ST 70

STRUCTURAL SPRINT™

- Award winning SPRINT™ matrix
- Zero volatile/solvent content
- Available with a range of reinforcements
- Suitable for vacuum bag processing
- Controllable in thick sections
- Low exothermic properties
- Recommended cure between 70-120ºC (158-248ºF)
- Excellent laminate quality, low bleed

INTRODUCTION

ST 70 is part of the range of SPRINT™ products. This unique range provides technically and commercially competitive engineering materials, ideal for use either solely, or in conjunction with other products from within the product range along with other Gurit products.

ST 70 is a hot-melt, Diuron free epoxy SPRINT™ ideally suited to the manufacture of thick sections. It can be cured at temperatures as low as 70ºC (158ºF), but it can also be used for the rapid manufacture of components through its 25 minute cure at 120ºC (248ºF). All of this can be achieved together with an outlife of 21 days at 21ºC (70ºF)

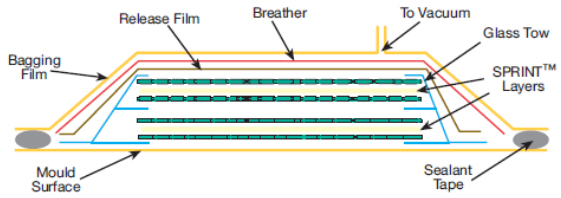
ST 70 is designed for vacuum bag processing and offers excellent mechanical performance on glass fibre reinforcements. Currently ST 70 is manufactured into a SPRINT™ structure with E-glass and Carbon fibres, which are manufactured into biaxial or woven materials.

INSTRUCTIONS FOR USE

1. The moulding surface must first be treated with a release agent. If a Surface Film is required, this should be applied directly to the tool face prior to the lay-up of the SPRINT™. Please refer to Processing Notes for application details.

The required number of plies of SPRINT™ are then placed on to the tool face. A thermocouple may be inserted into the lay-up outside the net trim line. Dry glass tows should be inserted between plies of SPRINT™ to provide an air evacuation path out of the laminate. The second end of the tow should be made available for contact with the breather.

2. If required, a peel ply, pre-impregnated or dry, can be applied over the top of the laminate stack. Note that for good secondary bonding of a peel-plied surface of a laminate, a nylon peal ply such as Tygavac Stitch Ply A, is strongly recommended. The peel ply is covered entirely with a non-perforated release film such as Tygavac WL3600 or a low bleed release film, such as WL3600RP2. The release film is then covered with breather material, such as Tygavac Econoweave 44W, so that it extends over the release film in all directions and contacts the dry glass strands.



Typical processing diagram showing two SPRINT™ layers

3. Once the lay-up is complete, a vacuum bag is installed by standard techniques. At least two vacuum stems should be inserted through the bag, one connecting to the vacuum source and the other, at a point on the part furthest from the source, to a calibrated vacuum gauge. The major benefit of SPRINT™ is that it enables all of the air to be removed from the laminate prior to fibre wet out and resin cure. It is recommended that a vacuum is applied at ambient temperature prior to cure, to fully evaluate the laminate stack. This should be held for between 5 minutes and 1 hour, depending upon the size and thickness of the component. Full vacuum is then maintained throughout the cure.

PLEASE NOTE: Further advice can be found in the SPRINT™ Processing Notes or by contacting Technical Services. Key points to observe are as follows:

- To avoid condensation on the product ensure that is has reached room temperature before unwrapping.
- Minimum curing vacuum level of 90% must be maintained throughout the cure
- Vacuum integrity should be less than a 5% loss in 5 minutes
- The low temperature curing chemistry necessitates the need to strictly observe the 21 day shelf-life at 21°C
- Minimum cure temperature must not fall below 70°C for the minimum 16 hour cure period
- For optimum air evacuation the lay-up should be designed such that each ply has direct dry fabric contact with the vacuum stack

4. Cure the laminate in accordance with the specification given later in this datasheet.

PRODUCT INFORMATION

ST 70 SPRINT™ materials can be used with both SPRINT™ and prepreg products. It is supplied with a poly backer and can be applied to the substrate with either side against the tool.

In order to maximise the potential of ST 70 product range please contact the Gurit Technical Department.

General prepreg working practices apply to these products, details of which can be obtained from the Gurit Guide to Composites or by contacting the Gurit Technical Department.

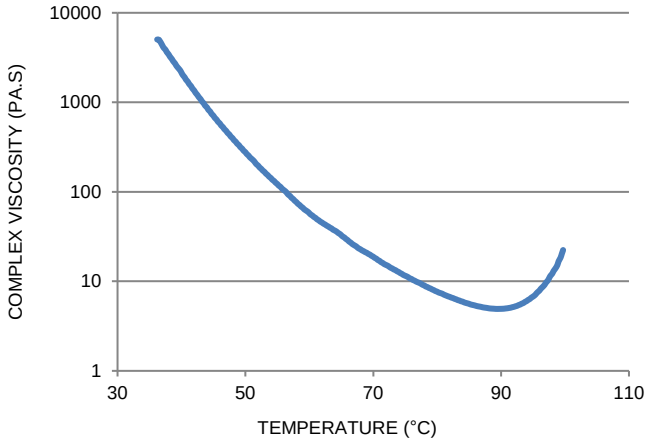
The self-impregnation of the SPRINT™ can compromise its ability to generate high quality laminates as the air breathing properties decrease after a certain length of time at ambient temperature. Self-impregnation will increase the tack and reduce the drape of the material. While self-impregnation will vary from product to product, most SPRINT™ materials stored at ambient temperatures will start to self-impregnate within approximately two weeks. It is recommended that ambient temperature storage is below 22ºC (71ºF) as higher storage temperatures will induce premature self-impregnation. Contact Technical Support for further advice.

PREPREG PROPERTIES

RHEOLOGY DATA

ST 70 resin viscosity profile conducted at 1°C (1.8°F)/minute.

PROPERTY	VALUE	
Minimum Viscosity	4.92 Pa.s	49.2 P
Temperature at Minimum Viscosity	89.5 °C	193 °F



TRANSPORT & STORAGE

When stored sealed & out of direct sunlight.

STORAGE TEMP		UNIT	VALUE
-18°C	0°F	months	24
21ºC	70ºF	days	21

All SPRINT™ materials should be stored in a freezer when not in use to maximise their useable life, since the low temperature reduces the reaction of resin and catalyst to virtually zero. However, even at -18°C (0°F), the temperature of most freezers, some reaction will still occur. In most cases after some years, the material will become unworkable. To avoid condensation on the product ensure that is has reached room temperature before unwrapping.

HEALTH AND SAFETY

Please refer to product SDS for up to date information specific to this product.

CURING SCHEDULE

CURE ENVELOPE AND CURED PROPERTIES

Structural SPRINT™ ST 70 has a relatively flexible cure envelope. The minimum cure is 16 hours 70ºC (158ºF) and rapid cure is 25 minutes at 120ºC (248ºF). Other cure temperatures and times are given in the Working Properties section.

Structural SPRINT™ ST 70 works by first applying a vacuum to the laminate stack to remove all air. It is recommended that an ambient vacuum is applied prior to cure, to fully evacuate the laminate stack. The temperature is then increased so that the matrix resin reduces in viscosity and wets the evacuated reinforcement within the laminate. A dwell can be used at the “infusion” temperature to ensure good laminate quality. The temperature is then further increased to cause the matrix resin to cross-link and is then held at the cure temperature until the cross linking process is complete. Once this is achieved heating is removed so that the temperature is reduced under natural cooling. The vacuum must be maintained throughout the cure until the part has been cooled to 60ºC (140ºF).

70ºC (158ºF) should be considered to be the minimum cure temperature to generate optimum mechanical properties. All temperature readings during cure should be taken from the lowest reading thermocouple.

TYPICAL CURE PROFILES

The successful use of these cure schedules will depend on part size laminate construction. Heat up rate and dwell periods need to be tailored to take consideration of oven capacity, thermal mass of tool, laminate construction etc. Data in the minimum cure temperature table on the next page is based on laminate temperatures, air temperatures may need to be higher. It is recommended that Gurit is contracted for further advice before utilising any of the suggested cure cycles.

MINIMUM CURE TIME & TEMPERATURE

ST 70 SPRINT™ using vacuum bag processing with recommended minimum cure of 16 hours at 70ºC (158ºF)

PROPERTY	ULTRA SLOW CURE CYCLE	STANDARD CURE CYCLE	FAST CURE CYCLE	TEST STANDARD
Processing Method	Vacuum Bag			
Typical Ramp Rate	0.3°C (0.5°F) per minute	1°C (1.8°F) per minute	2°C (3.6°F) per minute	-
Dwell Temperature	55°C (131°F)	55°C (131°F)	55°C (131°F)	-
Dwell Time	60 (min)	60 (min)	60 (min)	-
Cure Temperature	70°C (158°F)	70°C (158°F)	120°C (248°F)	-
Cure Time	16 hours	16 hours	25 (min)	-
Cure Pressure	-1 (bar)			-
Dry Tg_1 (DMA)	85°C (185°F)	85°C (185°F)	110°C (230°F)	ASTM D7028

NOTE: It is strongly recommended that laminate temperatures are monitored throughout the cure. 0.3ºC (0.5ºF)/min should be considered the minimum acceptable laminate ramp rate.

LAMINATE PROPERTIES

CURED RESIN PROPERTIES

Resin cast oven cured using standard processing techniques and standard cure of 16 hours at 70°C (158°F).

PROPERTY	SYMBOL	16 HOURS @ 70 °C (158ºF)		TEST STANDARD
Tensile Strength	σ_T	84 MPa	12 Ksi	ISO 527-2
Tensile Modulus	E_T	3.8 GPa	0.55 Msi	ISO 527-2
Tensile Strain to Failure	ε_T	3.1 %		ISO 527-2
Flexural Strength	σ_F	133 MPa	19 Ksi	ISO 178
Flexural Modulus	E_F	3.5 GPa	0.51 Msi	ISO 178

WOVEN LAMINATE PROPERTIES - CARBON

Cured using standard processing techniques and a standard cure time of 16 hours 70^0C (158°F).

PROPERTY	SYMBOL	ST70/RC303T/51%/RC303T		ST70/RC660T/51%/RC660T		TEST STANDARD
Fabric / Fibre Description	-	2 x 300g/m^2 2x2 twill fabric / 12k fibre		2 x 660g/m2 2x2 twill fabric / 12k fibre		-
Resin Content	-	51%		51%		-
Cure Method	-	Vacuum Bag		Vacuum Bag		-
Cure Schedule	-	16 hour / 70ºC (158ºF) / -1 bar		16 hour / 70ºC (158ºF) / -1 bar		-
Glass Transition Temperature (DMA)	Tg_1	85°C (185°F)				ISO 6721
Cured Ply Thickness	t_{ply}	0.41 mm	0.016 in	0.91 mm	0.036 in	ASTM D 3171 Method II
0° Tensile Cured Fibre Volume*	V_f	40.9 %		39.7 %		ASTM D 3171 Method II
0° Tensile Strength (Normalised to 60%)	X_T	1226 MPa	178 Ksi	1083 MPa	157 Ksi	ISO 527-4
0° Tensile Modulus (Normalised to 60%)	E_t	72 GPa	10 Msi	76 GPa	11 Msi	ISO 527-4
0° Compressive Str. Fibre Volume *	V_f	40.8 %		40.5 %		ASTM D 3171 Method II
0° Compressive Strength (Normalised to 60%)	X_C	703 MPa	102 Ksi	770 MPa	112 Ksi	SACMA SRM1-94
0° Comp. Mod. laminate Fibre Volume*	V_f	41.1 %		40.7 %		ASTM D 3171 Method II
0° Compressive Modulus (Normalised to 60%)	E_c	60 GPa	8.7 Msi	63 GPa	9.1 Msi	SACMA SRM1-94
±45° Tensile Cured Fibre Volume*	V_f	40.5 %		39.6 %		ASTM D 3171 Method II
±45° Tensile Strength	τ_{12}	128 MPa	19 Ksi	156 MPa	23 Ksi	ISO 14129
±45° Tensile Modulus	G_{12}	11 GPa	0.15 Msi	12 GPa	1.7 Msi	ISO 14129
0° ILSS Fibre Volume*	t_{ply}	40.7 %		42.1 %		ASTM D 3171 Method II
0° ILSS	V_f	61 MPa	8.8 Ksi	49 MPa	7.1 Ksi	ISO 14130

* original laminate fibre volume fraction

WOVEN LAMINATE PROPERTIES - GLASS

Cured using standard processing techniques and a standard cure time of 16 hours 70^0C (158°F).

PROPERTY	SYMBOL	ST70/WRE581T/41%/WRE581T		ST70/XE905/S/S		TEST STANDARD
Fabric / Fibre Description	-	2 x 580g/m^2 2x2 twill fabric / E-glass		945g/m^2 stitched triaxial fabric / E-glass		-
Resin Content	-	41%		43%		-
Cure Method	-	Vacuum Bag		Vacuum Bag		-
Cure Schedule	-	16 hour / 70ºC (158ºF) / -1 bar		16 hour / 70ºC (158ºF) / -1 bar		-
Glass Transition Temperature (DMA)	Tg_1	85°C (185°F)				ISO 6721
Cured Ply Thickness	t_{ply}	0.55 mm	0.021 in	0.90 mm	0.035 in	ASTM D 3171 Method II
0° Tensile Cured Fibre Volume*	V_f	40.4 %		38.2 %		ASTM D 3171 Method II
0° Tensile Strength (Normalised to 60%)	X_T	579 MPa	84 Ksi	402 MPa	58 Ksi	ISO 527-4
0° Tensile Modulus (Normalised to 60%)	E_t	33 GPa	4.8 Msi	23 GPa	3.3 Msi	ISO 527-4
0° Compressive Str. Fibre Volume *	V_f	39.8 %		-		ASTM D 3171 Method II
0° Compressive Strength (Normalised to 60%)	X_C	670 MPa	970 Ksi	-	-	SACMA SRM1-94
0° Comp. Mod. laminate Fibre Volume*	V_f	39.6 %		-		ASTM D 3171 Method II
0° Compressive Modulus (Normalised to 60%)	E_c	35 GPa	5.1 Msi	-	-	SACMA SRM1-94
±45° Tensile Cured Fibre Volume*	V_f	39.1 %		-		ASTM D 3171 Method II
±45° Tensile Strength	τ_{12}	177 MPa	26 Ksi	-	-	ISO 14129
±45° Tensile Modulus	G_{12}	12 GPa	1.7 Msi	-	-	ISO 14129
0° ILSS Fibre Volume*	t_{ply}	42.9 %		33.8 %		ASTM D 3171 Method II
0° ILSS	V_f	57 MPa	8.3 Ksi	49 MPa	7.1 Ksi	ISO 14130

* original laminate fibre volume fraction

NOTICE

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The Company strongly recommends that Customers make test panels in the final process conditions and conduct appropriate testing of any goods or materials supplied by the Company prior to final use to ensure that they are suitable for the Customer's planned application. Such testing should include testing under conditions as close as possible to those to which the final component may be subjected. The Company specifically excludes any warranty of fitness for purpose of the goods other than as set out in writing by the Company. Due to the varied nature of end-use applications, the Company does, in particular, not warrant that the test panels in the final process conditions and/or the final component pass any fire standards.

The Company reserves the right to change specifications and prices without notice and Customers should satisfy themselves that information relied on by the Customer is that which is currently published by the Company on its website. Any queries may be addressed to the Technical Services Department.

Gurit is continuously reviewing and updating literature. Please ensure that you have the current version by contacting your sales contact and quoting the revision number in the bottom left-hand corner of this page.

TECHNICAL CONTACT INFORMATION

For all other enquiries such as technical queries:

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24-HOUR CHEMICAL EMERGENCY NUMBER

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