TECHNOLOGY DESCRIPTION PAGE

Prepreg Resin Chemistries

<table>
<thead>
<tr>
<th>TECHNOLOGY</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>PHENOLIC</td>
<td>Phenolic based chemistry is well established within the aerospace and rail industries where ultimate Fire retardancy, low Smoke emission and low smoke Toxicity (FST) properties are required. Phenolic prepregs are therefore commonly used in interior components such as side walls and flooring.</td>
<td>4</td>
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<tr>
<td>EPOXY</td>
<td>Gurit has a range of fire-retardant epoxy systems suitable for applications where increased mechanical properties are required. They exhibit good flame spread properties and can be used in components where higher structural performance is required compared to phenolics, such as flooring panels. Where the optimum blend of FST and mechanical properties is required, certain Gurit epoxy prepregs also can be co-cured with phenolic prepregs. This is an established approach to the manufacture of certain flooring sandwich panels.</td>
<td>4-6</td>
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Structural Core

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<tr>
<th>TECHNOLOGY</th>
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<tr>
<td>PET</td>
<td>Gurit® G-PET™ is a highly adaptable, recyclable, thermoplastic PET (polyethylene-terephthalate) core material with good balance of mechanical properties, temperature resistance, density and cost for a wide range of applications and processes.</td>
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<td>Balsa</td>
<td>Gurit® Balsaflex™ is the classic end-grain balsa wood core, featuring very high strength to weight ratio and is available in range of densities, thickness and finish. Gurit® Balsaflex™ is approved by Germanischer Lloyd (GL).</td>
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ADVANCED COMPOSITE MATERIALS FOR THE RAIL INDUSTRY

As a trusted supplier of composite materials for interior and structural aerospace applications, Gurit has developed a broad range of tried, tested and qualified performance prepreg systems and structural core materials that are ideally suited to manufacture weight-optimised laminate structures, sandwich or crushed-core components that exceed the customers’ performance criteria and the most stringent safety requirements of the global rail market.

Gurit prepregs are used in a growing range of rail projects from High-Speed to Subway trains across the globe. From concept to product development and into production, Gurit’s experience and understanding ensure products are delivered on time and to specification.

Maximum Passenger Comfort

Sandwich constructions are an ideal way to achieve optimal results and meet passenger requirements. In a sandwich panel, two outer material layers provide a stable and smooth surface, while a lightweight core section adds stiffness and insulation, both ideal for rail applications. Modern rail tracks are designed for speed – the straighter the tracks, the smoother and faster the ride. The topography or citiescape between two destinations is a given and the availability of land is often scarce. Therefore, fast, high-speed, urban train lines feature ever-longer tunnels and bridges, consequently travellers and train crew must be even better protected to get a maximum chance of safety escaping during the unlikely event of an emergency. This is a true call for phenolic prepregs!

Meeting the Most Stringent Safety Standards

Favourable mechanical profiles are important, but chemical features of the material are equally vital, especially in terms of passenger safety requirements. The fire, smoke and toxicity performance (FST) is a top priority when selecting new materials. Gurit’s experience in the development of tailored, long-term solutions for the complex aerospace industry has allowed the development and market introduction of Gurit’s range of phenolic and epoxy prepregs to the rail market. The outstanding behaviours of Gurit’s prepregs include short burn lengths, lowest smoke densities and smoke toxicities and very low heat release values. The range of epoxy and phenolic prepregs and structural core materials now balance high performance, with the most stringent safety requirements for maximum passenger safety, including fire and fumes regulation EN45545.
## GURIT’S RANGE OF ADVANCED PREPREGS FOR THE RAIL INDUSTRY

<table>
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<tr>
<th>PRODUCT NAME</th>
<th>MAIN FEATURES</th>
<th>LOWEST CURING TEMP.</th>
<th>FASTEST CURING TEMP.</th>
<th>RECOMMENDED PROCESSING METHOD</th>
<th>SHELF LIFE</th>
<th>TYPICAL REINFORCEMENT</th>
<th>FIRE RATING ACHIEVED</th>
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<tr>
<td><strong>PHENOLIC</strong></td>
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<td><strong>PREPG PRODUCTS NAMING CONVENTION</strong></td>
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<td>- Epoxy Prepreg (E)</td>
<td>- Epoxy Film Adhesives (SA)</td>
<td>- Fire Retardant (FR)</td>
<td>- Epoxy Surfacing Films (SF)</td>
<td>- Phenolic Prepreg (PH)</td>
<td>- Fire Retardant Obliterated Black (FROBL)</td>
<td>- Fire Retardant and Smoke suppressant (FRS)</td>
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## PREPREG PRODUCTS NAMING CONVENTION
- Epoxy Prepreg (E)
- Epoxy Film Adhesives (SA)
- Fire Retardant (FR)
- Epoxy Surfacing Films (SF)
- Phenolic Prepreg (PH)
- Fire Retardant Obliterated Black (FROBL)
- Fire Retardant and Smoke suppressant (FRS)
ST 70FR
Fire Retardant SPRINT™

- Award winning SPRINT™ matrix
- Low smoke toxicity
- Halogen-free
- Suitable for monolithic and sandwich structures
- Excellent laminate quality, from vacuum-only processing

INTRODUCTION
ST 70FR is a fire retardant hot melt, Diuron free epoxy SPRINT™. This is ideally suited to the manufacture of thick sections requiring fire protection. It can be cured at temperatures as low as 70°C, but can also be used for the rapid manufacture of components through its 25-minute cure at 120°C. All of this can be achieved together with an outlife of 14 days at 20°C.

TYPICAL APPLICATIONS
Industrial / commercial marine craft and civil applications where thick fire retardant laminates are required.

PH 840
Phenolic Prepreg

- Tested to EN45545 - HL3 Rating in R1 Category (highest rating)
- Excellent mechanical behaviour
- Good surface finish
- Autoclave-free processes possible
- Short curing time 15 min at 160°C / 320°F
- Long shelf and shop life

INTRODUCTION
PH 840 is a halogen-free modified phenolic system, designed for laminate with bright colour and good surface quality. This prepreg material has been developed for industrial and rail applications with high specific mechanical properties and excellent FST (low heat-release and smoke-density) behaviour.

PH 840 can be cured between 120°C and 160°C (248°F and 320°F). Monolithic and sandwich structures can be easily manufactured with this prepreg. The curing can be performed by press, vacuum and autoclave moulding with a pressure of at least 0.7 bar / 10 psi. Suitable for composite structures experiencing in-service temperatures of -55°C up to +80°C.

TYPICAL APPLICATIONS
PH 840 is ideally suited to rail / industrial / commercial marine craft and automotive applications.

ST 120FRS
Low Smoke FR Epoxy SPRINT™

- Tested to EN45545 - HL2 Rating in R7 Category (HL1 in R1)
- Curable at temperatures as low as 95°C (203°F)
- Can achieve 120°C Tg using vacuum bag processing
- Excellent tack and drape allowing easy in-mould repositioning
- SPRINT™ enables high quality thick cored laminate production in one operation

INTRODUCTION
The SPRINT™ format makes this product ideal for the manufacture of thick sections requiring a high level of fire protection. It can be cured at temperatures as low as 95ºC / 203ºF, but can also be used for faster manufacture of components through its 120 minute cure at 140ºC / 284ºF. ST 120FRS provides high quality laminates from out of autoclave, vacuum only processing.

ST 120FRS has been tested in accordance with the stringent European fire test standard EN45545, achieving a HL2 rating in R7 category (HL1 in R1).

TYPICAL APPLICATIONS
ST 120FRS is ideally suited to rail / industrial / commercial marine craft and civil applications where thick fire retardant laminates are required.

SE 120FRS
Low Smoke FR Epoxy Prepreg

- Tested to EN45545 - HL2 Rating in R7 Category (HL1 in R1)
- Curable at temperatures as low as 95°C (203°F)
- Can achieve 120°C Tg using vacuum bag processing
- Excellent drape allowing easy in-mould repositioning

INTRODUCTION
SE 120FRS is a low temperature curing fire retardant & smoke suppressant epoxy prepreg product. SE 120FRS can be cured at temperatures as low as 95°C / 203°F, but can also be used for faster manufacture of components through its 120 minute cure at 140°C / 284°F. SE 120FRS provides high quality laminates from out of autoclave, vacuum only processing.

SE 120FRS has been tested in accordance with the stringent European fire test standard EN45545, achieving a HL2 rating in R7 category (HL1 in R1).

TYPICAL APPLICATIONS
SE 120FRS is ideally suited to rail / industrial / commercial marine craft and civil applications where thick fire retardant laminates are required.
**INTRODUCTION**

SF 80FROBL surfacing material is a Fire Retardant Obliterated Black (FROBL), filled epoxy film. It provides an effective fire retarding layer capable of withstanding exposure to fire, while preventing the epoxy substrate from combustion.

SF 80FROBL can be used directly against a suitably release treated mould surface, with prepreg or SPRINT™ plies laid up behind it, or as a final layer in the mould. The product is sufficiently tacky to aid placement into vertical surfaces of a mould. SF 80FROBL can be cured with vacuum only processing.

The epoxy system is supplied ready impregnated into a supporting medium and ready catalysed, requiring only a moderate temperature cure.

**TYPICAL APPLICATIONS**

Typical applications include protection of structural components in high risk areas such as engine bays, exhaust runs, and around the fuel system.

**Gurit® Balsaflex™**

**Classic Wood Core**

- High quality composite core material made from end grain balsa
- Highest strength to weight ratio of any structural core
- Natural, sustainable and responsibly sourced

**INTRODUCTION**

Gurit® Balsaflex™ is the classic end-grain balsa wood core, featuring very high strength to weight ratio. When an application requires high-strength and stiffness and cost effectiveness, Gurit® Balsaflex™ is a suitable solution due to a good balance between cost, properties and weight. Gurit® Balsaflex™ is GL and Lloyd’s approved.

**TYPICAL APPLICATIONS**

Gurit® Balsaflex™ is used for wind turbine blades and nacelles, marine, automotive, truck, rail and aircraft parts. Gurit® Balsaflex™ can be supplied in sheet form or kit-cut to customer’s desired shapes.
TECHNICAL INFORMATION AND PRICING

For more detailed information on aerospace grade prepregs, as well as the complete Gurit product portfolio, please visit: www.gurit.com to view the following:

- Product Data Sheets
- News / Case Studies
- Events Schedules
- Product Brochures
- Corporate Videos
- Composite Guides
- Representatives Contact Details

For pricing or other enquiries, please contact gurit@gurit.com