

# SE 70

## LOW TEMPERATURE CURE HIGH TOUGHNESS EPOXY PREPREG SYSTEM

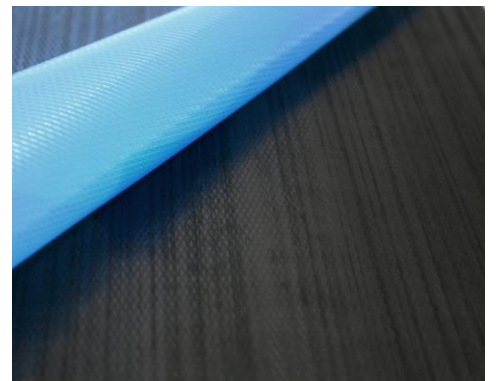
- ▣ Low temperature 70°C (158°F) curing
- ▣ Faster cycle times at elevated temperature
- ▣ Excellent balance of mechanical properties and toughness
- ▣ Long out-life – up to 4 weeks @ 18-22°C (64-72°F)
- ▣ Range of compatible adhesive films and ancillary products
- ▣ Excellent surface finish
- ▣ Good Tg
- ▣ Suitable for vacuum bag, press or autoclave consolidation

### INTRODUCTION

**SE70 is part of the range of prepreg products. This unique product 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.**

SE70 is a hot melt epoxy prepreg ideally suited to the manufacture of thick sections. It can be cured at temperatures as low as 70°C (158°F), but can also be used for the rapid manufacture of components through its 25-minute cure at 120°C (248°F). All of this can be achieved together with out-life of 28 days at 21°C (70°F).

SE70 is designed for vacuum bag pressing and offers excellent mechanical performance on glass fibre reinforcements. Currently SE70 is manufactured into a prepreg structure with E-glass and Carbon fibres, which are manufactured into biax or woven materials. This data sheet is concerned with carbon reinforcements.



## PROCESSING NOTES - GENERAL

### PREPARATION

When preparing the lay-up the prepreg should be removed from the freezer and allowed to thaw in a sealed bag. This may take 6 to 24 hours depending on roll size. This prevents atmospheric moisture from condensing on the prepreg which may cause voiding on cure. The mould surface should be release coated and must have been tested for vacuum integrity prior to lay-up.

### LAYING-UP

The following procedure is recommended for preparing vacuum cured laminates.

1. The moulding surface must first be treated with a suitable release agent. A separate prepreg nylon peel ply is available for covering the mould tool prior to layup in order to leave a clean, textured surface for subsequent bonding. The required number of plies of SE 70 prepreg are placed on the tool and a thermocouple inserted into the layup near the centre ply of the thickest edge section. Typically several vacuum debulks are required during the layup to ensure the removal of entrapped air. The frequency and temperature of debulks can vary depending on the type and size of application. The user should carry out test panels to determine the optimum schedule. Further advice can be obtained from Technical Services.

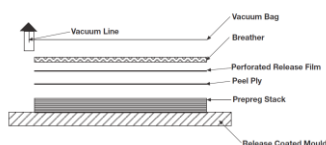
2. Apply a peel ply to the surface of the layup. Note that for good secondary bonding of a peelplied surface of an SE 70 prepreg laminate, a nylon peel ply, such as Tygavac stitch Ply A is strongly recommended. Cover the peel ply entirely with a perforated release film. Normally, no edge resin bleeder system is used. P98 grade release film is recommended. With the perforated release film, the amount of resin bled away is controlled by the number of dry plies of resin bleeder cloth placed over the perforated release film. For thin skins care must be taken not to overbleed the laminate (prepreg peel ply and low bleed RP2 release film will ensure this does not occur).

3. Install a vacuum bag by standard techniques. Insert at least two vacuum stems through the bag connecting one to the vacuum source and the other, at a point on the part furthest from the source, to a calibrated vacuum gauge. Position part in the oven or autoclave and draw vacuum to check for bag or system leaks.

4. Commence the heatup cycle, typically between 0.3°C(0.5°F)/min and 2°C(3.6°F)/min to the final cure temperature. At 70°C (158°F) the temperature should be held for 16 hours. Faster cures may be obtained at elevated temperatures, e.g. 100 mins @ 100°C (212°F), or 25 minutes @ 120°C (248°F). All temperatures should be measured by the previously installed thermocouple. When curing at 70°C (158°F), a minimum of 16 hours is recommended. Vacuum should be maintained as high as possible, with a minimum of 85% throughout the cure cycle.

5. Upon completion of cure, the heat is turned off and the part cooled until its temperature has fallen below 60°C (140°F). When fully cooled, the part may be debugged, trimmed and machined as necessary. A post-cure is not required.

Gloves should be worn both to avoid skin contact with the prepreg, and to avoid transfer of sweat onto the prepreg, which may cause voiding on cure.



## PROCESSING NOTES

### THIN LAMINATES

When using very thin laminates (eg with a total laminate fibre weight of less than 300g/m<sup>2</sup>), care needs to be taken to avoid extracting excessive amounts of resin during the cure process. To avoid this, a microporous release film can be used, and for particularly critical components, a pre-impregnated peel ply should be used before the application of a RP2 perforated release film and breather / bleeder fabric.

### THICK LAMINATES

When processing thick laminates, extra care should be taken to avoid entrapping air in the laminate by the use of regular vacuum debulks.

An intermediate dwell can be included during the cure to burn off any excess exothermic energy in a controlled manner. Contact Technical Services for further details.

### CURING ON A RELEASE COATED MOULD

Several thermocouples should be positioned at various parts of the layup; a minimum of 12 is recommended but this may vary depending on the size of the moulded structure.

On a well sealed mould tool it should be possible to achieve - 0.85 bar. If the achievable vacuum is below this level do not proceed with cure until the bag leaks have been plugged. The vacuum should be held at ambient temperature for one hour prior to heating. The vacuum should be maintained throughout the cure. Acceptable ramp rates vary from 0.3--2.0°C (0.5-3.6°F) per minute, with 0.3-0.5°C/min (0.5-3.6°F/min) being typical on large structures.

When curing large structures a dwell period can be included to allow temperature equilibration of the tool and laminate. See separate Processing Notes for further information.

For a good balance of composite properties, it is recommended that the laminate is cured at 70°C (158°F) for a minimum of 16 hours. A laminate may be cured in two stages if, for example, making a cored component. However in a two stage cure, a minimum of 8 hours at 70°C (158°F) or 4 hours at 80°C (176°F) is recommended before debugging a skin, and it must be ensured that this skin is cured for the equivalent of at least 16 hours at 70°C (158°F) or 8 hours at 80°C (176°F) before going into service.

### CURING AT 70°C (°F)

When curing at 70°C (158°F) it is important to ensure the temperature is monitored off the trailing thermocouple as 70°C (158°F) should be treated **as the minimum cure temperature** for SE 70.

### CURING AT HIGHER TEMPERATURES

SE 70 may be cured at higher temperatures for a shorter time. At a cure temperature of 100°C (212°F) cure can be achieved in 100 minutes, or at 120°C (250°F) cure can be achieved in 25 minutes.

It is not recommended to cure SE 70 under vacuum pressures of less than 0.85 bar. If a ramp rate of less than 0.3°C(0.5°F)/min is used, users should satisfy themselves that this allows adequate flow.

## PRODUCT INFORMATION

### AVAILABILITY

SE70 preregs are available in a variety of fabric forms, normally supplied on a single polythene film. Please contact Technical Services to discuss specific requirements and availability.

PROPERTY	UNIT	200GSM HEC UD CARBON
Tack	rating	*Medium
Nominal Resin Content (by weight)	%	37
Nominal Fibre Weight	g/m <sup>2</sup>	200
Nominal Areal Weight	g/m <sup>2</sup>	317
Nominal Roll Width	mm	400
Nominal Roll Length	Lm	20
Backer	-	1 x paper / 1 x MDPE poly

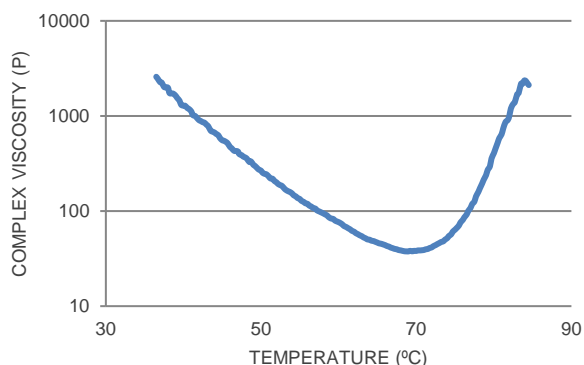
\*allows repositioning of plies at recommended handling temperature

## PREPREG PROPERTIES

### RHEOLOGY DATA

SE70 resin viscosity profile conducted at 1°C (1.8°F) per minute.

PROPERTY	VALUE	
Minimum Viscosity	37.6 Pa.s	376 P
Temperature at Minimum Viscosity	69°C	156°F



### TRANSPORT & STORAGE

When stored sealed & out of direct sunlight.

STORAGE TEMP		UNIT	VALUE
-18°C	0°F	months	24
+18-22°C	+64-72°F	weeks	4

All prepreg 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. When not in use SE 70 products should be maintained at -18°C (0°F). To avoid contamination on their surfaces, allow rolls to reach room temperature before unwrapping.

### HEALTH AND SAFETY

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

### MINIMUM CURE TIME & TEMPERATURE

Recommended minimum cure is 16 hours at 70°C (158°F) using vacuum bag processing.

PROPERTY	OVEN / VAC BAG					TEST STANDARD
Typical Laminate	8 plies of 200g/m <sup>2</sup> HEC UD carbon 37% resin content					-
Typical Ramp Rate	1 – 2°C (2 – 4°F) per minute					-
Cure Temperature	70°C (158°F)	80°C (176°F)	95°C (203°F)	110°C (230°F)	120°C (248°F)	-
Cure Dwell Time	16 hours	8 hours	4 hours	50 minutes	25 minutes	-
Cure Pressure	-1bar (14.5Psi)					-
De-mould Temperature	< 60°C / 140°F					-
Dry Tg <sub>1</sub> (DMA)	89°C / 192°F	101°C / 214°F	110°C / 230°F	126°C / 259°F	TBD	ISO 6721 (DMA)

\*suitable for use in conjunction with hot-in / hot-out rapid component manufacture is possible using appropriate press tooling

## LAMINATE PROPERTIES

Where possible properties presented are averages of multiple batch data from a variety of fibre suppliers. Customers with specific requirements should contact Gurit technical support who can recommend appropriate fibres and formats.

## CURED RESIN PROPERTIES

Oven cured using standard processing techniques and a minimum cure time of 16 hours at 70°C (158°F).

PROPERTY	SYMBOL	SE 70 RESIN CAST		TEST STANDARD
Tensile Strength	$\sigma_T$	54 MPa	7.83 ksi	ISO 527-2
Tensile Modulus	$E_T$	3.61 GPa	0.52 Msi	ISO 527-2
Flexural Strength	$\sigma_F$	80 MPa	11.6 Ksi	ISO 178
Flexural Modulus	$E_F$	3.45 GPa	0.50 Msi	ISO 178
Compressive Strength	$\sigma_C$	142 MPa	20.6 Ksi	ISO 604
Compressive Modulus	$E_C$	3.81 GPa	0.55 Msi	ISO 604

## UNIDIRECTIONAL LAMINATE PROPERTIES

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

PROPERTY	SYMBOL	UNIT	HEC FIBRE*	IMC FIBRE*	HMC FIBRE*	TEST STANDARD
Typical Fibre Density	$\rho_{\text{fibre}}$	g/cm <sup>3</sup>	1.8	1.79	1.82	-
Fibre Modulus	$E_{\text{fibre}}$	GPa	227 - 257	275 - 310	365 - 405	-
Resin Content	%	%	32 - 35	35 - 37	33	ASTM D 3171 Method II
Fibre Volume Fraction	$v_t$	%	54.2	52.0	56.1	ASTM D 3171 Method II
0° Tensile Strength**	$X_T$	MPa	2510	2896	1916	ISO 527-5
0° Tensile Modulus**	$E_t$	GPa	133	171	211	ISO 527-5
0° Compressive Strength**	$X_C$	MPa	1174	1295	1191	SACMA SRM1-94
0° Compressive Modulus**	$E_{C11}$	GPa	119	151	195	SACMA SRM1-94
90° Tensile Strength	$Y_T$	MPa	48	42	30	ISO 527-5
90° Tensile Modulus	$E_{T22}$	GPa	7.7	7.1	7.0	ISO 527-5
0° Flexural Strength	$X_F$	MPa	1295	-	-	ISO 14125
0° Flexural Modulus	$E_{F11}$	GPa	100	-	-	ISO 14125
0° ILSS	$X_{ILSS}$	MPa	78	78	52	ISO 14130

\*HEC = High Elongation Carbon, IMC = Intermediate Modulus Carbon, HMC = High Modulus Carbon, UHMC = Ultra-High Modulus Carbon

\*\*Normalised to 60% fibre volume fraction

## MULTIAXIAL LAMINATE PROPERTIES

Oven cured using standard processing techniques and a minimum cure time of 16 hours at 70°C (158°).

PROPERTY	SYMBOL	UNIT	XC411	TEST STANDARD
Resin Content	-	%	42	ASTM D 3171 Method II
Cured Ply Thickness	-	mm	0.46	ASTM D792
Fibre Volume Fraction	-	%	49.2	ASTM D 3171 Method II
±45° Tensile Strength*	$X_T$	MPa	1414	ISO 527-4
±45° Tensile Modulus*	$E_t$	GPa	66	ISO 527-4
±45° Compressive Strength*	$X_C$	MPa	655	SACMA SRM1-94
±45° Compressive Modulus*	$E_c$	GPa	59	SACMA SRM1-94
±45° Flexural Strength	$X_F$	MPa	911	ISO 14125
±45° Flexural Modulus	$E_{F11}$	GPa	51	ISO 14125
ILSS	$\tau_M$	MPa	44	ISO 14130

\*Normalised to 55% fibre volume fraction

## NOTICE

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