FORMULA 1, MOTORSPORT, AND HIGH PERFORMANCE AUTOMOTIVE
Composite Materials Selector Guide

DESIGNED TO FLY.
WINNING ON THE GROUND.

TORAY
Toray Advanced Composites
Toray Advanced Composites is a global leader in the development and manufacture of a wide range of advanced composite material solutions for high performance industrial and aerospace markets. With 30 years of supporting the unique demands of the Formula 1, supercar, and high performance automotive markets, Toray is the ideal specialty automotive program partner. Our unique product portfolio spans both thermoset and thermoplastic technologies, including tooling materials, highly cosmetic surfacing materials, and structural prepregs for chassis and body panel applications. Our material solutions can be tailored to processing, design, and commercial considerations.

**PLANNING FOR THE FUTURE—EXPANSION OF THERMOSET AND THERMOPLASTIC CAPABILITY**

**Toray Advanced Composites**

1972 - The Netherlands: First thermoset prepregging begins
1982 - Europe: First thermoset prepreg
1990 - USA: First thermoset aerospace materials
1999 - USA: Acquisition of Byko Technologies
2000 - USA: Morgan Hill, new manufacturing facility
2007 - USA: Acquisition of T3A, Inc. & CCS Composites, LLC for aerospace prepregs and compression molded parts
2008 - USA: Acquisition of Phoenix TPC for thermoset UD tapes
2010 - USA: Substantial increase in thermoset UD processing and capacity
2011 - USA: Major investment in thermoset processing capacity and technology
2012 - USA: New manufacturing and major investment in new technology and capacity in Fairfield
2013 - The Netherlands: Major investment in thermoset NDT
2015 - UK: Acquisition of Amber Composites with leading positions in tooling, automotive, motorsport, and industrial markets
2016 - USA: Morgan Hill, plant has doubled in size in < 10 years
2018 - Toray Industries Inc. acquires TenCate Advanced Composites

**FORMULA 1 AND MOTORSPORT**

Formula 1 pushes the boundaries of material science, fully utilizing even the smallest advantages. With the latest generation of fibers and resins available, Toray is testing the limits of speed.

Toray is a proven leader in aerospace grade material technologies for the Formula 1 and high performance motorsport markets. Trusted for innovation in advanced composites for 30 years, Toray continually invests in product development, ensuring a full portfolio of lightweight, durable, and high performance thermoset materials developed specifically for rigorous motorsport applications.

Coupled with dedicated mechanical testing capabilities, flexible lead times, and ready supply, Toray is your winning partner in high performance motorsport.

**HIGH PERFORMANCE AUTOMOTIVE**

In response to tighter CO2 emission controls, automobile manufacturers seek lightweight materials to increase efficiency. Auto design leaders have discovered composites offer a 30% lighter structure compared to aluminum, and 70% lighter compared to steel.

With 30 years of supporting the unique demands of the supercar and high performance automotive markets, Toray is the ideal specialty automotive program partner. Our unique product portfolio spans thermoset and thermoplastic technology, including tooling materials, highly cosmetic surfacing materials, and structural prepregs for chassis and body panel applications.

Advanced composite materials are not only strong and lightweight, facilitating reduced fuel consumption, but also promote an energy-efficient and cleaner solution for high performance automotive applications. Composites are literally paving the road for the next generation automobile.
# THERMOSET COMPOSITES

**Formula 1 and Motorsport**

The full suite of products from low to high temperature curing prepregs are utilized within motorsport. Low temperature curing epoxies are staple products for prototyping and wind tunnel testing. Mid temperature curing epoxies are especially suited for structural components. Cyanate esters are resistant to high temperatures and durable in the most challenging environments.

Toray thermoset materials are available in standard, intermediate, and high modulus carbon fibers. In addition, glass and aramid fibers are available in UD, woven, and multi-axial (NCF) reinforcements.

## LOW TEMPERATURE CURING PREPREGS

<table>
<thead>
<tr>
<th>RESIN NAME</th>
<th>RESIN TYPE</th>
<th>Tg</th>
<th>TYPICAL CURE TIME/CURE TEMPERATURE</th>
<th>DESCRIPTION OF PROPERTIES</th>
<th>APPLICATION EXAMPLES</th>
<th>FABRIC</th>
<th>UD</th>
</tr>
</thead>
<tbody>
<tr>
<td>E60</td>
<td>Epoxy</td>
<td>121°C (250°F)</td>
<td>3.5 hours at 70°C (158°F)</td>
<td>Medium tack level, easier lamination</td>
<td>Wind tunnel prototyping</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

## MID TEMPERATURE CURING PREPREGS

<table>
<thead>
<tr>
<th>RESIN NAME</th>
<th>RESIN TYPE</th>
<th>Tg</th>
<th>TYPICAL CURE TIME/CURE TEMPERATURE</th>
<th>DESCRIPTION OF PROPERTIES</th>
<th>APPLICATION EXAMPLES</th>
<th>FABRIC</th>
<th>UD</th>
</tr>
</thead>
<tbody>
<tr>
<td>E720</td>
<td>Epoxy</td>
<td>110°C (230°F)</td>
<td>60 minutes at 120°C (248°F)</td>
<td>Honeycomb bondable</td>
<td>Ambient structural</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>E745</td>
<td>Epoxy</td>
<td>118°C (244°F)</td>
<td>60 minutes at 135°C (275°F)</td>
<td>High toughness and impact properties</td>
<td>Side impact structures, F1 nose cones</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>E722</td>
<td>Epoxy</td>
<td>120°C (248°F)</td>
<td>60 minutes at 120°C (248°F)</td>
<td>Excellent drapability</td>
<td>Greater rigidity</td>
<td>Monolithic parts</td>
<td>○</td>
</tr>
<tr>
<td>E721-FR</td>
<td>FR Epoxy</td>
<td>120°C (248°F)</td>
<td>60 minutes at 120°C (248°F)</td>
<td>Fire retardant version of E720</td>
<td>Internal bodywork</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>E711</td>
<td>Epoxy</td>
<td>140°C (284°F)</td>
<td>60 minutes at 120°C (248°F)</td>
<td>High cosmetic clarity</td>
<td>Center console</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>E750</td>
<td>Epoxy</td>
<td>148°C (298°F)</td>
<td>60 minutes at 135°C (275°F)</td>
<td>Variable temperature cure, starting at 80°C (176°F)</td>
<td>High impact areas, bodywork</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>TC350-1</td>
<td>Epoxy</td>
<td>191°C (378°F)</td>
<td>2 hours at 177°C (350°F)</td>
<td>Highly toughened with high interlaminar performance</td>
<td>High impact areas e.g., chassis</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>E760</td>
<td>Epoxy</td>
<td>204°C (398°F)</td>
<td>2 hours at 180°C (356°F)</td>
<td>High temperature resistance and high mechanical performance</td>
<td>High temperature e.g., rear suspension</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>TC46</td>
<td>Epoxy</td>
<td>221°C (428°F)</td>
<td>2 hours at 180°C (356°F), followed by 200°C (392°F) post cure</td>
<td>Structural values retained at high temperatures</td>
<td>High temperature e.g., rear suspension, gearbox</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

## HIGH SERVICE TEMPERATURE

<table>
<thead>
<tr>
<th>RESIN TYPE</th>
<th>RESIN TYPE</th>
<th>Tg</th>
<th>TYPICAL CURE TIME/ CURE TEMPERATURE</th>
<th>DESCRIPTION OF PROPERTIES</th>
<th>APPLICATION EXAMPLES</th>
<th>FABRIC</th>
<th>UD</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS-BHT</td>
<td>BMI</td>
<td>202°C (394°F)</td>
<td>2 hours at 204°C (400°F), followed by post cure of 6 hours at 250°C (482°F)</td>
<td>Thermal stability, moderate toughness with good moisture resistance, available in RTM resin form</td>
<td>Rear structural components</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>TC430</td>
<td>Cyanate Ester</td>
<td>348°C (648°F)</td>
<td>3 hours at 317°C (603°F), followed by 260°C (502°F) post cure</td>
<td>Excellent thermal stability, resistance to microcracking</td>
<td>Gearbox, heat shields, and brake ducts</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>C740</td>
<td>Cyanate Ester</td>
<td>325°C (617°F)</td>
<td>2 hours at 315°C (607°F), followed by 300°C (572°F) post cure</td>
<td>High temperature resistance and longer cut life for larger parts</td>
<td>Pipework and ducting, exhaust area</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>C640</td>
<td>Cyanate Ester</td>
<td>335°C (635°F)</td>
<td>10 hours at 80°C (176°F), followed by 300°C (572°F) post cure</td>
<td>High temperature resistance and variable temperature cure</td>
<td>Brake ducts</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

Full mechanical data is available. Please call us at Toray Advanced Composites (UK) to discuss your requirements.
COMPOSITE TOOLING PREPREGS

Product Overview

COMPLETE TOOL DESIGN FREEDOM
With more than 25 years of pedigree in high performance motorsport, the Toray AmberTool® collection of prepregs comprised of the HX, HXR, and TC40 series, is sold globally by a proven team of tooling experts. Our comprehensive range of tooling products allows our customers complete tool design freedom and flexibility.

TORAY AMBERTOOL® COMPOSITE TOOLING PREPREGS
Toray AmberTool® composite tooling prepregs allow high precision for molded and machined tooling applications with a superior degree of accuracy. We support our products globally, offering customers a complete technical support service including tailored training courses.

MASTER AND SURFACE COAT APPLICATION
- Compatible with high performance epoxy paste and block master patterns
- Specialized sealing and release agent recommendations
- Excellent surface finish generation

FULL TOOLING DELIVERY SOLUTIONS
- Custom cutting solutions within Europe
- Fast delivery solutions for standard materials from stock
- Wide range of carbon and glass reinforcements
- Surface machinable for final accuracy
- Carbon and glass backing structures

EXPERIENCED TECHNICAL SUPPORT
- Proven processing procedures and full tooling processing guide available
- Tailored training courses offered
- Specialized tooling knowledge on surface treatments and advanced experience in mold heating applications
- Mold life-cycle maintenance control
- New materials research, assuring health and safety compliance

NEW PRODUCTS
Toray AmberTool® HXR56 is the latest innovation from our heritage range of composite tooling prepregs. The new Toray AmberTool® HXR series is a multi-axial format, specifically designed for when complexity and speed are required, ultimately reducing overall tooling costs.

Example of HXR lay-up:

[Toray AmberTool® Tooling Prepreg Processing Guide]
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 product data sheets and technical resources.

<table>
<thead>
<tr>
<th>TORAY AMBERTOOL® COMPOSITE TOOLING PREPREGS</th>
<th>TOOL DESIGN FREEDOM AND FLEXIBILITY</th>
<th>INTRINSICALLY QUASI-ISOTROPIC</th>
<th>HANDLEABLE AT AMBIENT TEMPERATURES</th>
<th>EXCELLENT SURFACE FINISH</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRODUCT NAME</td>
<td>Tg ONSET (DMTA)</td>
<td>MINIMUM CURE TEMPERATURE</td>
<td>OUT LIFE</td>
<td>END USE TEMPERATURE</td>
</tr>
<tr>
<td>HX56</td>
<td>Onset: 185°C (365°F)</td>
<td>40°C (104°F)</td>
<td>60 hours</td>
<td>180°C (356°F)</td>
</tr>
<tr>
<td>HXR56 NEW</td>
<td>Onset: 185°C (365°F)</td>
<td>40°C (104°F)</td>
<td>50 hours</td>
<td>180°C (356°F)</td>
</tr>
<tr>
<td>HX50</td>
<td>Onset: 190°C (374°F)</td>
<td>40°C (104°F)</td>
<td>60 hours</td>
<td>180°C (356°F)</td>
</tr>
<tr>
<td>HX42</td>
<td>Onset: 200°C (392°F)</td>
<td>50°C (122°F)</td>
<td>5 days</td>
<td>190°C (374°F)</td>
</tr>
<tr>
<td>TC40*</td>
<td>Onset: 213°C (415°F)</td>
<td>182°C (360°F)</td>
<td>14 days</td>
<td>190°C (374°F)</td>
</tr>
</tbody>
</table>

*Toray AmberTool® TC40 country of shipment is North America.
COMPLETING THE MOTORSPORT PRODUCT PORTFOLIO

Film Adhesives and Core Materials

Toray offers a wide range of film adhesives compatible with our prepregs. Toray MicroPly™ film adhesives are used for bonding honeycomb skin to core, and to bond pre-cured or post-cured laminates.

**TORAY MICROPLY™ FILM ADHESIVES**

<table>
<thead>
<tr>
<th>PRODUCT NAME</th>
<th>RESIN TYPE</th>
<th>Tg (ONSET)</th>
<th>CURE TEMP</th>
<th>KEY PRODUCT CHARACTERISTICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>EF020</td>
<td>Epoxy</td>
<td>102°C (215°F)</td>
<td>80°C (176°F)</td>
<td>Wide cure temperature between 70–130°C (158–266°F)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>30 days out life</td>
</tr>
<tr>
<td>EF72</td>
<td>Epoxy</td>
<td>112°C (234°F)</td>
<td>120°C (248°F)</td>
<td>Structural epoxy film adhesive with 30 days out life</td>
</tr>
</tbody>
</table>

**HONEYCOMB CORE**

Toray Advanced Composites (UK) has the largest independent core processing operation in Europe. Aluminum and Nomex® honeycomb are available in addition to Flex-Core®. We hold extensive stock in house for quick ordering. All orders are cut to customer specification and are available with fast turnaround times.

**PRODUCT NAME**

- **Aluminum Honeycomb**
  - Aerospace Grade
  - 3.1-1/8-07N-5052
  - 4.5-1/8-10N-5052
  - 5.2-1/4-28N-5052
  - 6.1-1/8-15N-5056

- **Nomex® Honeycomb**
  - Aerospace Grade
  - ANA-3.2-29 3.2 mm 29 kg/m³
  - ANA-3.2-48 3.2 mm 48 kg/m³
  - ANA-3.2 64 3.2 mm 64 kg/m³
  - ANA-4.8 48(OX) 4.8 mm 48 kg/m³

- **Nomex® Honeycomb**
  - Commercial Grade
  - ANC-3.2-48 3.2 mm 48 kg/m³
  - ANC-4.8 48(OX) 4.8 mm 48 kg/m³

- **Aluminum Flex-Core®**
  - 5052/F80-.0013N Density 4.3
  - 5052/F80-.0024N Density 8.0
  - 9056/F80-.0014N Density 4.3

**PRODUCT CONFIGURATIONS**

- **High strength-to-weight properties at relatively low cost**
- **Structural aerospace grade aluminum honeycomb available in 5052 and 5056 alloy**
- **Sheet size 1250 x 2500 mm except *1220 x 2440 mm**
- **Fire resistant and self-extinguishing to FAR 25.583**
- **High temperature strength up to 180°C (356°F)**
- **Nomex® paper sheets are coated and bonded together with a high modulus phenolic resin**
- **Sheet size 1250 x 2500 mm except *1220 x 2440 mm**
- **Fire resistant and self-extinguishing**
- **Good thermal and electrical insulating properties**
- **High strength-to-weight ratio and easily formable to shape**
- **Sheet size 1250 x 2500 mm**

**TORAY MICROPLY™ SYNTACTIC CORE**

<table>
<thead>
<tr>
<th>PRODUCT NAME</th>
<th>RESIN TYPE</th>
<th>Tg (ONSET)</th>
<th>CURE TEMP</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC72A</td>
<td>Epoxy</td>
<td>106°C (223°F)</td>
<td>120°C (248°F)</td>
<td>Mid temperature curing, nonexpanding, ideal for sandwich structure under 3 mm (0.11”)</td>
</tr>
<tr>
<td>SC8020A</td>
<td>Epoxy</td>
<td>108°C (232°F)</td>
<td>80°C (176°F)</td>
<td>• Low density, nonexpanding with flexible cure temperatures from 70–130°C (158–266°F)</td>
</tr>
<tr>
<td>ES72A-2</td>
<td>Epoxy</td>
<td>114°C (237°F)</td>
<td>125°C (257°F)</td>
<td>• Expanding epoxy resin film</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Varying density by tailoring cure pressure and/or volume</td>
</tr>
</tbody>
</table>

**NEW PRODUCTS**

Toray Compression Molded Billet Stock

Toray Advanced Composites can fabricate your next compression molded part utilizing chopped fiber compression molded billet stock, which is available* with a maximum size of 356 x 710 mm (14 x 28”) and thickness from 13 to 63.5 mm (0.5 to 2.5”).

**Common applications:**
- Hard point attachment areas in a composite part;
- Prototype/small volume parts;
- Part iterations during the development phase of compression molded parts;
- Hard to fabricate complex composite parts, which are better made from machining billet stock.

**Associated benefits:**
- Avoid tooling costs: Parts machined from billet have zero tooling costs!
- Short lead time: Parts can be machined quickly from billet stock avoiding long lead times.
- Billet stock is lower cost than continuous fiber thick laminates: Discontinuous fiber BMCs can be compression molded with lower labor and processing costs.
- Weight reduction: Over aluminum of 40%

*Country of shipment is North America

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*Offered from Langley Mill, UK.

Additional grades can be sourced upon request, subject to minimum order quantities, and extended lead times.

Flex-Core® is a registered trademark of Hexcel. Nomex® is a registered trademark of E.I du Pont de Nemours and Company.

Toray MicroPly™ syntactics are epoxy films loaded with glass microspheres for low-density and high-compressive strengths. Toray’s MicroPly™ range of syntactic films are ideal for sandwich core construction, edge close outs, core splices, and reinforcement areas.
MOTORSPORT PRODUCT APPLICATIONS

1. Toray E146, approved side impact protection material for increased driver safety

2. Floor panel with Toray E760 and E740 for ease of lamination and handling

3. Nose cone manufactured from Toray E745

4. Suspension parts made from Toray E740 and TC346

5. Bodywork manufactured from Toray E750

6. Gearbox made with Toray TC346
THERMOPLASTIC COMPOSITES

Toray Cetex® thermoplastic materials are available as a broad variety of organo sheets or UD tapes and prepregs to facilitate your manufacturing process and part design. Additionally, our continuous fiber reinforced thermoplastic (Toray CFRT®) can be pre-consolidated and cut to customer part demands.

KEY ADVANTAGES:
- Rapid assembly
- Short cycle times
- Weldability
- Recyclability
- No freezer storage

KEY PROCESSING TECHNOLOGIES FOR PROVEN AND RELIABLE VOLUME PART MANUFACTURING:
- Compression molding/thermoforming
- Overmolding
- Advanced tape placement
- Variable in-molded composite sandwich
- Tubular winding, in situ, or autoclave processed

TORAY CETEX® UD TAPES
Glass fiber and carbon fiber reinforced with thermoplastic polymers to a fiber volume content of 36-48% and a thickness of 0.13-0.27 mm. Suitable for tubular winding (pipes and tanks) and for automated part manufacture:

<table>
<thead>
<tr>
<th>UD TAPE RESIN</th>
<th>PROCESSING TEMPERATURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>PP</td>
<td>160–200°C (320–392°F)</td>
</tr>
<tr>
<td>PA6</td>
<td>230–300°C (446–572°F)</td>
</tr>
<tr>
<td>PPS</td>
<td>290–350°C (554–662°F)</td>
</tr>
<tr>
<td>PEI</td>
<td>300–370°C (572–698°F)</td>
</tr>
<tr>
<td>PEEK</td>
<td>350–400°C (662–752°F)</td>
</tr>
</tbody>
</table>

TORAY CETEX® ORGANO SHEETS
Carbon and glass fiber reinforced thermoplastic laminates (RTL) known in the automotive industry as organo sheets, with fabric architecture and fiber orientation tailored to customer-specific applications. Laminate thicknesses vary from 0.5 to 20 mm. They are engineered to meet the demands of high-end applications including structural, load bearing chassis, pillars, and structural interior parts. From these organo sheets, it’s possible to produce pre-cut blanks, tapered and shaped.

<table>
<thead>
<tr>
<th>ORGANO SHEET COMBINATION</th>
<th>PROCESSING TEMPERATURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon/PPS</td>
<td>300–350°C (572–662°F)</td>
</tr>
<tr>
<td>Glass/PPS</td>
<td>300–350°C (572–662°F)</td>
</tr>
<tr>
<td>Carbon/PEI</td>
<td>300–370°C (572–698°F)</td>
</tr>
<tr>
<td>Glass/PEI</td>
<td>300–370°C (572–698°F)</td>
</tr>
</tbody>
</table>

Different polymers, e.g., PEEK, available on request.

Jaguar F-type AWD underbody panel with cooling slits and vents reinforced with Toray Cetex® Glass/PP organo sheet.
HIGH-END AUTOMOTIVE THERMOPLASTIC APPLICATIONS

1. Engine protection plate manufactured from Toray Cetex® Carbon/PP organo sheet
   - STIFF
   - LIGHTWEIGHT

2. A, B, C pillars manufactured from Toray Cetex® Glass/PA6 UD tape
   - IMPACT RESISTANT
   - LIGHTWEIGHT

3. Underbody panel manufactured from Toray Cetex® Glass/PP organo sheet
   - DRAPABLE
   - LIGHTWEIGHT

4. Back seat/back rest plate manufactured from Toray Cetex® Carbon/PA6 UD tape
   - STIFF
   - LIGHTWEIGHT

5. Exterior and interior trim manufactured from Toray Cetex® Glass/PA6 Injection Molding
   - LIGHTWEIGHT

6. Fully composite and composite hybrid wheel manufactured from Toray Cetex® Carbon/PEI prepreg
   - LIGHTWEIGHT

7. Underbody panel manufactured from Toray Cetex® Glass/PP organo sheet
   - IMPPACT RESISTANT
   - LIGHTWEIGHT

8. Back seat/back rest plate manufactured from Toray Cetex® Carbon/PA6 UD tape
   - STIFF
   - LIGHTWEIGHT

9. Engine protection plate manufactured from Toray Cetex® Carbon/PP organo sheet
   - HIGH TEMPERATURE RESISTANT
   - LIGHTWEIGHT

10. A, B, C pillars manufactured from Toray Cetex® Glass/PA6 UD tape
    - IMPACT RESISTANT
    - LIGHTWEIGHT

11. Side impact beam manufactured from Toray Cetex® Glass/PP organo sheet/UD tape
    - IMPACT ABSORBING
    - LIGHTWEIGHT

12. Engine protection plate manufactured from Toray Cetex® Carbon/PP organo sheet
    - IMPACT RESISTANT
    - LIGHTWEIGHT

13. Underbody panel manufactured from Toray Cetex® Glass/PP organo sheet
    - DRAPABLE
    - LIGHTWEIGHT

14. Back seat/back rest plate manufactured from Toray Cetex® Carbon/PA6 UD tape
    - STIFF
    - LIGHTWEIGHT
Toray thermoset composites utilize both film impregnation and direct impregnation controlling the resin content, as well as the degree of impregnation to meet unique handling and processing requirements for each customer. We work with standard, intermediate, and high modulus carbon fibers in addition to glass fibers in UD, woven, and multi-axial (NCF) reinforcements. These include visual quality standard materials. We offer a wide variety of proprietary resin systems ranging from toughened epoxies to high temperature cyanate esters and BMIs.

We offer different types of thermoset prepregs in each of the following groups:

### MID TEMPERATURE CURING PREPREGS

<table>
<thead>
<tr>
<th>PRODUCT NAME</th>
<th>RESIN TYPE</th>
<th>Tg (DMTA ONSET)</th>
<th>CURE TEMP/TYPICAL CURE TIME</th>
<th>DESCRIPTION OF PROPERTIES</th>
<th>APPLICATION EXAMPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>E726</td>
<td>Epoxy</td>
<td>105°C (221°F)</td>
<td>60 minutes at 120°C (248°F)</td>
<td>Complex shapes easily formed</td>
<td>Bodywork</td>
</tr>
<tr>
<td>E720</td>
<td>Epoxy</td>
<td>110°C (230°F)</td>
<td>60 minutes at 120°C (248°F)</td>
<td>Honeycomb bondable</td>
<td>Ambient structural</td>
</tr>
<tr>
<td>E745</td>
<td>Epoxy</td>
<td>118°C (244°F)</td>
<td>60 minutes at 135°C (275°F)</td>
<td>High toughness and impact properties</td>
<td>Side impact structures</td>
</tr>
<tr>
<td>E722</td>
<td>Epoxy</td>
<td>120°C (248°F)</td>
<td>60 minutes at 120°C (248°F)</td>
<td>Excellent drapability</td>
<td>Monolithic parts</td>
</tr>
<tr>
<td>E721-FR</td>
<td>FR Epoxy</td>
<td>120°C (248°F)</td>
<td>60 minutes at 120°C (248°F)</td>
<td>Fire retardant version of E720</td>
<td>Internal bodywork</td>
</tr>
<tr>
<td>B20</td>
<td>Epoxy</td>
<td>121°C (250°F)</td>
<td>5.5 hours at 80°C (176°F)</td>
<td>Flexible low-to-medium cure schedules 70°C (158°F) to 130°C (266°F)</td>
<td>Development and prototype products requiring a high-quality finish</td>
</tr>
<tr>
<td>E731</td>
<td>Epoxy</td>
<td>140°C (284°F)</td>
<td>60 minutes at 125°C (257°F)</td>
<td>High cosmetic clarity</td>
<td>Door panels, center console, dashboard</td>
</tr>
<tr>
<td>E750</td>
<td>Epoxy</td>
<td>148°C (298°F)</td>
<td>60 minutes at 135°C (275°F)</td>
<td>Variable temperature cure, starting at 80°C (176°F)</td>
<td>High impact areas, body work</td>
</tr>
<tr>
<td>E732 NEW</td>
<td>Epoxy</td>
<td>170°C (338°F)</td>
<td>4 minutes at 160°C (320°F)</td>
<td>Hot in hot-out press processing Short cure cycles between 120°C (248°F) to 160°C (320°F)</td>
<td>Press molded parts, automotive accessories</td>
</tr>
<tr>
<td>E760</td>
<td>Epoxy</td>
<td>204°C (399°F)</td>
<td>2 hours at 180°C (356°F)</td>
<td>High temperature resistance and high mechanical performance</td>
<td>High temperature e.g., rear suspension</td>
</tr>
</tbody>
</table>

### HIGH SERVICE TEMPERATURE

<table>
<thead>
<tr>
<th>PRODUCT NAME</th>
<th>RESIN TYPE</th>
<th>Tg (DMTA ONSET)</th>
<th>CURE TEMP/TYPICAL CURE TIME</th>
<th>DESCRIPTION OF PROPERTIES</th>
<th>APPLICATION EXAMPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC420</td>
<td>Cyanate Ester</td>
<td>178°C (352°F) or 248°C (474°F) with post cure</td>
<td>3 hours at 177°C (350°F). Optional post cure of 260°C (500°F) for higher Tg</td>
<td>Excellent thermal stability, resistance to microcracking</td>
<td>Gear box</td>
</tr>
<tr>
<td>C740</td>
<td>Cyanate Ester</td>
<td>325°C (617°F)</td>
<td>60 minutes at 135°C (275°F) followed by 300°C (572°F) post cure</td>
<td>High temperature resistance and longer out life for larger parts</td>
<td>Pipework and ducting, exhaust area</td>
</tr>
<tr>
<td>C640</td>
<td>Cyanate Ester</td>
<td>335°C (635°F)</td>
<td>10 hours at 80°C (176°F) followed by 300°C (572°F) post cure</td>
<td>High temperature resistance and variable temperature cure</td>
<td>Brake ducts</td>
</tr>
</tbody>
</table>

Full mechanical data is available. Please contact us at Toray Advanced Composites (UK) to discuss your requirements.
HIGH-END AUTOMOTIVE THERMOSET APPLICATIONS

1. Front splitter and roof panel manufactured from Toray E760
   - Impact Resistant
   - Energy Absorbing

2. Engine compartment cover made with Toray C640
   - High Temperature Resistant
   - Lightweight

3. Inserts—vents and headlights made with Toray E731
   - Smooth Surface
   - Drapable

4. Door mirror manufactured from Toray E731
   - Smooth Surface
   - Drapable

5. Door panel manufactured from Toray E731
   - Impact Resistant
   - Energy Absorbing

6. Dashboard manufactured from Toray E731
   - Smooth Surface
   - Drapable

7. Diffuser made with Toray TC346
   - Smooth Surface
   - Impact Resistant

8. Spoiler manufactured from Toray E750
   - Smooth Surface
   - Drapable

9. Center console made with Toray E731
   - Smooth Surface
   - Drapable

10. Chassis with Toray E750
    - Impact Resistant
    - Energy Absorbing

11. Front and rear wings with E750, E760, and TC346
    - Impact Resistant
    - Drapable

12. Door panel manufactured from Toray E750
    - Impact Resistant
    - Energy Absorbing

13. High temperature flooring with E760
    - Impact Resistant
    - Energy Absorbing

14. Diffuser made with Toray TC346
    - Smooth Surface
    - Impact Resistant
LOCATIONS AND CAPABILITIES

SOLUTIONS
- Thermoplastic composites
- Thermoplastic laminates
- Thermoset composites
- Parts manufacture
- Carbon-free manufacturing
- Sales office

CERTIFICATIONS
- ISO 9001:2015
- AS9100D

Morgan Hill - California, United States
Fairfield - California, United States
Camarillo - California, United States
Nottingham, United Kingdom
Nijverdal, The Netherlands
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For more product information such as product data sheets, case studies, or technical papers, please use the following resources:

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