITY

**ANTENNAS AND REFLECTORS**
From small sandwich panel sub reflectors to huge deployable spinning structures, and flat phased arrays meters across, Toray materials meet satellite communication needs. Reflectors demand tight dimensional tolerances for accurate operation.

STIFF | LOW OUTGASSING | THERMAL CYCLE STABILITY

**SATELLITE BUS STRUCTURE**
Highly stiff and lightweight carbon fiber skinned sandwich panels support and protect the payload inside the satellite through launch, ensuring reliability of operation throughout the lifetime of the mission.

STIFF | LOW OUTGASSING

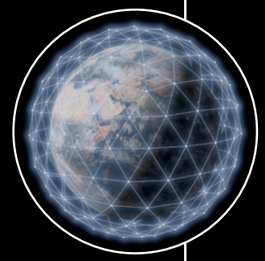
**HEAT SINKS**
All electronics equipment can generate heat and the satellite payload is no different. There's no convection of heat in the hard vacuum of space, so heat is "dumped" to the outside of the satellite by heat pipes, or sometimes composite plates with highly thermally conductive fibers.

HIGH TEMPERATURE RESISTANT | THERMOCYCLE STABILITY

**SOLAR ARRAY PANEL SUBSTRATES**
Thin skin sandwich panel structures supporting the solar cells, which provide all of the satellite's power requirements – there are no power sockets in space! For a satellite which maneuvers to generate Earth images, the stiffness of these panels is critical to the timing of how quickly it can take its next picture.

STIFF | LOW OUTGASSING

**NEW SPACE, SMALL SATELLITES, AND CONSTELLATIONS IN LEO**
As we progress towards smaller satellites and the rise of constellation networks, composite materials remain indispensable. The lightweight yet stiff properties of carbon fiber composite materials enable the creation of smaller, lighter structures, which reduce the load on the satellite supporting structure. This leads to significant mass savings and, in turn, a higher mass capacity and lower launch costs!



# Launch Vehicle

## Product Applications

**PAYLOAD ADAPTORS, INTERSTAGE, SKIRTS, STRUTS, TUBES, LATTICES, STRUCTURAL PANELS**
Toray exceptionally durable and microcrack resistant thermosets delivery a lightweight, high-strength structure for landing leg assemblies, secondary tubes, and struts and conduits.

MICROCRACK RESISTANT
LIGHTWEIGHT
STRONG

**FAIRINGS, SATELLITE DISPENSERS**
The latest generation of launch vehicles utilize TORAYCA™ SM, IM, IM+, HM carbon fibers and out-of-autoclave (OOA) processable prepreg systems for cost-competitive vehicle barrel assemblies, inner and outer stages, satellite dispenser units, and fairings for weight and cost savings.

STIFF
LOW OUTGASSING
THERMAL CYCLE STABILITY

**HIGH TEMPERATURE CAPABILITIES, INCLUDING HEATSHIELDS AND OTHER HOT AREAS**
Toray's high temperature cyanate ester prepregs create lightweight, thermally stable structures. The high char yield of these materials acts as an ablative, protecting the structure from excessive heat.

THERMAL CYCLE STABILITY
LIGHTWEIGHT
HIGH TEMPERATURE RESISTANT

**CRYOGENIC TANKS**
Toray high-quality toughened epoxy prepreg systems are ideally suited for high strength, low weight tanks. Retaining toughness at a low temperature, coupled with a low coefficient of thermal expansion (CTE), results in a tank that can perform in the harsh environment of space.

STIFF
LOW OUTGASSING


**BACK TO EARTH**
Reusability is key to a sustainable future in spaceflight. Toray's toughened and durable materials have a proven track record in the production of reusable components, including landing legs and fins, ensuring reliability and efficiency in every mission.

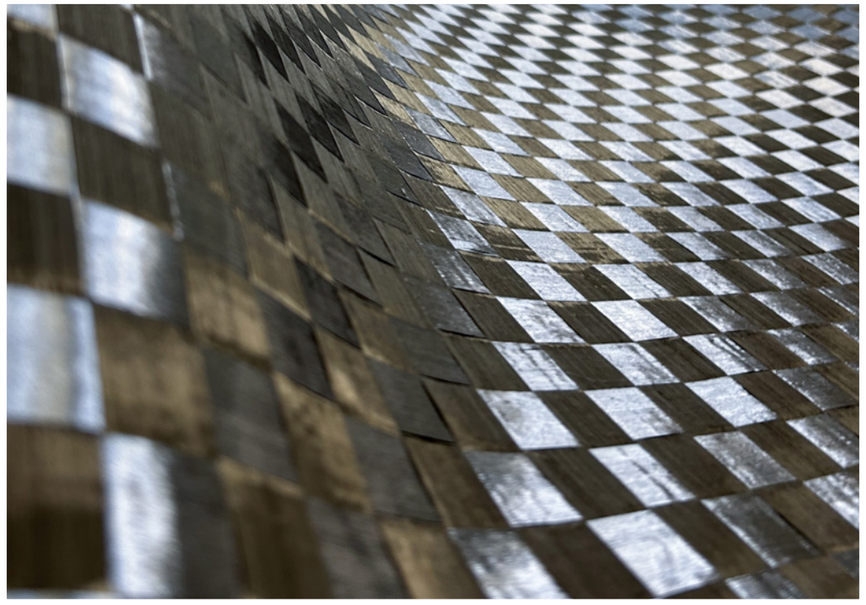
# Space, Satellite, & Launch

## Product Overview

### TORAYCA™ Carbon Fiber

| Fiber Type | Tensile Strength ksi (MPa) " | Tensile Modulus Msi (GPa) | Tensile Elongation (%) | Yield (g/1000 m)* | Density (g/cm³) | Number of Filaments | | | | | Twist | | | Sizing Type | | | | | | | Manufacturing Process | | | | Market Segments | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 1K | 3K | 6K | 12K | 24K | Twisted | Untwisted | Never Twisted | 1 | 3 | 4 | 5 | 6 | 7 | F | Filament Winding | Pultrusion | Weaving/Braiding | Prepreg | Aerospace & Defense | Automotive | Industrial | Sports & Recreation |
| T300 | 512 (3,530) | 33.4 (230) | 1.50 | 66 / 198 / 396 | 1.76 | ● | ● | ● | | | ● | ● | | | | ● | ● | | | | | | ● | ● | ● | ● | | ● |
| T700S | 711 (4,900) | 33.4 (230) | 2.10 | 396 / 800 / 1,650 | 1.80 | | | ● | ● | ● | | | ● | | | | ● | ● | | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| T700G | 711 (4,900) | 34.8 (240) | 2.00 | 800 | 1.80 | | | | ● | | | | ● | | ● | ● | ● | | | | ● | | ● | ● | ● | | | |
| T800H | 796 (5,490) | 42.7 (294) | 1.90 | 223 / 445 | 1.81 | | | ● | ● | | ● | ● | | | | ● | ● | | | | | | ● | ● | ● | | ● | |
| T800S | 853 (5,880) | 42.7 (294) | 2.00 | 515 / 1,030 | 1.80 | | | | ● | ● | | | ● | ● | | | ● | | | | ● | ● | ● | ● | ● | ● | ● | ● |
| T1100S | 1,017 (7,000) | 47.0 (324) | 2.00 | 505 / 1,010 | 1.79 | | | | ● | ● | | | ● | | | | ● | | | | ● | | | | ● | ● | ● | |
| T1100GC | 1,017 (7,000) | 47.0 (324) | 2.00 | 505 / 1,010 | 1.79 | | | | ● | ● | | | ● | | | | | | ● | | | | ● | ● | ● | | | ● |
| M40J | 640 (4,400) | 54.7 (377) | 1.20 | 225 / 450 | 1.77 | | | ● | ● | | ● | ● | | | | | ● | | | | | | ● | ● | ● | | ● | ● |
| M46J | 609 (4,200) | 63.3 (436) | 1.00 | 223 | 1.84 | | | ● | | | ● | ● | | | | | ● | | | | | | ● | ● | ● | | | ● |
| | 583 (4,020) | 63.3 (436) | 0.90 | 445 | 1.84 | | | | ● | | ● | ● | | | | | ● | | | | | | ● | ● | ● | | ● | ● |
| M55J | 583 (4,020) | 78.2 (540) | 0.80 | 218 | 1.91 | | | ● | | | | ● | | | | | ● | | | | | | ● | ● | ● | | | ● |
| M60J | 554 (3,820) | 85.3 (588) | 0.70 | 103 / 206 | 1.93 | | ● | ● | | | ● | ● | | | | | ● | | | | | | ● | ● | ● | | | ● |

**Multiple Yield values are for each tow size (number of filaments per tow)*



# Space, Satellite, & Launch
## Product Overview

### Thermoset Prepregs Epoxy

| | Resin matrix | Dry Tg onset | Cure time and temperature | Key product characteristics | Outgassing, CTE/ CME or hot/wet data | Public Database | OoA/VBO | Toughened | Low Mositure Absorption | Impact Resistant | High Temperature Performance |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2510 | Epoxy | 131°C (294°F) | 132°C (270°F) 2 hours | • Qualified to AMS 3960, 3914, and 3915<br>• Long freezer life | Wet Tg 131°C (267°F)<br>TML 0.46 %<br>CVCM 0.02 %<br>WVR 0.12 % | AGATE | ● | | | | |
| 2511 | Epoxy | 162°C (324°F) | 132°C (270°F) 2 hours | • Qualified to AMS 3962<br>• Low void content with OOA/VBO<br>• Long freezer life | Wet Tg 118°C (244°F)<br>TML 0.33 %<br>CVCM 0.02 %<br>WVR 0.07 % | CMH-17 | ● | ● | ● | ● | |
| 2700 | Epoxy | 163°C (326°F)<br><br>200°C (392°F) with post cure | 160°C (320°F) 5 minutes (press)<br><br>132°C (270°F) 2 hours | • Multi-process flexible system for high volume<br>• Short cure cycles < 5 min<br>• Low void content and optimized tack | Wet Tg 146°C (294°F)<br>TML 0.32 %<br>CVCM <0.01 %<br>WVR 0.06 % | | ● | ● | ● | ● | ● |
| 3900 | Epoxy | 204°C (400°F) | 177°C (350°F) 2 hours | • Qualified to AMS 6891<br>• Long out life<br>• Legacy commercial aerospace material<br>• 121°C (250°F) hot/wet service<br>• Outstanding toughness" | Wet Tg 166°C (330°F)<br>TML 0.38 %<br>CVCM 0.04 %<br>WVR 0.07 % | CMH-17 | | ● | ● | ● | ● |
| 3960 | Epoxy | 204°C (400°F) | 177°C (350°F) 2 hours | • Long out life, extremely long freezer life<br>• Excellent balance of CAI and OHC properties<br>• 121°C (250°F) hot/wet service<br>• Outstanding toughness | Wet Tg 166°C (330°F)<br>TML 0.38 %<br>CVCM 0.04 %<br>WVR 0.07 % | NCAMP *in progress* | ● | ● | ● | ● | ● |
| EX-1522 | Modified Epoxy | 180°C (356°F) | 2 hours at 177°C (350°F) | • Excellent mechanical properties<br>• Good balance of properties between cyanate ester and epoxy<br>• Low $D_k$ and $D_L$ | TML 0.28 %<br>CVCM 0.01 %<br>WVR 0.16 %<br>TML-WVR 0.12 % | | | ● | ● | | |
| TC250 | Epoxy | 140°C (285°F) or 180°C (356°F) with post cure | 60 minutes at 88°C (190°F), followed by 2 hours at 130°C (265°F) | • NCAMP qualified<br>• Long out life of 60 days and the ability to post cure makes it ideal for large structures | Wet $T_g$ 125°C (257°F)<br>Cured at 130°C (265°F)<br>TML 0.27 %<br>CVCM 0.01 %<br>WVR 0.32 % | | ● | ● | | | |
| RS-36 / RS-36-1 | Epoxy | 181°C (358°F)<br>190°C (374°F) | 90 minutes at 177°C (350°F) | • ESA qualified for solar array<br>• High toughness<br>• Low moisture absorption | TML 0.4 %<br>CVCM 0.01 %<br>WVR 0.17 %<br>TML-WVR 0.12 % | | ● | ● | ● | | |
| TC275-1E | Epoxy | 168°C (334°F) | 6 hours at 135°C (275°F) Optional post cure of 2 hours at 177°C (350°F | • Long out time version of TC275-1<br>• Allows construction of thick or larger composites structures<br>• OOA/VBO processable | Wet $T_g$ 136°C (277°F)<br>TML 0.44 %<br>CVCM 0.01 %<br>WVR 0.22 % | | ● | ● | ● | | |
| TC350-1 | Epoxy | 191°C (376°F) | 2 hours at 177°C (350°F) | • OOA/VBO processable<br>• Good hot/wet properties | Wet $T_g$ 160°C (320°F)<br>TML 0.55 %<br>CVCM 0.01 %<br>WVR 0.27 % | | ● | ● | ● | | |
| TC380 | Epoxy | 204°C (399°F) | 2 hours at 177°C (350°F) | • Extreme toughness for structural and cryogenic applications<br>• Excellent balance of CAI, OHC, and hot/wet properties | TML 0.83 %<br>CVCM 0.01 %<br>WVR 0.75 % | | ● | ● | ● | | |

### High Temperature Polyimide and BMI

| | Resin matrix | Dry Tg onset | Cure time and temperature | Key product characteristics | Public Database | OoA/VBO | Toughened | Low Mositure Absorption | Impact Resistant | High Temperature Performance |
|---|---|---|---|---|---|---|---|---|---|---|
| RS-8HT | BMI | 203°C (397°F) or 285°C (545°F) with post cure | 2 hours at 204°C (400°F) followed by 6 hours at 250°C (482°F) | • Excellent elevated temperature performance<br>• Good moisture resistance | | | | ● | | |
| TC890 | Polyimide 900HT | 454°C (850°F) | Call for cure details | • Non-MDA PMR-15 replacement<br>• Short-term service temperature capability of 538°C (1000°F) | | | | | | ● |

### Thermoset Prepregs Cyanate Ester

| | Resin matrix | Dry Tg onset | Cure time and temperature | Key product characteristics | Outgassing, CTE/CME or hot/wet data | OoA/VBO | Toughened | Low mositure absorption |
|---|---|---|---|---|---|---|---|---|
| EX-1515 | Cyanate Ester | 121°C (249°F) or 174°C (345°F) with post cure | 3 hours at 121°C (250°F) Optional post cure of 2 hours at 177°C (350°F) | • Low density<br>• Resistant to microcracking<br>• Low residual stress with 121°C (250°F) cure | TML 0.18 %<br>CVCM 0.01 %<br>CTE 61 ppm/°C | | ● | ● |
| TC410 | Cyanate Ester | 112°C (234°F) or 181°C (358°F) with post cure | 3 hours at 121°C (250°F) Optional post cure at 177°C (350°F) | • Low CTE 58.4 µm/m/°C<br>• Extremely low CME 1205 µm/m/%<br>• Ideal system for stable structures | TML 0.29 %<br>CVCM < 0.01 %<br>WVR 0.17 %<br>TML-WVR 0.12 % | | ● | ● |
| BTCy-1A | Cyanate Ester | 185°C (365°F) or 207°C (405°F) with post cure | 2 hours at 177°C (350°F) Optional post cure of 60 minutes at 204°C (400°F) | • Tough<br>• High Tg | CTE 77 ppm/°C | | ● | ● |
| RS-3/ RS-3C | Cyanate Ester | 191°C (375°F) or 254°C (490°F) with post cure | 2 hours at 177°C (350°F) Optional post cure of 60 minutes at 232°C(450°F) | • Extensive qualification portfolio<br>• Low CTE, CME<br>• High stability<br>• RS-3C is controlled-flow version | TML 0.22 %<br>CVCM 0.01 % | ● | ● | ● |
| TC420 | Cyanate Ester | 176°C (349°F) or 348°C (658°F) with post cure | 3 hours at 177°C (350°F) Optional post cure at 260°C (500°F) | • Good resistance to microcracking<br>• Capable of high-temperature service<br>• Ideal for heat shield and ablative applications | TML 0.41 %<br>CVCM < 0.01%<br>WVR 0.28%<br>CTE 55 ppm/°C | ● | ● | ● |

# Space, Satellite, & Launch

## Product Overview

### Toray Cetex® Thermoplastic

| | Resin matrix | Melting temperature $T_m$ | Processing temperature $T_p$ | Key product characteristics | Public Database | OoA/VBO | Durability/ Toughness | Low Mositure Absorption | Impact Resistant | High Temperature Performance |
|---|---|---|---|---|---|---|---|---|---|---|
| TC1225 | LMPAEK™ Low-Melt Polyaryle-therketone | 305°C (581°F) | 340-385°C (644-725°F) | • Lower processing temperature with good high temperature performance<br>• May be overmolded with PEEK for final part<br>• Very good CAI properties 282 MPa (40.9 ksi)<br>• Ideal for structural applications | NIAR NCAMP[1] CMH-17 | ● | ● | ● | ● | ● |

[1] *Database is FAA accepted*

### RTM Resins

| | Resin | Dry $T_g$ onset | Cure time and temperature | Key product characteristics | Toughened | Low Mositure Absorption |
|---|---|---|---|---|---|---|
| EX-1545 | Cyanate Ester | 173°C (345°F) | 2 hours at 177°C (350°F) | • Toughened resin system with low viscosity of 140 cPs at 43°C (110°F)<br>• Long pot life for complex parts | | ● |
| RS-16 | Cyanate Ester | 151°C (304°F)<br>252°C (486°F) with elevated post cure | 2 hours at 135°C (275°F) | • Low-temperature cure resin system<br>• Post curable for higher $T_g$ | ● | ● |
| EX-1510 | Cyanate Ester | 193°C (380°F) | 2 hours at 177°C (350°F) | • Low room temperature viscosity of 150 cPs<br>• Post curable for higher $T_g$ | | ● |

### Toray Microply™ Film Adhesives Epoxy

| | Resin Matrix | Dry $T_g$ onset | Cure time and temperature | Key product characteristics | OoA/VBO | Toughened | Low Mositure Absorption |
|---|---|---|---|---|---|---|---|
| RS-15H | Epoxy | 99°C (211°F) | 6 hours at 93°C (200°F) Alternate cures are available | • Low-temperature curing adhesive | ● | ● | |
| TC263 | Epoxy | 110°C (230°F) | 2 hours at 121°C (250°F) | • High peel strength<br>• Ideal for metal or composite bonding | ● | ● | |
| TC310 | Epoxy | 157°C (315°F) | 2 hours at 177°C (350°F) or 2 hours at 121°C (250°F), followed by 1 hour at 177°C (350°F) | • Ideal composite bonding film adhesive | ● | ● | |

### Toray Microply™ Film Adhesives Cyanate Ester

| | Resin Matrix | Dry $T_g$ onset | Cure time and temperature | Key product characteristics | OoA/VBO | Toughened | Low Mositure Absorption |
|---|---|---|---|---|---|---|---|
| EX-1516 | Cyanate Ester | 126°C (258°F) | 5 hours at 121°C (250°F) | • Compatible with Toray EX-1515 prepreg | ● | ● | ● |
| RS-4A | Cyanate Ester | 195°C (383°F) or 238°C (460°F) with post cure | 2 hours at 177°C (350°F) Optional post cure of 1.5-2 hours at 232°C (450°F) | • Moisture resistant | ● | ● | ● |
| EX-1543 | Cyanate Ester | 191°C (376°F) or 211°C (412°F) with post cure | 2 hours at 177°C (350°F) Optional post cure of 2 hours at 204°C (400°F) | • Compatible with 177°C (350°F) curing cyanate ester prepregs<br>• Low shrinkage<br>• Low outgassing | ● | | ● |
| TC4015 | Cyanate Ester | 176°C (349°F) or 321°C (610°F) with post cure | 2 hours at 177°C (350°F) Optional post cure of > 60 minutes at 232°C (450°F) | • Excellent high-temperature properties<br>• Compatible with TC420 | ● | | ● |

### Toray Microply™ Syntactics Epoxy

| | Resin Matrix | Dry $T_g$ onset | Cure time and temperature | Key product characteristics | OoA/VBO | Toughened | Low Mositure Absorption |
|---|---|---|---|---|---|---|---|
| EM-3 | Epoxy | ~116°C (240°F) | 60 minutes at 121°C (250°F) | • High expansion (8-10 x)<br>• 0.64 g/cc (40 pcf) density<br>• $T_g$ estimated from base resin data | | | |
| TCF4035 | Epoxy | 140°C (284°F) | 3 hours at 130°C (265°F) | • Low density 0.64 g/cc (40 pcf)<br>• Compatible with TC250, may be post cured for higher $T_g$ | ● | ● | |

### Toray Microply™ Syntactics Cyanate Ester

| | Resin Matrix | Dry $T_g$ onset | Cure time and temperature | Key product characteristics | OoA/VBO | Toughened | Low Mositure Absorption |
|---|---|---|---|---|---|---|---|
| TCF4001 | Cyanate Ester | 176°C (349°F) | 2 hours at 177°C (350°F) Optional post cure of 60-90 minutes at 232°C (450°F) | • Low density 0.38 g/cc (24 pcf) | ● | | ● |
| TCF4050 | Cyanate Ester | 176°C (349°F) or 232°C (450°F) with post cure | 2 hours at 177°C (350°F) Optional post cure of 60-90 minutes at 232°C (450°F) | • Expanding syntactic film/core splice<br>• Density of 0.28-0.55 g/cc (17-35 pcf)<br>• Compatible with TC420 prepreg system | ● | ● | ● |
| EM-5A | Cyanate Ester | 204°C (400°F) | 2 hours at 177°C (350°F) Optional post cure of 60-90 minutes at 232°C (450°F) | • Expansion ratio of 4 x | ● | | ● |
| EX-1541 | Cyanate Ester | 227°C (441°F)<br>240°C (464°F) with post cure | 177°C (350°F)—2 hours Optional post cure 232°C (450°F)—2 hours | • Density of 0.16–0.38 g/cc (10–24 pcf)<br>• Good structural properties<br>• Low dielectric constant and loss | | | ● |

# Space, Satellite, & Launch

## Product Overview

### Toray Microply™ Syntactics Other Matrices

| | Resin Matrix | Dry $T_g$ onset | Cure time and temperature | Key product characteristics | OoA/VBO | Toughened | Low Mositure Absorption |
|---|---|---|---|---|---|---|---|
| SF-4 | BMI | 295°C (563°F) | 2 hours at 204°C (400°F), then 6 hour post cure at 250°C (452°F) | • Low density 0.62 g/cc (39 pcf)<br>• Compatible with RS-8HT and other BMI systems | ● | | |

### BMC Thermoset Epoxy

| | Resin Matrix | Dry $T_g$ onset | Cure time and temperature | Key product characteristics | OoA/VBO | Toughened | Low Mositure Absorption |
|---|---|---|---|---|---|---|---|
| MS-1A | Epoxy | 164°C (327°F) | 15-30 minutes at 138°C (280°F) followed by post cure of 1-2 hours at 177°C (350°F) | • Chopped fiber epoxy BMC with high-modulus fiber | | | |
| MS-1H | Epoxy | 191°C (375°F) | 15-30 minutes at 138°C (280°F) followed by post cure of 1-2 hours at 177°C (350°F) | • Chopped fiber epoxy BMC with intermediate-modulus fiber | | | |
| MS-4H | Epoxy | 191°C (375°F) | 15-30 minutes at 138°C (280°F) followed by post cure of 1-2 hours at 177°C (350°F) | • Chopped fiber epoxy BMC with high- strength (standard-modulus) fiber | | | |

### Toray Cetex® BMC Thermoplastic

| | Resin Matrix | Dry Tg onset | Processing temperature | Key product characteristics | OoA/VBO | Durability/ Toughness | Low Mositure Absorption |
|---|---|---|---|---|---|---|---|
| MC1100 | PPS | 90°C(194°F) | 330°C (626°F) | • PPS based BMC<br>• Fire retardant | | ● | ● |
| MC1200 | PEEK | 143°C (290°F) | 385°C(725°F) | • PEEK based BMC<br>• Fire retardant | | ● | ● |

### Toray AmberTool® Composite Tooling Prepregs

| | Resin | Neat resin dry $T_g$ onset | $T_g$ PEAK | Typical cure temperature and time | Key product characteristics | Out life # days | Freezer live # months |
|---|---|---|---|---|---|---|---|
| HX40 | Epoxy | 203°C (397°F) | 229°C (444°F) | 65°C (149°F) 12 hours | • Extended out life for larger scale tooling applications<br>• High temperature end use performance<br>• 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<br>• Shorter cure schedule at lower temperatures<br>• Available in carbon reinforcements from 205gsm to 990gsm<br>• Excellent surface finish<br>• 210°C (410°F) end use temperature | 5 | 12 |

Notes

## Toray Composite Materials America Inc.

Tacoma, Washington
19002 50th Avenue East, Tacoma, WA 98446
+1-253-846-1777
salescmacontact@toraycma.com

Decatur, Alabama
2030 Highway 20, Decatur, AL 35601
+1-256-260-2626
salescmacontact@toraycma.com

Spartanburg, South Carolina
2202 Moore-Duncan Highway, Moore, SC 29369
+1-864-586-3444
salescmacontact@toraycma.com

## Toray Advanced Composites

Morgan Hill, California
18255 Sutter Blvd, Morgan Hill, CA 95037
+1-408-465-8500
explore@toraytac-usa.com

Fairfield, California
2450 Cordelia Road, Fairfield, CA 94534
+1-707-359-3400
explore@toraytac-usa.com

Nottingham, United Kingdom
Amber Drive
Langley Mill, Nottingham, NG16 4BE
United Kingdom
+44-1773-530899
explore@toraytac-europe.com

Nijverdal, The Netherlands
G. van der Muelenweg 2, Nijverdal, 7443 RE
The Netherlands
+31-548-633-933
explore@toraytac-europe.com


Visit toray.com for other Toray locations



www.toraytac.com | www.toraycma.com

TORAY
Innovation by Chemistry