LTM® 212

LTM210 series tooling prepregs are low temperature curing epoxy resins systems that can be post cured to produce tools with a service temperature of 210°C (410°F).

LTM212 prepregs are suitable for the manufacture of small to medium sized tools.

Features and Benefits

- 2 ½ days out life at 21°C (70°F)
- 6 months storage at -18°C (0°F)
- Routine processing by autoclave cure with excellent quality surface finish achievable
- Mould tools directly from low temperature master
- Prepregs have excellent tack, drape and handleability at temperatures between 15°C and 35°C (59 and 95°F)
- Initial cure temperatures down to 35°C (95°F)
- Able to produce tools with low residual stress
- Unsupported (free-standing) post-cure
- Low tool shrinkage matched to Syensqo's tooling block expansion during cure
- Low tool coefficient of thermal expansion (CTE) matched with Syensqo-supplied backing structures
- Good retention of mechanical properties up to 210°C (410°F) when fully post cured
- Tooling solution optimised for moulding 180°C (356°C) curing epoxy components

CURE CYCLES

With full vacuum applied to the bag, start raising the temperature towards the required initial cure temperature set point. Start the pressurisation cycle as soon as the stated minimum cure temperature (as indicated by the leading thermocouple, NOT the lagging thermocouple) for the resin system you are using is reached, provided that the time from the start of the heating cycle is not less than 30 minutes, and not greater than 1 hour. (Different equipment, tooling heat capacity, and ramp rates may mean that the stated minimum cure temperature for the resin has not been reached within the time limits. In this case the time limits apply). Maintaining vacuum throughout the process, raise the autoclave pressure to 0.62MPa (90psi/6.2bar) and the temperature to the selected initial cure temperature. Care should be taken not to exceed the heat up rate of 3°C (5.4°F) per minute during pressurisation, as the internal temperature may rise substantially when the pressure is raised.

Autoclave cure LTM 212

Vacuum bag pressure	Minimum of 980mbar (29"Hg)*
Autoclave pressure	6.2 bar (90 psi)
Ramp rate	1 to 3°C (1.8 to 5.4°F)/minute
Minimum temperature cure cycle	50 hours at 35°C (95°F)
Maximum temperature cure cycle	8 hours at 60°C (140°F)
Cool down	Maximum of 3°C (5.4°F)/minute to room

*This is the ideal vacuum level, however, it is recognised that it is not always possible to attain. If in doubt, please contact our technical support staff for advice

Notes:

Due to the highly exothermic nature of the material, it is not recommended to cure at temperatures above 60°C (140°F).

For laminates greater than 6 to 7mm thickness, e.g. 1-16-1, please contact our technical support staff for advice on appropriate cure schedules.

ALTERNATIVE CURE CYCLES

Temperature	Minimum cure duration	Recommended cure duration
35°C (95°F)	40 hours	50 hours
40°C (104°F)	30 hours	35 hours
45°C (113°F)	20 hours	24 hours
50°C (122°F)	13 hours	16 hours
55°C (131°F)	9 hours	11 hours
60°C (140°F)	6 hours	8 hours

POST-CURE

The post-cure schedule is recommended for all LTM212 tools.

In applications demanding maximum temperature or environmental resistance, it is essential that the component is post cured to fully develop the glass transition temperature.

Ramp rate	0.3°C (0.5°F)/minute
Recommended post cure cycle	15 minutes at 200°C -0/+5°C (392°F -0/+9°F)
	+ 8 hours at 190°C -0/+5°C (374°F -0/+9°F)
Cool down	3°C (5.4°F))/minute to 60°C (140°F)

* Temperature must be measured by the lagging thermocouple attached to the part.

Notes:

Parts may be loaded into a pre-heated oven or heated at 3°C (5°F)/minute to the initial cure temperature.

Large components should be adequately supported to avoid distortion.

PHYSICAL PROPERTIES

Typical properties for LTM210 series resins/prepregs

Test	Sample/test conditions	Results	
Cured resin density	Post cured samples	LTM212	1.22g/cm^3
TMA Tg	Cure at 40°C (104°F), dry Cure at 50°C (122°F), dry Cure at 60°C (140°F), dry Fully post cured	55°C (131°F)** 65°C (149°F)** 75°C (167°F)** 205 – 210°C (401 – 410°F)	
Shrinkage	Post cured laminates	Carbon tool	0.06%*
Coefficient of thermal expansion (CTE)	Post cured laminates tested from 21°C (70°F) to 180°C (356°F)	Carbon tool	2.5 – 3.5 x 10-6/°C (1.4 – 1.9 x 10-6/°F)

*Shrinkage and CTE are dependent on construction and processing. Figures quoted are based on Syensqo's standard 1-8-1 quasi-isotropic tooling laminates using fabric styles CF0100 or CF0300 and CF0700 for carbon and GF0100 and GF0700 for the glass tool laminate.

**Dependent on a particular resin system.

Gel times for LTM210 series resins/prepregs

This table provided approximate gel times at the respective cure temperatures for standard 1-8-1 tooling laminate:

	Gel time/temperature									
Material	35°C (95°F)	40°C (104°F)	45°C (113°F)	50°C (122°F)	55°C (131°F)	60°C (140°F)	65°C (149°F)	70°C (158°F)	75°C (167°F)	80°C (176°F)
LTM212	24 hours	15 hours	10 hours	6.6 hours	4.5 hours	3.1 hours	-	-	-	-

AVAILABILITY

LTM212 prepregs are available on the following fabrics.

199 g/m^2 2x2 twill weave, 3K HS carbon fibre

660 g/m^2 2x2 twill weave, 12K HS carbon fibre

STORAGE

Out life* at 21°C (70°F)	2 ½ days
Storage at -18°C (0°F)	6 months from date of manufacture

*Out life refers to accumulated time out of the freezer before the part is cured.

Note:

The actual freezer storage life and out life are dependent on a number of factors, including; fibre type, format and application. For certain formats, it may be possible for the storage life and out life to be longer than stated. Please contact our technical support staff for advice.

EXOTHERM

LTM® 212 prepreg 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.

HEALTH & SAFETY

Please refer to the product SDS for safe handling, personal protective equipment recommendations and disposal considerations.