www.delta-tech.it

DT120

Versatile High Toughness Epoxy Matrix

Introduction

DT120 resin are is a high viscosity thermosetting epoxy resin. **DT120** prepregs are mainly suitable for processing by autoclave vacuum bag curing.

DT120 prepregs offer a versatile curing range from 80°C to 135°C.

DT120 is a highly toughened system, making it suitable for structural applications requiring high impact performance and energy absorption.

With the correct carbon fibre fabrics, **DT120** offers good resin transparency and good laminate surface finish.

It is available in all formats of reinforcements, with all fibres, either as fabric or unidirectional prepreg.

It is anticipated **DT120** prepregs will find uses in industrial, automotive, motorsport and sport goods applications.

Key Features

DT120 epoxy resin offers a good combination of cure reactivity, versatile processing and availability in fabric and unidirectional fibre formats.

Main features are:

- Maximum DMA Tg of 120°C
- Processing by autoclave vacuum bag curing
- Flexible cure characteristics between 80°C and 135°C
- 30 days outlife at 21°C
- Good tack
- High toughness
- Good impact resistance and energy absorption

DT120 Resin Matrix Properties

Chemical nature	Epoxy Thermosetting Resin
Curing Temperature range	80 to 135°C
Density of cured neat resin	1.22 g/cm³
Dynamic viscosity	High, > 2000 Poise @ 60°C, frequency 10 rad/sec.
Gel Times (ASTM D 3532),	29 to 33 minutes @ 100°C 8 to 13 minutes @ 120°C 2 to 5 minutes @ 135°C

The following chart shows the rheological behaviour of **DT120.**

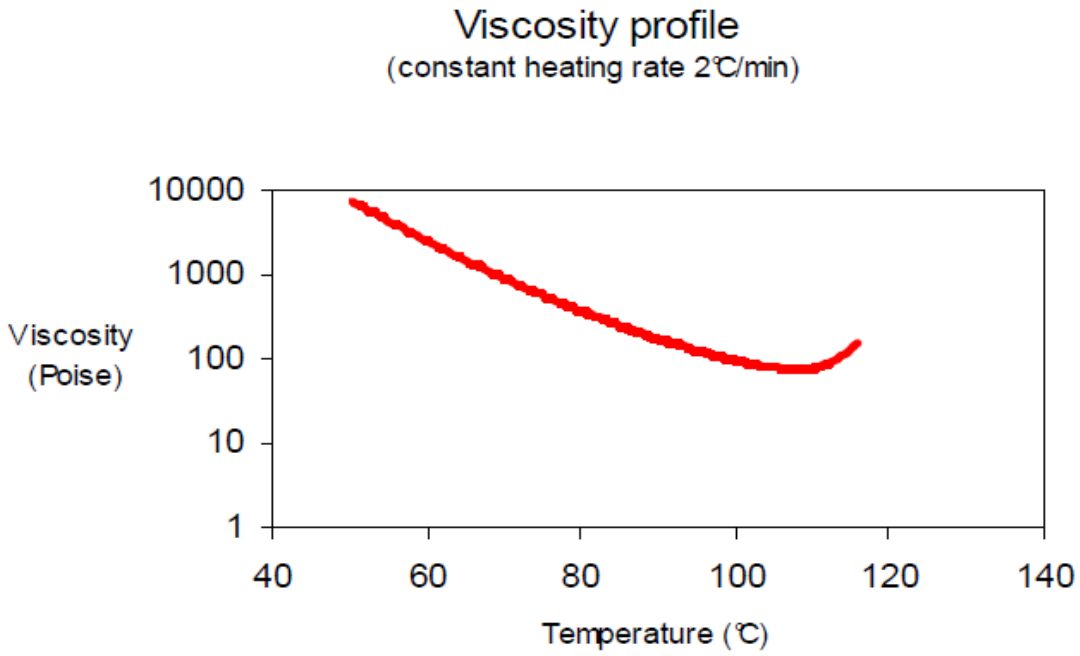

Figure 1: Dynamic Viscosity profile for DT120 resin

Thermal Performance of DT120 Laminates

The following table indicates the typical glass transition temperature (Tg) developed by **DT120** laminates.

Cure Cycle	Tg (°C)
4 Hrs @ 100°C 1.5 Hrs @ 120°C 1.0 Hrs @ 135°C	110°C 115 to 120 120 maximum

Note: The Tangent Modulus Intercept Tg values have been measured by DMA, according ASTM D7028.

Mechanical Properties of Carbon Fabric and Unidirectional Reinforced Laminates

Table 1 below shows some indicative averaged mechanical characteristics of **DT120** carbon fibre laminates. These are with 200 gsm (g/m²) and 430 gsm (g/m²) high strength carbon twill fabrics. The laminates were cured 90 minutes @ 120°C, 6 Bar pressure.

Table 1

GG200T(Toray FT300B)-DT120-42 Fabric Laminate

GG430T(Tenax HTS40)-DT120-38 Fabric Laminate

Mechanical Tests	Test Method	RT	RT
		GG200T	GG430T
Tensile Strength (0°) (MPa)	ASTM D 3039	693	1070
Tensile Modulus (0°) (GPa)	ASTM D 3039	55.8	62.3
Tensile Strength (90°) (MPa)	ASTM D 3039	610	976
Tensile Modulus (90°) (GPa)	ASTM D 3039	53.7	61.5
Compression Strength (0°) (MPa)	ASTM D 6641	552	715
Compression Modulus (0°) (GPa)	ASTM D 6641	50.7	59.3
Compression Strength (90°) (MPa)	ASTM D 6641	558	694
Compression Modulus (90°) (GPa)	ASTM D 6641	51.3	59.8
In-Plane Shear Strength (MPa)	EN 6031	109.1	107.6
In-Plane Shear Modulus (GPa)	EN 6031	3.12	3.33
ILSS (MPa)	EN 2563	67.7	72.4

Table 2 below shows some indicative averaged mechanical characteristics of **DT120** with 200 gsm (g/m²) unidirectional intermediate modulus carbon fibre, cured 90 minutes @ 120°C, 6 Bar pressure.

Table 2

Toray M30SC-DT120-200-36 UD Laminate

Mechanical Tests	Test Method	RT
Tensile Strength (0°) (MPa)	ASTM D 3039	3010
Tensile Modulus (0°) (GPa)	ASTM D 3039	145.0
Tensile Strength (90°) (MPa)	ASTM D 3039	39
Tensile Modulus (90°) (GPa)	ASTM D 3039	6.4
Compression Strength (0°) (MPa)	ASTM D 6641	1020
Compression Modulus (0°) (GPa)	ASTM D 6641	133.0
Compression Strength (90°) (MPa)	ASTM D 6641	138.0
Compression Modulus (90°) (GPa)	ASTM D 6641	8.1
In-Plane Shear Strength (MPa)	EN 6031	95.6
In-Plane Shear Modulus (GPa)	EN 6031	3.38
ILSS (MPa)	EN 2563	77.2

Recommended Cure Cycles for DT120 products

DT120 products allow processing by autoclave vacuum bag moulding. The main recommended cure cycle is at 120°C for the conventional bagging routes. However, other cure options are available.

Autoclave Vacuum Bag Curing Cycles

The following are recommended cycles:

Cycle 1: **1.5 Hours @ 120°C**

Cycle 2: 12 Hours @ 80°C

Cycle 3: 4 Hours @ 100°C.

Cycle 4: 1.0 Hours @ 135°C.

All these cure cycles use an initial heating ramp-rate of 1 to 3°C/min from room temperature to the cure temperature. A vacuum should be applied to the bagged component during cure. For autoclave bag curing, the applied cure pressure needs to be between 3.0 and 6.0 bar.

It should be noted that cures at 100°C or less, leave the laminate with a reduced glass transition temperature. It may then be appropriate to postcure the component.

Post-Cure Options for Reduced Temperature Cures

If maximum Tg is required then postcuring can be applied, with an initial cure of 100°C or less. This covers **Cycles 2 and 3**. The free-standing postcure cycle is:

- Heat the part at 2°C/ minute ramp rate to the initial cure temperature (either 80°C or 100°C).
- Slow the ramp rate.
- Heat the part at 0.3°C/min (20°C/Hour) to 120°C (*Important).
- Dwell at 120°C for 1.5 Hours.
- Cool the part at 2°C/min.

Note: *The reduced ramp-rate is essential for even development of Tg in the part and avoiding part distortion.

Processing Guidelines

Important notice: Prepregs rolls must be stored in a freezer at -18°C when not being used. Thaw the prepreg to room temperature before removing the roll from the protective bag of polyethylene. This may typically take six (6) hours. This will prevent the uncured prepreg product from absorbing moisture from the air, as this can affect the quality of the final part. After using the roll of prepreg it is recommended to seal the roll in the protective bag before replacing it in the freezer.

Prepreg Lay Up and Laminating

1. Prepreg: Pay particular attention to conform the prepreg plies to the geometry of the released mould when laminating, especially in corners of small radius of curvature.
2. A non-perforated release film must be used. Lay carefully over the laminate and mould, then seal at the mould edges with tape. This will prevent any leakage of resin from the part and coming into direct contact with the vacuum bag during the cure process.
3. Breather (non-woven polyester). Make sure the breather covers the entire part and reaches all the vacuum valves. A heavyweight breather is recommended.
4. Vacuum bag. Use a generous quantity of high temperature bagging film to cover the part. Make sure the bag can fill all corners of the part with excess film, and there is no bridging of the film which could cause a bag burst in the autoclave.
5. Make sure the vacuum in the bag is to a high level, typically 980 mbar. Check the vacuum tightness of the bag before curing, by removing the vacuum pump for at least 5 minutes. The loss of vacuum pressure should not be greater than 50 mbar.

For further information, please contact Delta-Tech's Technical Service Department.

Exothermic Reaction

DT120 are reactive resin formulations which can undergo excessive exothermic heating during the initial curing process if the correct curing procedures are not followed. Care must be taken to use the heating rates and dwell temperatures in the recommended cure cycles. The risk of exotherm increases with laminate thickness and increasing cure temperature.

If oven vacuum bag or autoclave curing laminates are greater than 5 mm in thickness, please contact our technical department for confirmation of the correct cure cycle.

Available Products/Prepregs

DT120 resins can be impregnated with a wide range of fibre reinforcements, such as woven and unidirectional tapes of high strength and high modulus carbon fibre, woven E-glass, S-glass and multi-axials, with a range of fibre weights per square metre**.**

Prepreg Storage

Out Life: 30 days @ 21°C
Shelf Life: 12 months @ -18°C

Handling Precaution

When handling uncured resins and fibrous materials precaution should be considered. It is recommended to use clean protective gloves in order to protect the operators and avoid contamination of the components.