

Product Description

LTM®110 Series prepregs are high service temperature cyanate ester matrices capable of initial cure at temperatures as low as 70°C (158°F). After a suitable post-cure, the glass transition temperature can be increased to a maximum of 330°C (626°F), thus allowing components to withstand short duration thermal spikes up to this temperature.

LTM110 Series autoclave processing prepregs have been specifically developed for applications where the best dimensional stability is required over a wide temperature range, and where tooling suitable for high temperature autoclave curing is not available.

Features

- 70°C (158°F) initial cure.
- Good dimensional stability and thermal durability up to 250°C (482°F) after post-cure.
- Maximum Tg of 330°C (626°F); can withstand thermal spikes to 330°C (626°F).
- Inherently flame retardant, with low toxic gas and smoke generation.
- Good dielectric properties for radar transparency.
- Low out-gassing and off-gassing for space structures.
- LTM110-5 variant available for unidirectional prepreg formats.
- LTA110-5 film is available for bonding applications.

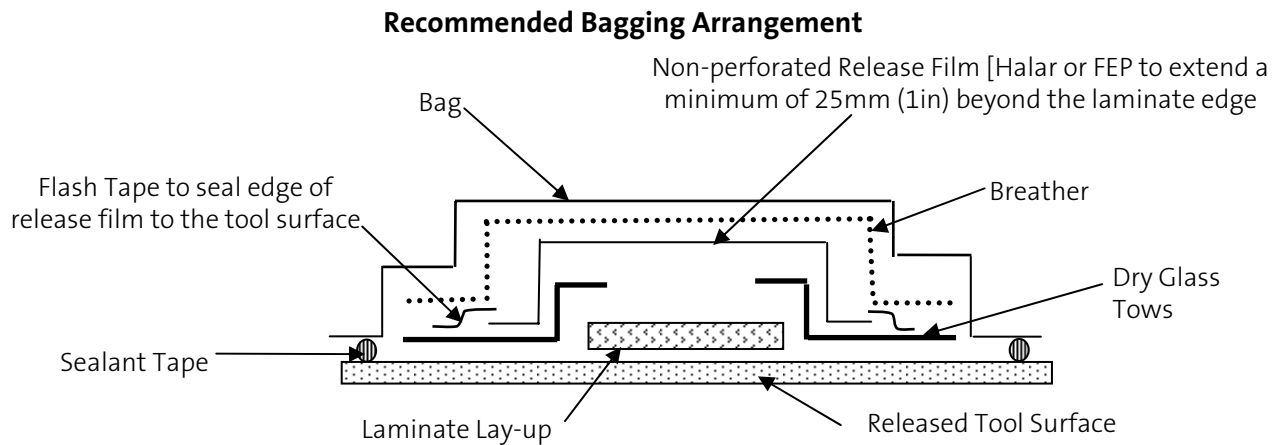
Instructions for Use

Moisture Effects - Special Precautions

LTM110 Series prepreg polymerisation reaction can be adversely affected by moisture so special precautions must be taken to ensure that the prepreg, and everything in contact with it during the cure, is as free as possible from absorbed moisture. The same precautions need to be taken with an initially cured (partially cross-linked) component during the post-cure process.

Under certain conditions, moisture will react with the polymer functional groups to produce carbon dioxide gas and, at high temperature, any trapped gas will expand and cause the laminate to blister. It is, therefore, strongly recommended that care is taken when thawing the prepreg to minimise any condensation. The prepreg should be removed from the freezer, thawed and allowed to reach room temperature before removal from the polythene protective bag. All tooling and any moulded inserts must be thoroughly dried before lay-up commences.

Prepreg should be cut to shape using templates and laid up in accordance with design instructions. Care must be taken to ensure the prepreg conforms exactly to the tool shape, especially around internal corners. The lay-up should be vacuum debulked at regular intervals using a P3 (pin pricked) Halar release film on the prepreg surface and a lightweight breather. A vacuum of 980 mbar (29in Hg) should be applied for up to 30 minutes depending on prepreg format.



Glass Tows Detail

Placing dry glass tows at 0.5m (20in) intervals around the edge of the laminate will provide air paths under the release film and into the breather (depicted above).

Release Film Detail

The release film may be taped down to the tool surface with flash tape as required.

Breather Detail

One ply of heavyweight breather 340gsm (10oz/yd²) is recommended. The breather should connect directly to the vacuum ports where two or three additional layers of breather should be applied locally.

The highest available vacuum, typically 980mbar (29in Hg), must be achieved. It is critical to ensure that the laminate is exposed to this vacuum. This can be checked by placing a gauge at the opposite side of the laminate to the position of the vacuum port.

A vacuum drop test should be performed prior to curing the part. The test must show a pressure loss of no more than 68mbar (2in Hg) pressure within 10 minutes once the vacuum is removed.

Exotherm

LTM110 Series prepregs are reactive formulations, which can undergo severe exothermic heat up during the initial curing process if incorrect curing procedures are followed.

Great care must be taken to ensure that safe heating rates, dwell temperatures and lay-up / bagging procedures are adhered to, especially when moulding solid laminates in excess of 10mm (0.4in) thickness. The risk of exotherm increases with lay-up thickness and increasing cure temperature. It is strongly recommended that trials, representative of all the relevant circumstances, are carried out by the user to allow a safe cure cycle to be specified. It is also important to recognise that the model or tool material and its thermal mass, combined with the insulating effect of breather / bagging materials can affect the risk of exotherm in particular cases. Please contact ACG Technical department for further information on exotherm behaviour of these systems.

Cure Cycle

Recommended Initial Cure:	20 hours at 70°C (158°F)
Minimum Initial Cure:	16 hours at 70°C (158°F)
Recommended Post-Cure:	2 hours at 250°C (482°F) for prolonged use at 250°C (482°F)
Maximum Post-Cure:	2 hours at 300°C (572°F) for thermal spiking to 330°C (626°F)
Heat-up Rate (Cure);	3°C (5.7°F)/minute maximum
Heat-up Rate (Post-Cure);	Maximum 20°C (36°F)/hour from 70°C (158°F)
Recommended Cure Pressure:	Final autoclave pressure 6bar (90psi). Apply 980mbar (28in Hg) vacuum and start pressurisation together. Vent vacuum when pressure reaches 1bar (0.4in Hg).

Post-Cure Note

ACG recommends performing the post-cure immediately after the initial cure has been completed, and that a minimum post-cure of 1 hour at 150°C (302°F) is applied. This will avoid the risk of moisture absorption by the partially cured polymer and the subsequent problems.

Post-curing above 250°C (482°F) will increase the Tg to a maximum of 330°C (626°F). However, there will be degradation and possible charring of the polymer which can limit the in service life may impact on dielectric and mechanical performance.

Technical Data

Cured Resin Properties:

Property	Result
Prepreg Volatiles	<1%
Post-cured Resin Density	1.28 grams/cc
Tg (TMA) 16 hours at 70°C (158°F)	80°C (175°F)
Tg (DMA) 2 hours at 250°C (482°F)	300°C (572°F)
Tg (DMA) 30 minutes at 300°C (572°F)	330°C (626°F)

Mechanical Properties:

Thermal Stability in Air at 250°C (482°F)

Woven carbon prepreg – T300(3k)-280gsm-4x4twill	
Cure:	20 hours at 70°C (158°F), 6 bar (87psi) pressure
Post-cure:	0.5 hours at 250°C (482°F)
Vf	55%
Laminate thickness:	2mm

Time at 250°C (482°F) (hours)	ILSS MPa (ksi)		Flexural Strength MPa (ksi)		Flexural Modulus GPa (msi)		Weight Loss (%)
	21°C (70°F)	180°C (356°F)	21°C (70°F)	180°C (356°F)	21°C (70°F)	180°C (356°F)	
0	34 (4.9)	44 (6.3)	773 (112)	665 (964.2)	55 (8)	47 (6.8)	0
100	32 (4.6)	38 (5.5)	608 (88)	724 (105)	45 (6.5)	51 (7.4)	0.6
200	31 (4.5)	33 (4.8)	851 (123.4)	788 (114.2)	53 (7.6)	49 (7.1)	0.8
400	32 (4.6)	33 (4.8)	828 (120)	776 (112.5)	57 (8.2)	48 (7)	1.3
600	38 (5.5)	37 (5.4)	792 (115)	872 (126.4)	48 (7)	50 (7.2)	1.8
800	38 (5.5)	37 (6.2)	864 (125.3)	859 (124.5)	49 (7.1)	53 (7.7)	2.2
1000	44 (6.4)	40 (5.8)	761 (110.3)	904 (131)	48 (7)	52 (7.5)	2.8

Thermal Stability in Nitrogen up to 400°C (752°F):

Woven carbon prepreg – T300(3k)-280gsm-4x4 twill	
Cure:	20 hours at 70°C (158°F), 6 bar (87psi) pressure
Post-cure:	0.5 hour at 250°C (482°F)
Vf:	55%
Laminate thickness:	2mm

Aging Temp °C (°F)	Aging Time (Hours)	Weight Loss %		ILSS – MPa (ksi)	Comments
		Resin	CF Laminate		
250 (482)	0	-	-	37 (5.4)	-
250 (482)	50	-	-	36 (5.2)	-
250 (482)	100	-	-	-	-
300 (572)	50	-	-	31 (4.5)	-
300 (572)	100	6.8	5.7	31 (4.5)	Slight defects
350 (662)	100	17.2	9.1	-	Delaminated
400 (752)	100	23.2	11.4	-	Blistered

Electrical Applications

Dielectric properties of LTM110 resin:	
Cure:	20 hours @ 70°C (158°F)
Post-cure:	0.5 hour @ 250°C (482°F)

Test frequency (GHz)	Permittivity ϵ'	Loss Factor ϵ''
14	2.98	0.016
21	2.89	0.017

Mechanical Data

LTM110/Quartz 581 fabric	
Cure:	1 hour @ 120°C (158°F)
Post-cure:	1 hour @ 150°C (482°F)
Vf:	5%

Test	Test condition	Result
Tensile Strength - MPa (ksi)	Room temperature - dry	619 (89.7)
	125°C (257°F) - dry	618 (89.6)
Tensile Modulus - GPa (msi)	Room temperature - dry	26 (3.7)
	125°C (257°F) - dry	26 (3.7)
Compression Strength - MPa (ksi)	Room temperature - dry	423 (61.3)
	125°C (257°F) - dry	392 (56.8)
Compression Modulus - GPa (msi)	Room temperature - dry	25.5 (3.7)
	125°C (257°F) - dry	-
In-plane Shear Strength - MPa (ksi)	Room temperature - dry	130 (18.8)
	125°C (257°F) - dry	101 (14.6)
In-plane Shear Modulus - GPa (msi)	Room temperature - dry	7.87 (1.1)
	125°C (257°F) - dry	8.66 (1.25)

Availability

LTM110 Series prepregs are available in a wide range of reinforcements.

LTA110-5 is available in film weights of 150 to 300gsm.

Storage

Storage at -18°C (0°F)	6 months
Out Life at 21°C (70°F)	3 days

When not in use, LTM110 Series prepregs should be stored in a freezer in a sealed polyethylene bag. When material is removed from the freezer, it is essential that the roll be allowed to thaw and reach room temperature before the bag is opened. For example, the thaw time for a 15Kg (35lb) roll taken from -18°C (0°F) storage into a 21°C (70°F) room is typically between 4 and 6 hours. Unless the material is fully thawed, condensation may form on the surface. Moisture within a curing laminate may be detrimental to final part quality and appearance.

When materials are returned to the freezer they must be resealed to prevent ingress of moisture.

Health and Safety

LTM110 Series prepregs contain cyanate ester resin which can cause allergic reaction on prolonged or repeated skin contact. Gloves and protective clothing must be worn.

Wash skin thoroughly with soap and water or resin removing cream after handling. Do not use solvents for cleaning the skin.

Use mechanical exhaust ventilation when heat curing the resin system.

For further information consult ACG (Material) Safety Data Sheets:

LTM110: (M)SDS 110
LTM110-5: (M)SDS 509
LTA110-5: (M)SDS 510