

SE 85

Epoxy Prepreg System

- **Rubber toughened system - good resistance to microcracking**
- **High flow**
- **Good surface finishes possible**

Introduction

The SE 85 series are toughened hot-melt, epoxy prepregs that offers an extremely good balance of mechanical properties. They are ideal for structural components where improved impact performance and resistance to resin microcracking is desired. SE 85 can be cured at 80°C, yet retains an outlife of up to 56 days at 23°C. With its $\frac{3}{4}$ hour cure at 120°C, it is also suitable for the quick manufacture of parts, and is also used in the development of trial components.

■ SE 85 has high flow characteristics, so that heavy reinforcements can be easily wet out, and good consolidation can be achieved in very thick (>25mm) laminates, under just vacuum bag pressures. Its flow behaviour also means that it can produce excellent surface finishes when used in pressure-moulded components.

■ SE 85BL is a black pigmented variant, often used in carbon fabrics to provide an excellent deep black gloss finish on the outer surface of carbon components such as yacht spars and race car parts.

SE 85 system can equally be used in sandwich structures with honeycomb and foam cores. In this application, depending on resin content, it can be used in a self-adhesive mode, although it is more commonly used in conjunction with the toughened SA 80 Adhesive Film. (See separate datasheet).

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. Place the lay-up on a tool or caul sheet which has been treated with a release agent or film. Insert a thermocouple into the lay-up near the centre ply of the thickest edge section, outside the net trim line. A separate prepreg nylon peel ply is available for covering a mould tool prior to layup in order to leave a clean, textured surface for subsequent bonding.
2. Apply a peel ply to the surface of the lay-up. Note that for good secondary bonding of a peel-plied surface of an SE 85 prepreg laminate, a nylon peel ply, such as SP-High Modulus' Stitch Ply A, is strongly recommended. This is particularly important where the cure temperatures are in excess of 90°C. Cover the peel ply entirely with a perforated release film. Normally, no edge resin bleeder system is used. For thin sections, SP-High Modulus' WL3600P90 grade release film are recommended, while for sections of 4mm and above, SP-High Modulus' WL3600P release film is also suitable. With WL3600P the amount of resin bled away is controlled by the number of dry plies of resin bleeder cloth placed over the perforated release film.
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 heat-up cycle, typically between 0.3°C/min and 2°C/min to the final cure temperature. At 85°C, the temperature should be held for 10 hours. Faster cures may be obtained at elevated temperatures, e.g. 3 hours @ 100°C, or 3/4 hour @ 120°C. All temperatures measured by the previously installed thermocouple. When curing at 80°C, a minimum of 12 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, turn off heat and cool until part temperature has fallen below 60°C. When fully cooled, the part may be debagged, trimmed and machined as necessary. A post-cure is not required.

Processing Notes - Curing

Cure Cycles

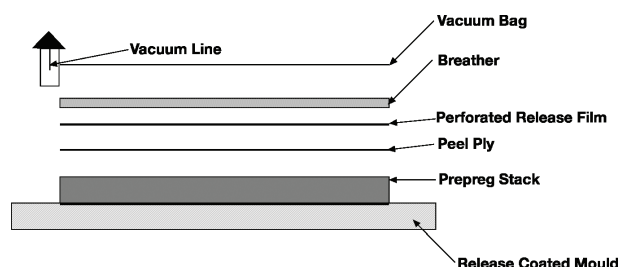
For a good balance of composite properties, it is recommended that the laminate is cured at 85°C for a minimum of 10 hours. A laminate may be cured in two stages - if, for example, making a cored component. However in a two stage cure, a minimum of 4 hours at 85°C or 5 hours at

80°C is recommended before debagging a skin, and it must be ensured that this skin is cured for the equivalent of at least 10 hours at 85°C or 12 hours at 80°C before going into service.

SE 85 may be cured at higher temperatures for a shorter time. At a cure temperature of 100°C (212°F) cure can be achieved in 3 hours or at 120°C (250°F) cure can be achieved in 50 minutes.

It is not recommended to cure SE 85 under vacuum pressures of less than 85%. If a ramp rate of less than 0.3°C/min is used, users should satisfy themselves that this allows adequate flow.

SE 85 is a high flow system. Care should be taken not to overbleed laminates



Curing at 80°C

When curing at 80°C it is important to ensure the temperature is monitored off the trailing thermocouple. 80°C should be treated as the minimum cure temperature for SE 85; 70-75°C will not generate adequate mechanical properties.

Thin Laminates

When using very thin laminates (eg with a total laminate fibre weight of less than 600 gm²), care needs to be taken to avoid extracting excessive amounts of resin during the cure process.

Use of prepreg peelply is recommended.

A perforated release film with fine widely spaced holes may also be suitable.

Core bonding

Various core materials can be used with the prepreg system, including foams and honeycombs. However, due to the wide variety of PVC and other foams available, and the cure temperatures involved, special procedures have been developed which must be carefully followed. For details of these processes, please contact Technical Services.

When using Nomex™ or aluminium honeycombs, the separate SA 80 adhesive film is recommended and full details of use are provided on the separate SA 80 data sheet. This adhesive film is supplied on a lightweight glass carrier, or in some cases it can be supplied directly coated onto one face of the SE 85 prepreg.

The system is fully compatible with Ampreg 20 and Ampreg 26 wet layup epoxy systems and therefore all types of cores may be bonded to a first skin by using a separate 'wet-bonding' operation. In this case, the addition of filler powders to the appropriate resin system is required to provide the correct paste-like consistency.

When press-moulding in a 'hot-in, hot-out' cycle at 140°C, an SE 85 prepreg of adequate resin content may be used in a self-adhesive mode on honeycomb cores. Outside of these conditions a separate SA 80 adhesive film should be used.

Availability

Small quantities of a black pigmented version of SE 85 on RC 200T and RC 280T4 are usually held in stock but other SE 85 prepregs are available in a wide variety of fabric forms and collimated unidirectional tapes. Unidirectional materials are normally supplied on a single release paper and fabrics on a single polythene film. Please contact Customer Support to discuss specific requirements and availability.

Properties

Uncured Properties	
Out-Life @ 18-22°C	8 wks
Storage Life @ -18°C	2 years
Hazard Designation	Xi, N
Risk Phrases	36/38, 43, 51/53
Safety Phrases	24, 26, 28, 37/39, 57, 60

Working Properties	
Minimum Cure Temperature (°C)	80
Min. Cure Time (@ min. cure temp.) (hrs)	12
Min. Visc. (iso. @ min. cure temp. (P)	21
Min. Viscosity (1°C/min. ramp) (P)	4.5
Temp. @ min. Visc. (1°C/min. ramp (°C)	98
Minimum Cure Time @ 90°C (hrs:mins)	6:00
Minimum Cure Time @ 100°C (hrs:mins)	3:00
Minimum Cure Time @ 110°C (hrs:mins)	1:30
Minimum Cure Time @ 120°C (hrs:mins)	0:45

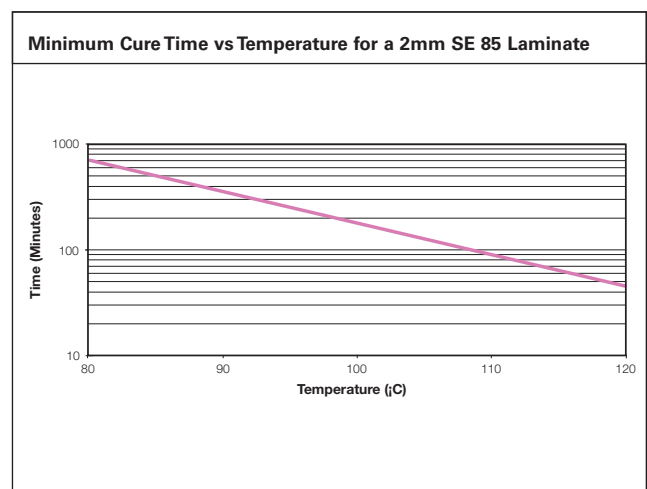
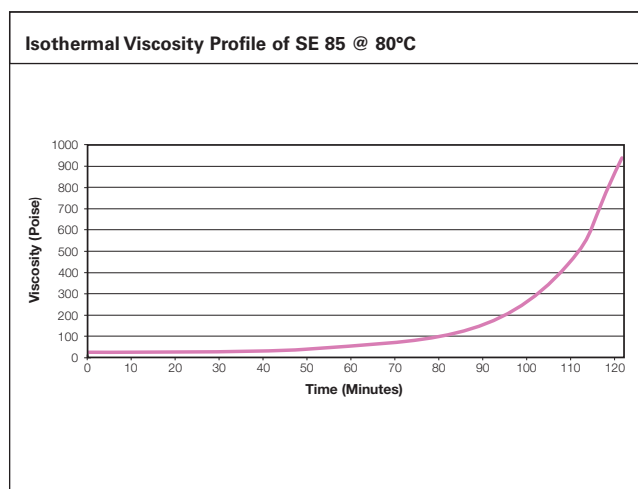
Cured System Physical Properties		
	Cure	Tg (°C)
Tg DMTA (Peak Tan δ)(°C)	12 hrs @ 80°C	116.6
Tg1 DMTA (°C)	12 hrs @ 80°C	103
Tg DMTA (Peak Tan δ)(°C)	3 hrs @ 100°C	129.7
Tg1 DMTA (°C)	3 hrs @ 100°C	116.4
Cured Resin Density (g/cm³)	2 hrs @ 90°C + 2 hrs @ 135°C	1.214

Notes: For an explanation of test methods used see 'SP-High Modulus Prepregs Technical Characteristics'.

All figures quoted are indicative of the properties of the product concerned. Some batch to batch variation may occur.

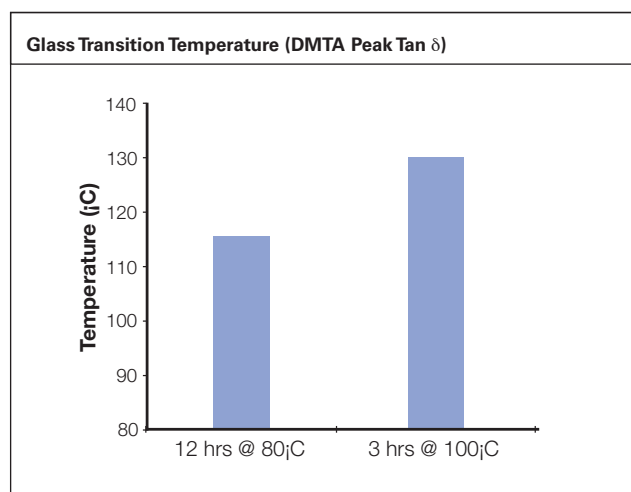
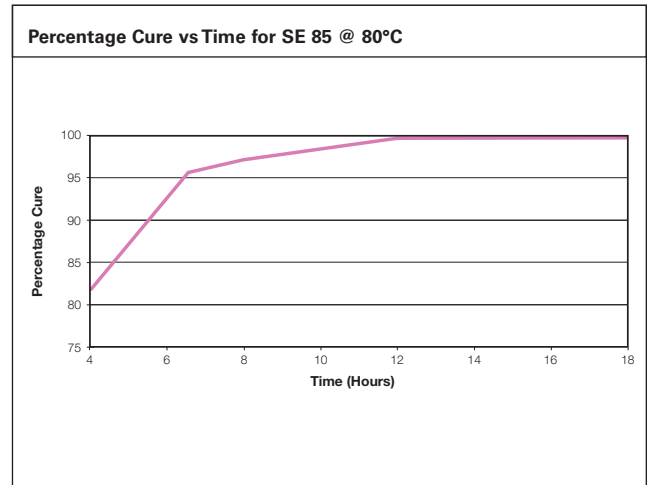
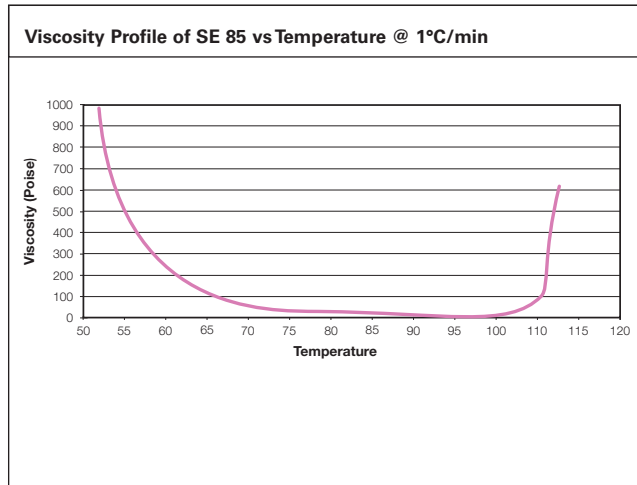
Properties (cont'd)

Mechanical Properties			
	RC200T Woven 2x2 Twill HS Carbon	RC200T Woven 2x2 Twill HS Carbon	RC280T4 Woven 4x4 Twill HS Carbon
Cure (time / temperature / pressure)	10 hrs / 85°C / 1 Bar	1 hr / 120°C / 6 Bar	1 hr / 120°C / 6 Bar
Process	vacuum bag	press	press
Fibre Weight (g/sqm)	194	194	280
Prepreg Areal Weight (g/sqm)	334	334	483
Prepreg Resin Content (%bw)	42	42	42
Tensile Strength (MPa)	720	833	1164
Tensile Modulus (GPa)	60	70	74
Tensile Laminate Fibre Vol. (%)	54.6	56.7	60.9
Cured Ply Thickness (mm)	0.202	0.175	0.236
Normalised Tensile Strength @ 60% FVF (MPa)	792	882	1147
Normalised Tensile Mod. @ 60% FVF (GPa)	66	74	73
Compressive Strength (MPa)	640	761	957
Compressive Laminate Fibre Volume (%)	54.7	56.5	69.5
Normalised Compr. Strength @ 60% FVF (MPa)	702	808	826
ILSS (MPa)	65	69	72



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Properties (cont'd)



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Health and Safety

Although SE 85 prepregs have greatly improved health and safety characteristics when compared to wet lay-up epoxy systems, the following points must still be considered:-

1. Avoid skin contact - wear disposable rubber gloves and use skin barrier creams.
2. Avoid eye contact. If this occurs, flush with water for 15 minutes and seek medical advice.
3. Ensure good ventilation of vacuum pump exhaust during laminate cure.
4. Avoid inhalation and eye contact with sanding dust. After any sanding operation of reasonable size a shower or bath should be taken and should include hair washing.
5. Wear overalls or other protective clothing. Thoroughly clean or discard soiled garments.
6. Use only resin removing creams/soap and water on exposed skin. Do not use solvents.

Washing should be part of routine practice:

- before eating or drinking
- before smoking
- before using the lavatory
- after finishing work

SP-High Modulus produces a separate full Materials Safety Data Sheet for this product covering usage, transport, storage and emergencies. Please ensure that you have the correct MSDS's to hand for the materials you are using before commencing work.

Applicable Risk & Safety Phrases

R 36/38, 43, 51/53
S 24, 26, 28, 37/39, 57, 60



Transport & Storage

When not in use SE 85 products should be maintained at -18°C. Shelf life for SE 85 is two years at -18°C and eight weeks at 18-22°C. To avoid condensation on their surfaces, allow rolls to reach room temperature before unwrapping.

Notice

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