EPIKOTE™ Resin MGS® LR285

EPIKURE™ Curing Agent MGS® LH285-287

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Characteristics

Approval	German Federal Aviation Authority
Application	Production of gliders, motor gliders and motor planes, boat and shipbuilding, sports equipment, model airplanes, moulds and tools
Operational temperature	-60 ℃ up to +50 ℃ without heat treatment -60 ℃ up to +80 ℃ after heat treatment
Processing	At temperatures between 15 ℃ and 50 ℃, all common processing methods
Features	Extremely good physiological compatibility Good mechanical properties Pot life of approx. 30 min to approx. 3.5 hours at 25℃
Storage	Shelf life of 24 months in originally sealed containers

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Application

Laminating resin system approved by the GERMAN FEDERAL AVIATION AUTHORITY Application with different pot lives for processing of glass, carbon and aramide fibres, featuring high static and dynamic loadability.
After heat treatment at 50 – 55 °C, the system meets the standards for gliders and motor gliders (operational temperatures -60 °C to + 54 °C). In order to meet the standards for motor planes (operational temperatures -60 °C to +72 °C), heat treatment at 80 °C is necessary.
The range of pot lives at 25°C is between approx. 30 min and 3.5 h. The curing agents have the same mixing ratio and can be mixed among themselves in any ratio. This permits a selection of the optimum system for all processing methods. After initial curing at room temperature, the components manufactured are workable and demouldable. You will receive high-gloss and non-tacky surfaces, even with unfavourable precuring conditions, e. g. lower temperatures or high humidities.

The mixing viscosity guarantees fast and complete impregnation of the reinforcement fibres; however, the resin will not spill out of the fabrics on vertical surfaces. In order to obtain special properties, it is also possible to add fillers to the mixture of resin/hardener, such as Aerosil, microballoons, cotton flakes, metal powder, etc.

If high heat resistance or aircraft approval are not necessary, curing agent LH285 can also be used without heat treatment afterwards. However, the indicated properties will only be obtained after heat treatment at temperatures over 50 °C
As a matter of experience LR285 can be combined with suitable gelcoats on UP, PU and EP basis.

Epoxy resins are super cooled liquids, therefore crystallisation is immanently possible. In an early stage, crystallisation is visible as a clouding, and can progress to a stage, where the resin becomes a wax- like solid. This physical phenomenon is reversible and is no restriction to quality after its reversion, in fact a high purity of material will increase a tendency for crystallisation.
Crystallisation can be reversed by slow heating of the product to approx. 40 - 60 °C. If possible, stir the content or shake the container until the content clarifies. Use only completely transparent products.
Although LR285 is very unlikely to crystallize at low temperatures, storage conditions of 15 – 30 °C and low humidity are recommended. After dispensing material, the containers must again be closed carefully, to avoid contamination or absorption of water. All amine curing agents show a chemical reaction when exposed to air, known as „blushing“. This reaction is visible as white carbamide crystals, which could make the materials unusable.

Since the approval of laminating resin LR285 in 1985, it has been used by nearly all manufacturers of planes and gliders and - especially because of the extremely good physiological compatibility - it is the most commonly used system in the aircraft industry today. It often happens that workers who have experienced problems with some epoxy resins concerning allergies or skin irritation are able to process laminating resin LR285.

The relevant industrial safety regulations for the handling of epoxy resins and curing agents and our instructions for safe processing are to be observed.

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Specifications

		Laminating resin LR285
Density [1]	[g/cm³]	1.18 – 1.23
Viscosity [1]	[mPa·s]	600 – 900
Refractory index [1]		1.525 – 1.530

		Curing agent		
		LH285	**LH286**	**LH287**
Density [1]	[g/cm³]	0.94 – 0.97	0.94 – 0.97	0.93 – 0.96
Viscosity [1]	[mPa·s]	50 – 100	60 – 100	80 – 120
Refractory index [1]		1.500 – 1.506	1.498 – 1.502	1.495 – 1.499
Potlife [2]	[min]	15 – 20	app. 40	app. 140
Tg $_{pot}$ unconditioned	[℃]	80 – 85 ℃	85 – 90 ℃	90 – 95 ℃
Tg $_{pot}$ conditioned [3]	[℃]	65 – 70 ℃	78 – 82 ℃	83 – 88 ℃

Measuring conditions:
1) measured at 25℃
2) measured in 30℃ water bath, 100g sample
3) conditioned at 40 ℃ / 90% r.H.

Mixing ratio

	LR285 : All curing agents
Parts by weight	100 : 40 ± 2
Parts by volume	100 : 51 ± 2

The mixing ratio stated must be observed very carefully. Adding more or less curing agent will not result in a faster or slower reaction – but in incomplete curing which cannot be corrected in any way. Resin and curing agent must be mixed very thoroughly. Mix until no clouding is visible in the mixing container. Pay special attention to the walls and bottom of the mixing container.
All curing agents have blue colour to distinguish between resin and curing agents, and for easier identification of a correct mixing process. Although unlikely, deviations in colour are possible (e.g. due to UV radiation after longer exposure to sun light), but however have no effect on the processing and final properties of the material

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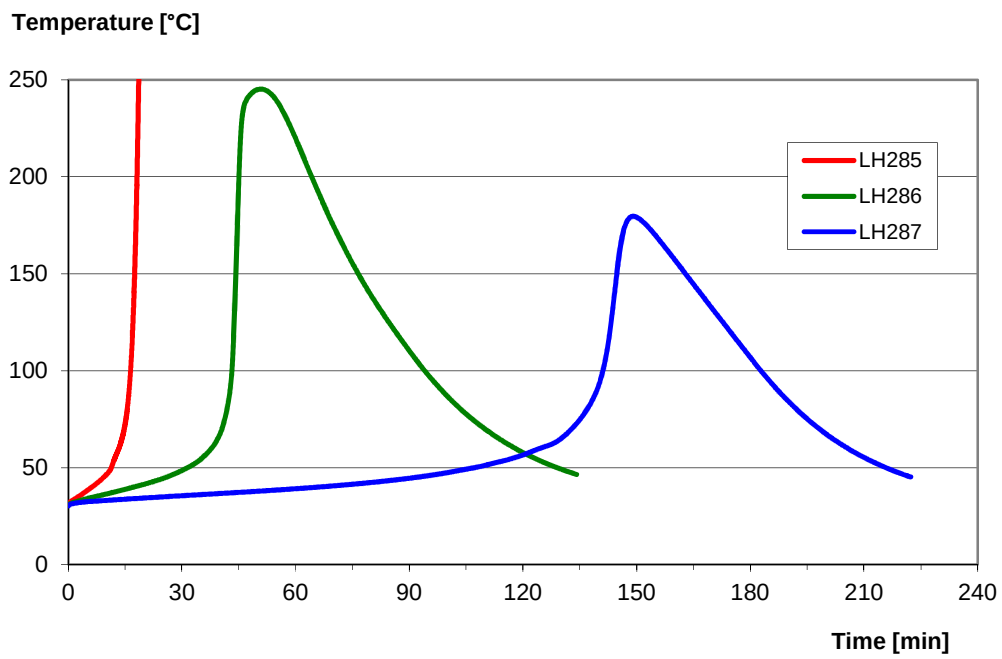
Temperature development



Measuring conditions: 100g mixture at 30℃ in a wat er basin

Optimum processing temperature is in the range of 20 to 35 ℃. Higher temperatures are possible, but will shorten pot life. A temperature increase of 10 ℃ will halve the pot life. Water (e.g. high humidity or contained in additional fillers) causes an acceleration of the resin/ curing agent reaction. Different temperatures during processing are not known to have significant impact on the mechanical properties of the cured product.
Do not mix large quantities – particularly of highly reactive systems – at elevated processing temperatures. As the heat dissipation in the mixing container is very slow, the contents will be heated up by the reaction heat (exothermic resin-curing agent reaction) rapidly. This can result in temperatures of more than 200 ℃ in the mixing container, which may cause smoke-intensive burning of the resin mass.

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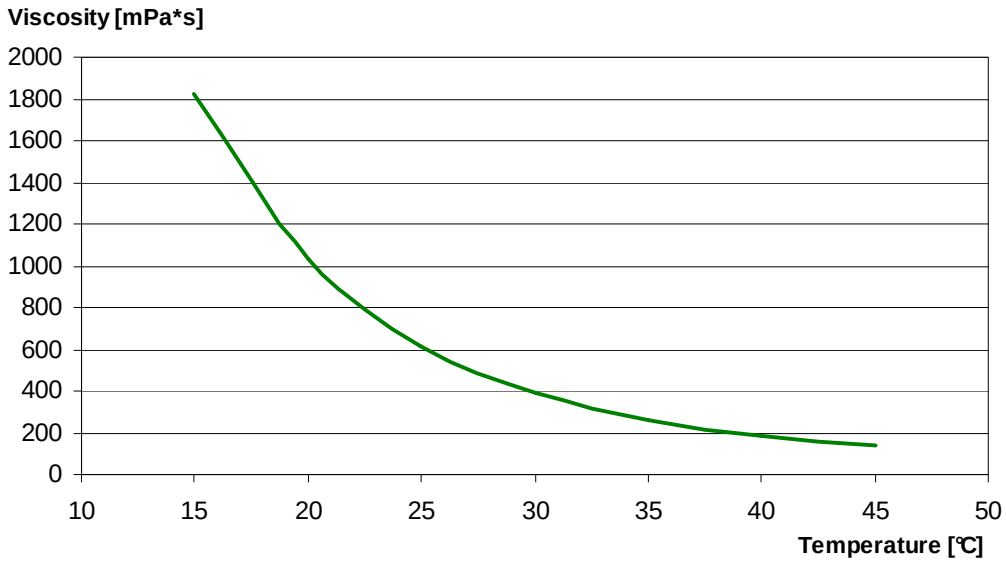
Gel time

	Curing agent		
	LH285	**LH286**	**LH287**
20 – 25℃	App. 2 – 3 h	App. 3 – 4 h	App. 5 – 6 h
40 – 45℃	App. 45 – 60 min.	App. 60 – 90 min.	App. 80 – 120 min.

Measuring conditions: Film thickness 1 mm at different temperatures

Viscosity of mixture



Measuring conditions:
rotation viscosimeter, plate-plate configuration, measuring gap 0.2 mm

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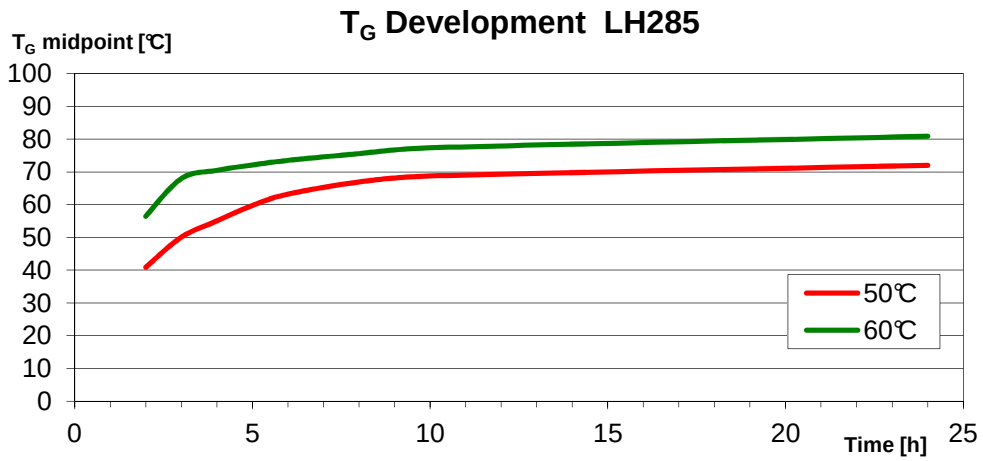
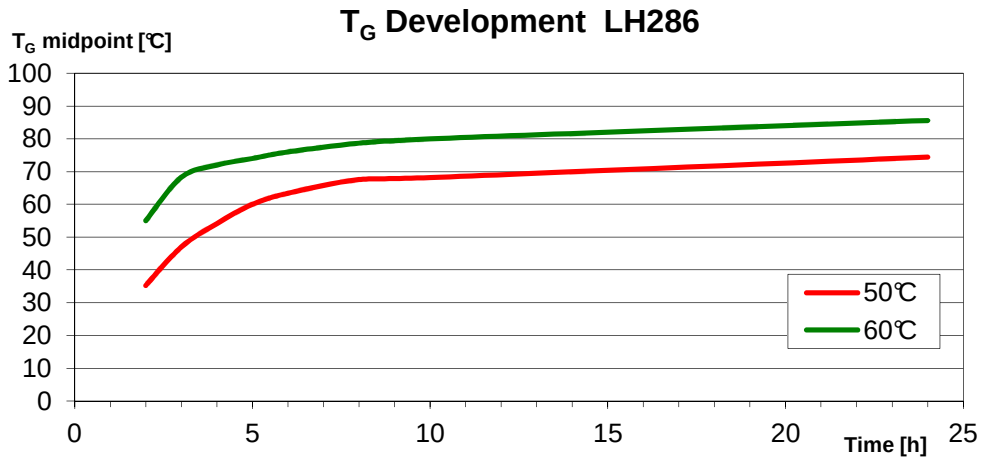
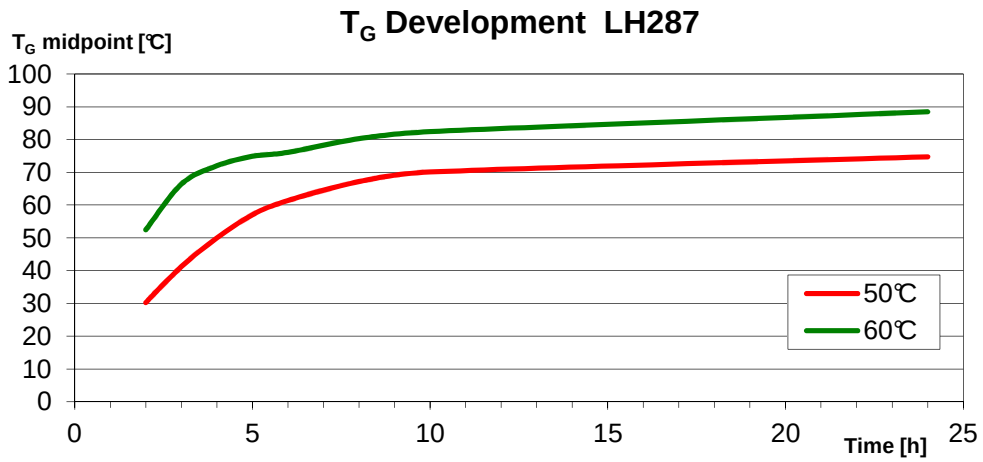
T_G development







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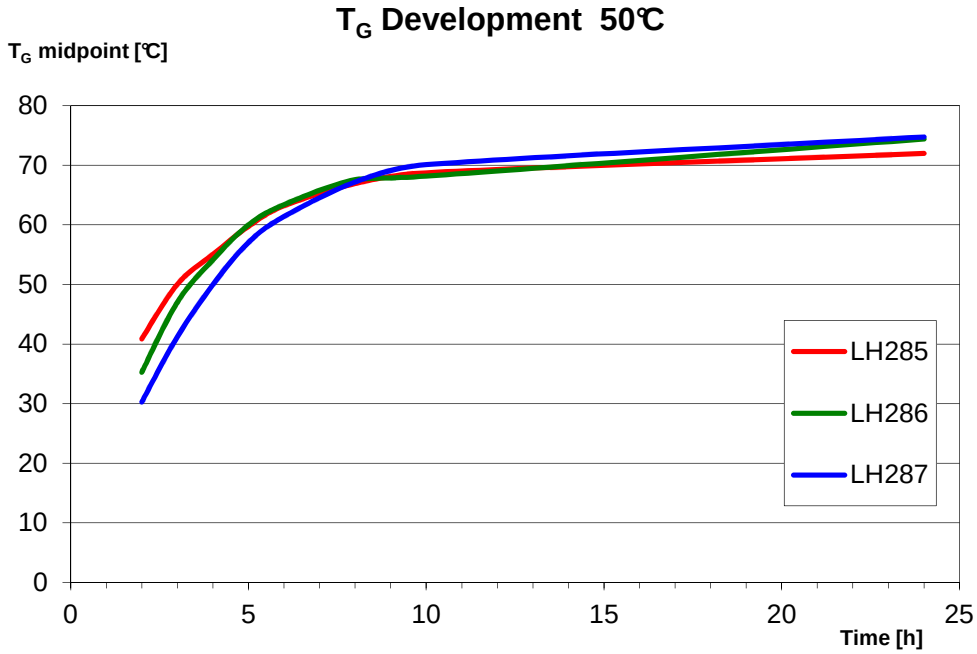

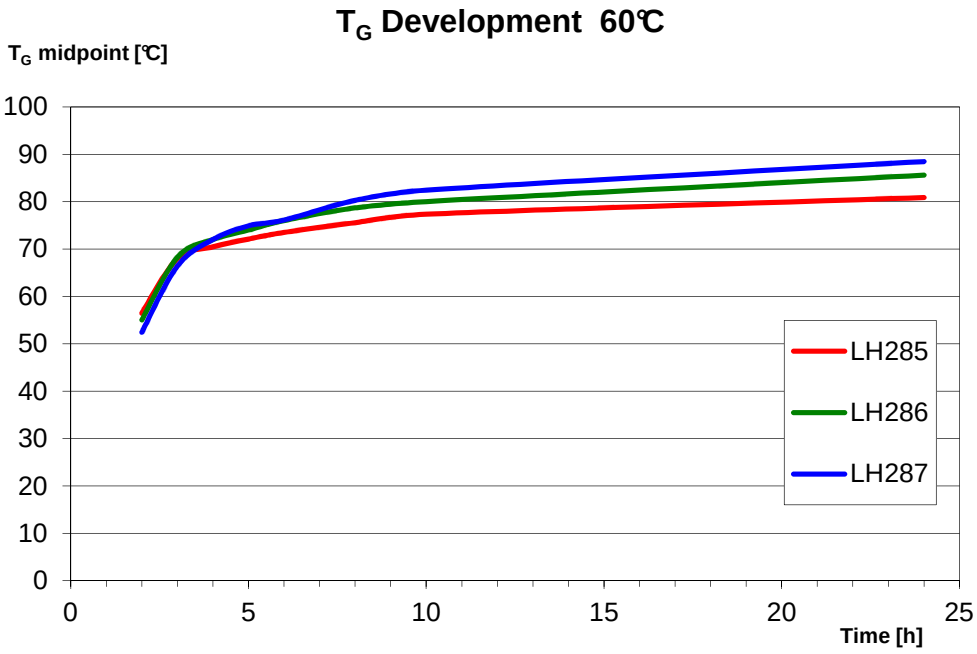

Measuring conditions for all T_G measurements: DSC, ISO 11357

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Mechanical data of neat resin

Mechanical data		
Density DIN EN ISO 1183-1	[g/cm³]	1,18 – 1,20
Flexural strength DIN EN ISO 178	[MPa]	110 – 120
Modulus of elasticity DIN EN ISO 178	[GPa]	3,0 – 3,3
Tensile strength DIN EN ISO 527-2	[MPa]	70 – 80
Compressive strength DIN EN ISO 604	[MPa]	120 – 140
Elongation at break DIN EN ISO 527-2	[%]	5,0 – 6,5
Impact strength ISO 179-1	[kJ/m²]	45 – 55
Water absorption at 23℃ DIN EN ISO 175	24h [%] 7d [%]	0,20 – 0,30 0,60 – 0,80
Curing: 24h at 23℃ + 15h at 60℃		

Advice:

Mechanical data are typical for the combination of laminating resin LR285 with curing agent LH287. Data can differ in other applications.

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Mechanical data of reinforced resin

Mechanical data		Glass fibre	Carbon fibre	Aramide fibre
Flexural strength	[MPa]	510 – 560	720 – 770	350 – 380
Tensile strength	[GPa]	460 – 500	510 – 550	400 - 480
Compressive strength	[MPa]	410 – 440	460 – 510	140 – 160
Interlaminar Shear Strength	[MPa]	42 – 46	47 – 55	29 – 34
Modulus of Elasticity	[MPa]	20 – 24	40 – 45	16 – 19

Curing: 24h at 23℃ + 15h at 80℃

Glass fibre laminate:
16 layers of glass fabric, 8H satin, 296 g/m², 4 mm thick

Carbon fibre laminate:
8 layers of carbon fabric, plain weave, 200 g/m², 2 mm thick

Aramide fibre laminate:
15 layers of aramide fabric, 4H satin, 170 g/², 4 mm thick

Fibre content of samples during processing/testing: 40 - 45 vol%
Data calculated for fibre content of 43 vol%

Typical data according to WL 5.3203 Parts 1 and 2 of the GERMAN AVIATION MATERIALS MANUAL

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