Composite Materials for Wind Energy
INTRODUCTION
The wind energy industry is one of Gurit’s long-standing, strategic target markets. Gurit serves wind turbine blade and component manufacturers with a complete offering - from Tooling (i.e. the design, production and supply of wind turbine blade moulds and related equipment), the development, production and supply of advanced Composite Materials to Technical Support and solutions for the repair of installed wind blades.

Composite material solutions developed by Gurit for manufacturers of wind turbine blades have continuously contributed to the increasing efficiency of wind power installations worldwide. New materials solutions were developed with the aim to keep the weight of the wind turbine blades as light as possible, yet maximising their strength, stiffness and durability. At the same time, Gurit has contributed to making wind energy a technical and also a commercial success story by helping to decrease manufacturing costs of wind turbine blades and enhancing the efficiency of wind power installations.

Gurit’s broad range of award-winning products and solutions is unique in covering both infusion and prepreg blade technology, with the capability to supply all the relevant materials needed for building a composite blade.
### MATERIALS FOR WTG BLADE MANUFACTURE

#### STRUCTURAL CORE MATERIALS
- Kerdyn™
- Gurit PVC
- Corecell™
- Balsaflex™
- WE Prepreg
- WT SPRINT™
- SparPreg™
- Spabond™
- 5-Minute Spabond™
- 730 Spabond™
- 840 Spabond™
- SA 80 Ampreg™
- TPC
- S-Fill 15 min
- S-Fair 600
- RENUVO™ PP
- RENUVO™ MPS

#### MATERIALS FOR WTG BLADE SERVICING & MAINTENANCE

1. **Leading / Trailing Edge Erosion**
   - Pinholes
   - Blisters
   - Superficial scratches

2. **Trailing Edge Split**

3. **Lightning Strike**
   - Gutter
e   - Winglets
   - Lightning protection

4. **Surface Defects**
   - Pinholes
   - Blisters
   - Superficial scratches

5. **Retrofitted Parts**
   - Gutter
e   - Winglets
   - Lightning protection

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<th>B Trailing Edge Split</th>
<th>C Lightning Strike</th>
<th>D Surface Defects</th>
<th>E Retrofitted Parts</th>
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INTRODUCTION

Gurit® Corecell™ T has been developed as a technological step-change from traditional PVC and Balsa structural core. Gurit® Corecell™ T is an outstanding core material in every application where balsa or cross-linked PVC is commonly used. High mechanical toughness and thermal stability give Gurit® Corecell™ T excellent fatigue characteristics. This reliability makes Gurit® Corecell™ T a natural replacement for cross-linked PVC or balsa in applications where a significant service life is required.

The high temperature stability of Gurit® Corecell™ T also means that it can be used in manufacturing processes to at least 120°C / 250°F with short durations during a cure cycle to over 150°C / 300°F. This makes it ideal for use with conventional prepreg and in some liquid infusion processes where high resin exotherms can often be seen. Gurit® Corecell™ T is available in every resin infusion format and is compatible with polyester, vinylester and epoxy resin systems. Low resin absorption characteristics of Gurit® Corecell™ T and unique knife cut formats allow for higher performing infusions, lower resin cost and lower weight than any other structural core.

TYPICAL APPLICATIONS

Ideal for applications where loads are less dynamic in nature, such as wind turbines, above the waterline on yachts, and in mass transport.

Gurit® Kerdyn™ Green

Recycled Structural Foam

- Up to 100% recycled PET content
- Improved mechanical properties
- Recyclable
- Compatible with all types of composite manufacturing techniques

INTRODUCTION

Gurit® Kerdyn™ Green is a new recyclable, thermoplastic foam with an improved balance of mechanical properties, enhanced resin uptake performance, and good temperature resistance for a wide range of applications and production processes.

TYPICAL APPLICATIONS

Gurit® Kerdyn™ Green is used extensively in wind turbine blades, civil and marine structures. Gurit® Kerdyn™ Green is available in plain sheet form. A fire retardant version is also available with certification under review.

Gurit® PVC & Gurit® PVC HT

All-Purpose Foam Core

- Suitable for all composite sandwich applications
- Superior strength and stiffness to weight ratio
- Self extinguishing

INTRODUCTION

Gurit® PVC is a closed cell, cross-linked PVC foam. It provides superior strength to weight ratio for all composite applications. Other key features of Gurit® PVC include outstanding chemical resistance, negligible water absorption, and excellent thermal insulation capabilities. It is compatible with most common resin systems including epoxy, polyester and vinyl ester.

Gurit® PVC is available in a wide range of formats with all standard cut patterns and finishes possible.

TYPICAL APPLICATIONS

Gurit® PVC is an all-purpose core and can be used in wind turbine blade shells, boat decks, hull sides, bulkheads, floors.
### PREPREG & SPRINT™ MATERIALS

<table>
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<tr>
<th>WE 91-1 / WE 91-2</th>
<th>Long shop life</th>
<th>Cure from 85°C to 120°C</th>
<th>GL approved</th>
</tr>
</thead>
</table>

- High flow epoxy resin matrix
- High (WE 91-1) and medium (WE 91-2) tack prepreg
- Long ambient shelf-life - up to 2 months

**INTRODUCTION**

Gurit’s WE 91 prepreg product range comprises of two tack variants; WE 91-1 high tack and WE 91-2 medium tack prepregs. WE 91 is a high flow epoxy prepreg ideally suited to structural composite component manufacture. It can be cured at temperatures as low as 85°C / 185°F, but can also be used for the rapid manufacture of components through its 45-minute cure at 120°C / 250°F. All of this can be achieved together with an out-life of 60 days at 21°C / 70°F. WE 91 is designed for vacuum bag processing and offers excellent mechanical performance on glass and carbon fibre reinforcements.

**TYPICAL APPLICATIONS**

- Technically and commercially competitive engineering materials.

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<table>
<thead>
<tr>
<th>WT 93</th>
<th>Cure from 85°C to 120°C</th>
<th>Ideal for thick UD sections</th>
<th>Out of autoclave</th>
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</table>

- WT 93 low tack SPRINT™ resin matrix
- Good out-life at 21°C / 70°F
- Cure from 85°C - 120°C / 185°F - 250°F
- Dry fabric enables efficient air evacuation
- Suitable for automated lay-up
- Excellent laminate quality with low void content

**INTRODUCTION**

WT 93 is part of Gurit’s comprehensive offering of structural composite product solutions comprising of 3 main product groups: Prepreg, SPRINT™ and SparPreg™. This unique product range provides technically and commercially competitive engineering materials, ideal for use either solely, or in conjunction with other Gurit products from within the range. WT 93 can be cured at temperatures as low as 85°C / 185°F, but can also be used for the rapid manufacture of components through its 45-minute cure at 120°C / 250°F. All of this can be achieved together with an out-life of 21 days at 21°C / 70°F. WT 93 is designed for vacuum bag processing and offers excellent mechanical performance on glass and carbon fibre reinforcements.

**TYPICAL APPLICATIONS**

- Gurit’s innovative WT 93 SPRINT™ product range uses a high flow, low tack epoxy prepreg ideally suited to the manufacture of thick sections such as turbine blade roots or spars.

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<table>
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<tr>
<th>SparPreg™</th>
<th>Glass &amp; Carbon formats</th>
<th>High performance UD Prepreg</th>
<th>Out of autoclave</th>
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- UD prepreg ideal for use in thick sections
- Available with glass or carbon fibre
- Excellent mechanical properties
- Out-of-autoclave curing
- Excellent handling & processing properties during lamination
- Recommended cure between 85°C / 185°F and 120°C / 250°F

**INTRODUCTION**

SparPreg™ was developed to benefit the lay-up of thick UD sections, such as wind turbine blade spars. The material can produce thick laminates of exceptional quality with low void content, without the need for an intermediary debulking process or additional dry fabric reinforcement to aid air removal. The net result enables blade manufacturers to eliminate production steps and redundant materials and increase capacity.

SparPreg™ has been specially formulated to achieve the outstanding in-cure and mechanical performance of the WE 91 prepreg and WT 93 SPRINT™ resin systems. SparPreg™ can be cured at temperatures as low as 85°C / 185°F, but can also be used for the rapid manufacture of components at 120°C / 250°F.

**TYPICAL APPLICATIONS**

SparPreg™ is an advanced UD prepreg, developed to enable the economic manufacture of unidirectional spar caps for more demanding blade designs, ideal for use in conjunction with other Gurit products.
ADHESIVE SYSTEMS

SPABOND™ 5-MINUTE
Tacking and Secondary Bonding

- 5 minute adhesive
- Available in cartridges
- Can be used alongside other Spabond™ products
- Ideal when used as an "extra hand" in assembly

INTRODUCTION
Spabond™ 5-Minute uses Gurit's fast-setting technology. It combines outstanding bonding speed with a simple 1:1 by weight and by volume mix ratio. This thixotropic system is ideal for general bonding and repair work on a wide range of materials. Components bonded with Spabond™ 5 Minute demonstrate high bond strengths and can be handled after a very short period of time. Spabond™ 5-Minute can be used in conjunction with other Spabond™ products as a “spot weld” system in situations where the use of conventional clamps is not possible.

TYPICAL APPLICATIONS
Used for in-field & component bonding (gutters, lightning protection).

PACK SIZES & AVAILABILITY
Spabond™ 5-Minute is available in individual 310ml resin and hardener cartridges or 400ml combined cartridges with mix-heads.

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SPABOND™ 730
Rapid Structural Bonding

- Reduced clamp time structural adhesive
- High strength and toughness
- Gels in 10 minutes, touch-dry in 2 hours
- Full properties after an overnight cure at ambient

INTRODUCTION
Spabond™ 730 is a fast curing structural adhesive designed for applications where reduced clamp times are important. It has a simple 1:1 by weight and volume mix ratio. It can be used to bond together a wide variety of dissimilar materials and has been designed to give a durable high strength bond.

TYPICAL APPLICATIONS
- Fit-out, finishing and repair.

PACK SIZES & AVAILABILITY
Spabond™ 730 is available in 400ml cartridges with mix-heads. Cartridge guns and additional mix heads are also available.

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SPABOND™ 840
Fast Curing Structural Epoxy Adhesive

- DNV-GL Certified
- Long working time – for manufacture of large components
- Rapid cure in 2 hours at 70°C – allows reduced cycle time
- High strength and next-generation high toughness & impact strength
- Formulated with Gurit LRT (Light Reflective Technology) as standard to allow easy inspection of hard to reach bond lines
- Low Toxicity Formulation: Improved Hazard Labelling, CMR, SVHC & AEP** Free

INTRODUCTION
Spabond 840 is a high performance, cost-effective toughened adhesive system with good thermal, mechanical properties with a long working time for adhesive application yet incorporates innovative chemistry to allow a rapid 2 hour cure time at elevated temperature. The unique formulation offers improved health & safety through the careful selection of low-toxicity raw materials as well as Light Reflective Technology which in conjunction with a UV light-source can detect droplets as small as 1mm for easy identification of contamination to improve industrial hygiene or for the inspection of bondlines to ensure constant quality and reliability of components.

The components are contrasting colours to give a visual indication of mix quality, which is a useful feature when mixing by hand or with a machine. The system has a simple 3:1 mix ratio by weight.

TYPICAL APPLICATIONS
Used for bonding large structures such as wind turbine blades and yacht hulls.

PACK SIZES & AVAILABILITY
Spabond 840 is available in 20 kg straight-sided pails and 180kg drums for machine mixing and dispense.

** CMR = Substances classified as Carcinogenic, Mutagenic or toxic for Reproduction.
SVHC = Substances of Very High Concern.
AEP = Commonly used fast epoxy curing agent classified as CM

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SA 80
Toughened Epoxy Film Adhesive

- Low temperature cure
- Designed for bonding prepreg skins to honeycomb and certain foam cores
- Controlled flow for maximum bond integrity
- Toughened for impact resistance and peel strength

INTRODUCTION
SA 80 is a film adhesive that is designed for secondary bonding, core-bonding and for co-curing with the range of Gurit prepregs. It can be cured at temperatures as low as 80°C, or can be more quickly cured at temperatures above 120°C. It has an out-life of 56 days at room temperature.

TYPICAL APPLICATIONS
Suitable for bonding aluminum, foam and honeycomb cores in conjunction with Gurit’s range of Prepreg or Ampreg laminating systems. See individual Technical Datasheets for further information.

PACK SIZES & AVAILABILITY
SA 80 is available in weights up to 300g resin films with or without a glass carrier.

*150, 250g and 300g only
**LAMINATING SYSTEMS**

**AMPREG™ 30**
Low Toxicity Epoxy
Wet Laminating System

- DNV-GL certified formats available
- Low initial mixed viscosity & good cure progression from ambient only cures
- With Gurit LRT (Light Reflective Technology) as standard
- Same 100:26 resin to hardener mix ratio by weight across range of hardener speeds

**INTRODUCTION**

Ampreg™ 30 has been optimised for the manufacture of large composite structures using hand layup and vacuum bagging techniques whilst offering improved health and safety through the careful selection of low toxicity raw materials.

The relatively low initial mixed viscosity of Ampreg™ 30 allows easy wetout of heavyweight reinforcements.  Ampreg™ 30 has been designed to give excellent mechanical and thermal properties from both ambient temperature cures, and moderate temperature postcures (50°C).  This system is available with a range of hardener speeds, from Fast to Extra Slow.  The unique formulation offers improved health & safety through the careful selection of low toxicity raw materials as well as Light Reflective Technology which in conjunction with a UV light-source can detect droplets as small as 1mm for easy identification of contamination to improve industrial hygiene.

**TYPICAL APPLICATIONS**

Manufacture of large composite structures in the wind, construction and marine industries.

**PACK SIZES & AVAILABILITY**

Available in a wide range of formats from small pack sizes to drums and IBCs.

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**AMPREG™ 31**
Low Toxicity Epoxy
Wet Laminating System

- DNV-GL certified formats available
- Viscosity optimised for good fabric wet-out and drainage resistance
- With Gurit LRT (Light Reflective Technology) as standard
- Same 100:26 resin to hardener mix ratio by weight across range of hardener speeds

**INTRODUCTION**

Ampreg™ 31 has been optimised for the manufacture of large composite structures using hand layup and vacuum bagging techniques whilst offering improved health and safety.  The viscosity of Ampreg™ 31 has been optimised for good fabric wet-out whilst maintaining good drainage resistance for application on vertical surfaces.  Ampreg™ 31 has been designed to give excellent mechanical and thermal properties from both ambient temperature cures and moderate temperature postcures (50°C).  This system is available with the full range of Ampreg 30 hardener speeds, from Fast to Extra Slow.  The unique formulation offers improved health & safety through the careful selection of low toxicity raw materials as well as Light Reflective Technology which in conjunction with a UV light-source can detect droplets as small as 1mm for easy identification of contamination to improve industrial hygiene.

**TYPICAL APPLICATIONS**

Manufacture of large composite structures in the wind, construction and marine industries.

**PACK SIZES & AVAILABILITY**

Available in a wide range of formats from small pack sizes to drums and IBCs.

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**IN-MOULD PROCESS COAT**

**TRANSLUCENT PROCESS COAT (TPC)**
Epoxy In-mould Process Coat

- Suitable for all blade manufacturing techniques
- Easy to sand
- Mix ratio (by weight) 100:25

- Long over-coating window
- Easy to sand
- Semi-Translucent
- Provides high quality, pin hole free, toughened surface for PU paint application
- Can be applied up to 750 microns on a vertical surface without drainage
- Excellent adhesion to SPRINT™, prepreg and infused laminate

**INTRODUCTION**

Gurit TPC is a translucent in-mould process coat designed to give a pin-hole free surface on composite laminates for subsequent PU paint application. It tacks off in 30 minutes at 50°C and 90 minutes at 25°C.

**TYPICAL APPLICATIONS**

Excellent adhesion to infusion, SPRINT™ and prepreg material can be achieved. Process Coat is easy to sand and is compatible with a wide range of PU paints typically used to finish wind turbine blades.

**PACK SIZES & AVAILABILITY**

Process Coat is available in 28 / 220 kg resin and 7 / 25 kg hardener quantities.
FILLING AND FAIRING

**S-Fair™ 600**

- Available in 10 / 2.5 L resin and 10 / 2.5 L hardener quantities.
- Designed for filling and fairing large composite and metal structures.

**TYPICAL APPLICATIONS**
- Used in combination with RENUVO™ Multi-Purpose System (MPS) to complete structural repairs.
- Can be used as a stand-alone spot repair or in combination with RENUVO™ Prepreg for structural repair.

**INTRODUCTION**

Gurit’s S-Fair™ 600 is available in 10 / 2.5 L resin and 10 / 2.5 L hardener quantities. It is easy to sand and is compatible with a wide range of primers and top coats typically used in the marine market for the finishing of yachts. It is available with two hardeners; Fast and Standard, which enables the customer to tailor the working/cure time to the ambient workshop temperature.

**TYPICAL APPLICATIONS**
- Designed for filling and fairing large composite and metal structures.

**PACK SIZES & AVAILABILITY**
- S-Fair™ 600 is available in 10 / 2.5 L resin and 10 / 2.5 L hardener quantities.

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REPAIR SYSTEMS

**RENUVO™ PP**

- UV Curing resin system
- Mono-component resin technology
- Clean processing avoiding mixing and contamination
- Compatible with current topcoat solutions

**INTRODUCTION**

RENUVO™ Prepreg (PP) is a breakthrough UV curing Prepreg system, developed by Gurit as a repair system for turbine blades. The system can be used either as a stand-alone spot repair or in combination with RENUVO™ Multi-Purpose System (MPS) to complete structural repairs.

**TYPICAL APPLICATIONS**
- Repair system for turbine blades.

**PACK SIZES & AVAILABILITY**
- RENUVO™ MPS is available in 310ml (10.9floz) cartridge format.

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**RENUVO™ MPS**

- UV Curing Multi-Purpose System
- Clean processing avoiding mixing and contamination
- Compatible with current topcoat solutions

**INTRODUCTION**

RENUVO™ Multi-Purpose System (MPS), is a breakthrough UV curing resin system, developed by Gurit as a repair system for turbine blades. The system can be used either as a stand-alone spot repair or in combination with RENUVO™Prepreg for structural repair.

**TYPICAL APPLICATIONS**
- Repair system for turbine blades.

**PACK SIZES & AVAILABILITY**
- RENUVO™ MPS is available in 310ml (10.9floz) cartridge format.

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**S’Fill™ 15 Minute**

- Simple 1:1 mix ratio by volume
- Spreadable for up to 5 minutes
- 15 minute tack-off time
- Easy to sand without clogging after 1 hour

**INTRODUCTION**

Gurit’s S’Fill™ 15 Minute Filler is an epoxy filler system designed for rapid cure at ambient temperature, to allow sanding without clogging at just over an hour after application. As well as rapid cure and good sandability, the system has been developed to offer ease of dispense and mixing, good sag resistance during application, good cured properties. The system offers a simple 1:1 mix ratio, high levels of adhesion, low shrinkage and good thermal and mechanical properties.

**TYPICAL APPLICATIONS**
- Ideal for rapid filling and repairing all sizes of composite and metal structures.

**PACK SIZES & AVAILABILITY**
- S’Fill™ 15 Minute is available in 2 L resin and hardener pack quantities.

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**S-Fair™ 600**

- Sag resistance up to 35mm on vertical surfaces
- Easy to sand
- Simple 1:1 mix ratio by volume
- Available with two hardeners; Fast and Standard
- Simple mix ratio (volume)
- Density of 0.86-0.93 g/cm³

**INTRODUCTION**

S-Fair™ 600 is a simple 1:1 by volume, two component filler that can be applied up to a thickness of 35mm on a vertical surface. It is easy to sand and is compatible with a wide range of primers and top coats typically used in the marine market for the finishing of yachts. It is available with two hardeners; Fast and Standard, which enables the customer to tailor the working/cure time to the ambient workshop temperature.

**TYPICAL APPLICATIONS**
- Designed for filling and fairing large composite and metal structures.

**PACK SIZES & AVAILABILITY**
- S-Fair™ 600 is available in 10 / 3.5 L resin and 10 / 3.5 L hardener quantities.