

Solvent based Prepregging system for G-11 laminates

Lapox L-12	100	pbw
Lapox K-10	35	pbw
Lapox K-86	1 - 3	pbw

Description

Lapox L-12 is a liquid, unmodified, bisphenol-A based epoxy resin of medium viscosity which can be processed with various hardeners for making glass fiber or carbon fiber reinforced composites. The grade is most suitable for laminating application.

Hardener Lapox K-10 is an off-white coloured fine powder. The pre-impregnates produced using this hardener are relatively stiff and non-tacky and therefore, the application is in simple curve-shaped or flat sheet products. A long curing schedule is required for the complete development of mechanical and electrical properties. However, these properties and their percentage retention on aging at higher temperature are better compared to those obtained using only Lapox K-86 as a hardener.

Hardener Lapox K-86 is supplied in the form of crystalline powder. It can be used either as standalone hardener or as an accelerator in small dosages. It is highly hygroscopic in nature and therefore one should be careful while storing and using it.

One can use ketone solvents such as acetone, methyl ethyl ketone or methyl isobutyl ketone to dissolve the hardener and to adjust the viscosity of the resin | hardener mixture. Hardener Lapox K-86 dissolves readily in all these solvents while Hardener Lapox K-10 has limited solubility at room temperature in acetone. To improve upon solids content of Hardener Lapox K-10, one can use mixture of acetone and dimethyl formamide. Total solid content of 50% to 60% (resin + hardener) is recommended in solutions used for glass fiber pre-impregnation. One can adjust further solvent dilution accordingly.

Applications

G-11 laminates as per NEMA specification and many other electrical and electronic components. Shelf-life of prepreg can be achieved up to 6 months depending on processing and storage conditions.

Processing

Prepreg

Typical specifications

Lapox L-12

Properties	Unit	Test method	Values
Appearance	-	Visual	Clear, viscous liquid
Colour	GS	ASTM D1544	Max 1
Viscosity at 25°C	m Pas	ASTM D2196	9,000 - 12,000
Epoxy content	Eq/kg	ASTM D1652	5.26 - 5.55
Specific gravity at 25°C	-	ASTM D792	1.1 - 1.2

Lapox K-10

Properties	Unit	Test method	Values
Appearance	-	Visual	White powder
Melting point	°C	-	175 - 181
Shelf-life	Years	-	2

Lapox K-86

Properties	Unit	Test method	Values
Appearance	-	Visual	White to light-yellow hygroscopic powder
Melting point	°C	-	Min 75
Shelf-life	Years	-	2

Processing properties

Properties	Unit	Test method	Values
Mixing ratio (by weight)	-	Visual	Resin: 100 Hardener: 35 Accelerator: 1 - 3 Solvent (MEK): 100 - 150
Initial mix viscosity	m Pas	ASTM D2196	5,000 - 8,000 / 100°C
Pot life at 25°C	Weeks	ASTM D2471	6 - 8
Drying time of prepreg	°C / hours	-	130°C for 10 hours - 15 hours + 135°C for 6 hours - 10 hours

Processing

Complete drying of the material to be impregnated such as glass fiber, carbon fiber, paper, mica, mica paper etc. is necessary before impregnating with the ready mixture. Impregnation is carried out in a resin bath. The excess resin is removed by passing the impregnated material through rollers or doctor blades and pre-impregnates are then dried to the required condition. The time required for drying depends upon several factors such as; temperature of the oven | drying tower, air flow and residence time in the over | drying tower.

A typical drying schedule is 1 hour to 2 hours at 80°C or 15 minutes at 130°C. The dried pre-impregnates have a very long shelf-life (as long as about 6 months below 10°C). It, however, depends upon the heat history during drying. Since partial curing takes place during drying, care must be taken not to exceed the drying time as otherwise the prepreg will not have adequate flow in the press which will result in poor inter-laminar adhesion.

Curing

The required number of pre-shaped pre-impregnates may be placed together and cured in a press or autoclave under a pressure of 1 m Pa to 7 m Pa at 150°C for 1 hour. The press or autoclave may then be cooled gradually to 100°C for better dimensional accuracy. Post curing may be carried out at 180°C for 3 hours for complete development of mechanical and electrical properties. The un-accelerated system (Lapox L-12 + Hardener Lapox K-10) requires curing for 5 hours at 200°C for developing the optimum properties. If the composites are consolidated, for whatever reason, at lower temperature, they have lower deflection temperature.

Prepreg manufacturing

Composition:
Determined on standard test specimen at 25°C

Properties	Unit	Test method	Values
Resin content	%	-	40 - 45
Volatile content	%	-	< 0.9
Resin flow at 175°C	%	-	15 - 25
Shelf life of prepreg at 20°C	Weeks	-	12 - 16
Press temperature	°C	-	160
Pressure	Kg/cm ²	-	20 - 40
Contact time	Minutes	-	3 - 5
Pressing time	Minutes	-	60
Water absorption 25°C / 24 hours	% w/w	ISO 62	Max 0.2
Electrolytic corrosion - initial	Factor	DIN 53489	A / 1
Electrolytic corrosion - after 4 hours in boiling water	Factor	DIN 53489	A / 1.2

Typical electrical properties of cured system

Cured at:

Properties	Unit	Test method	Values
Breakdown strength (50 Hz, 25°C)	kV/cm	IEC 60243	150 - 200
Loss factor (1 MHz) - initial	%	IEC 60250	2.0 - 2.5
Loss factor (1 MHz) - after 24 hours in water at 23°C	%	IEC 60250	2.4 - 2.6
Loss factor (1 MHz) - after 48 hours in water at 50°C	%	IEC 60250	2.6 - 2.8
Loss factor (1 MHz) - after 4 hours in boiling water	%	IEC 60250	3.0 - 3.2
Dielectric constant (1 MHz) - initial	-	IEC 60250	4.7 - 5.2
Dielectric constant (1 MHz) after 24 hours in water at 23°C	-	IEC 60250	4.7 - 5.2
Dielectric constant (1 MHz) after 48 hours in water at 50°C	-	IEC 60250	4.7 - 5.2
Dielectric constant (1 MHz) after 4 hours in boiling water	-	IEC 60250	4.9 - 5.4
Volume resistivity - initial	ohm.cm	IEC 60093 / DIN 53482	10 ¹⁵ - 10 ¹⁶
Volume resistivity after 90 hours at 90% RH at 35°C	ohm.cm	IEC 60093 / DIN 53482	10 ¹⁴ - 10 ¹⁵
Surface resistivity - initial	ohm.cm	IEC 60093 / DIN 53482	10 ¹³
Surface resistivity after 90 hours at 90% RH at 35°C	ohm.cm	IEC 60093 / DIN 53482	10 ¹⁰ - 10 ¹¹

** Tests conducted on a glass cloth laminate with a Volant A finish, 3.2 mm thick and having a resin content of 33% to 35%.

Packaging

Lapox L-12 is available in 30 kg, 110 kg and 240 kg carboys. Lapox K-10 and Lapox K-86 are available in 1 kg HDPE bottles. Other packing may be considered on request.

LAPOX[®] L-12 | K-10 | K-86

Technical Data Sheet | Polymers Business



Storage and handling

Lapox L-12, hardener Lapox K-10 and accelerator Lapox K-86 have a shelf-life of at least 2 years if stored in its original container away from humidity and excessive heat. Care must be taken to avoid direct contact with skin as far as possible. If contact does occur, then wash off immediately with soap and warm water. Please refer to the Safety Data Sheet (SDS) for detailed instructions on storage and handling.

Safety

Wear personal protective equipment (PPE). Avoid contact with the eyes and skin. In case of direct contact and irritation, the resin should be washed off immediately with soap and warm water. Avoid breathing vapours, mist or gas. Please refer to the SDS for detailed safety instructions.

Spills and disposal

In case of spills, sweep up and shovel the spilled material. Keep spilled material in suitable, closed containers for disposal. Soak up with an absorbent such as clay, sand or other suitable material. Flush area with water to remove trace residue. Do not allow the product to reach the sewage system. Waste must be disposed of in accordance with federal, state or local regulations, as applicable.

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Note

Lapox[®] is a registered trademark of Atul Ltd.

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