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Advanced Materials

Araldite® LY 556 / Aradur® 5021 / Hardener XB 3403 / Hardener XB3471

PREPREG SYSTEM FOR AMBIENT TEMPERATURE CURE

Araldite® LY 556 (epoxy resin)
Aradur® 5021 (hardener paste)
Hardener XB 3403 (hardener based on polyamine)
Hardener XB 3471 (hardener based on polyamine)

APPLICATIONS	Industrial composites		
PROPERTIES	Prepreg system with a long shelf life and curable from 80°C on		
PROCESSING	Prepreging		
KEY DATA	**Araldite® LY 556**		
	Aspect (visual)	clear, pale yellow liquid	
	Viscosity at 25 °C (ISO 9371B)	10000 - 12000	[mPa s]
	Density at 25 °C (ISO 1675)	1.15 - 1.20	[g/cm^3]
	Aradur® 5021		
	Aspect (visual)	White viscous paste	
	Viscosity at 25 °C	70000 - 90000	[mPa s]
	Density at 25 °C (ISO 1675)	1.0	[g/cm^3]
	Storage temperature	< 8	[°C]
	Hardener XB 3403		
	Aspect (visual)	clear liquid	
	Viscosity at 25 °C	5 - 20	[mPa s]
	Density at 25 °C (ISO 1675)	1.0	[g/cm^3]
	Hardener XB 3471		
	Aspect (visual)	transparent liquid	
	Density at 25 °C (ISO 1675)	1.0	[g/cm^3]
	Flash point (ISO 2719)	≥ 100	[°C]

PROCESSING DATA

MIX RATIO

Components, parts by weight	System 1	System 2
Araldite® LY 556	100	100
Aradur® 5021	25	25
Hardener XB 3403	12	
Hardener XB 3471		14

Mix the Araldite® LY 556 with Aradur® 5021 and add the Hardener XB 3403 **or** Hardener XB 3471 just before the prepregging process. The premix of Araldite® LY 556 / Aradur® 5021 has a long shelf life at RT (> 1 week)

The prepreg tackiness can be adjusted by the amount of the Hardener XB 3403 or Hardener XB 3471.

We recommend that the components are weighed with an accurate balance to prevent mixing inaccuracies which can affect the properties of the matrix system. The components should be mixed thoroughly to ensure homogeneity. It is important that the side and the bottom of the vessel are incorporated into the mixing process.

When processing large quantities of mixture the pot life will decrease due to exothermic reaction. It is advisable to divide large mixes into several smaller containers.

INITIAL MIX VISCOSITY			System 1	System 2
	at 78°F	*[cps]*	3900 - 4400	3800 - 4300

POT LIFE	all the 3 components		System 1	System 2
(TECAM, 100 ML, 65 % RH)		*[min]*	410 - 460	380 - 430

GEL TIME (HOT PLATE)			System 1	System 2
	at 176°F	*[min]*	210 - 240	200 - 230
	at 194°F	*[min]*		60 - 80
	at 212°F	*[min]*	40 - 60	
	at 230°F	*[min]*	17 - 25	15 - 23
	at 248°F	*[min]*	6 - 10	6 - 10
	at 266°F	*[min]*	2- 5	2 - 5

The values shown are for small amounts of pure resin/hardener mix. In composite structures the gel time can differ significantly from the given values depending on the fibre content and the laminate thickness.

PREPREG PRODUCTION		
	Impregnation bath temperature	78 - 86 °F

B-STAGING (PRE REACTION)	System 1	System 2
	24-48h at 73-78°F	2-3 min at 176-194°C + 6-12h at 73°F

PREPREG SHELF LIFE		System 1	System 2
	at 73 °F	> 6 weeks	> 3 weeks

PROPERTIES OF THE CURED, NEAT FORMULATION

GLASS TRANSITION TEMPERATURE (T_G) (IEC 1006, DSC, 10 K/MIN)	*Cure: after B-Stage*	System 1 *T_G [°F]*	System 2 *T_G [°F]*
	10 h 158 °F	113 - 127	151 - 162
	10 h 158 °F + 4 h 176 °F	180 - 190	
	10 h 158 °F + 8 h 176 °F	189 - 199	208 - 219
	10 h 158 °C + 4 h 194 °F	194 - 205	
	8 h 176 °F	156 -167	194 - 205
	16 h 176 °F	192 - 203	208 - 219
	24 h 176 °F	194 - 205	212 - 223
	10 h 158 °F + 8 h 194 °F	214 - 225	
	4 h 194 °F	183 - 194	208 - 219
	6 h 194 °F	210 - 221	212 - 223
	8 h 194 °F	216 - 226	219 - 230
	10 h 194°F	221 - 232	221 - 232
	4 h 212 °F		230 - 241
	6 h 212 °F	235 - 246	241 - 252
	2 h 248 °F	243 - 253	252 - 262

FLEXURAL TEST (ISO 178)			Tested at	System 1	System 2
CURE CYCLE					
10H 158°F + 10H 176°F	Flexural strength	[Kpsi]	73 °F	20.3 – 21.8	20.3 – 22.0
	Ultimate elongation	[%]		4.0 - 4.6	4.5 - 5.7
	Flexural modulus	[Kpsi]		522 - 558	486– 522
16H 176°F	Flexural strength	[Kpsi]	73 °F	21.0 – 22.5	
	Ultimate elongation	[%]		4.8 - 5.5	
	Flexural modulus	[Kpsi]		522 - 551	
24H 176°F	Flexural strength	[Kpsi]	73 °F	21.0 – 22.5	
	Ultimate elongation	[%]		4.5 - 5.5	
	Flexural modulus	[Kpsi]		493 - 529	
10H 194°F	Flexural strength	[Kpsi]	73 °F	21.2 – 22.6	21.8 – 23.2
	Ultimate elongation	[%]		6.0 - 7.0	6.0 - 8.0
	Flexural modulus	[Kpsi]		457 - 493	473 – 508
10H 194°F	Flexural strength	[Kpsi]	158 °F	14.5 – 16.0	
	Ultimate elongation	[%]		5.0 - 5.6	
	Flexural modulus	[Kpsi]		363 -406	
10H 194°F	Flexural strength	[Kpsi]	176 °F	13.6 – 15.1	
	Ultimate elongation	[%]		4.6 - 5.2	
	Flexural modulus	[Kpsi]		363 - 406	
10H 194°F	Flexural strength	[Kpsi]	194 °F	11.6 – 13.1	
	Ultimate elongation	[%]		4.4 - 5.2	
	Flexural modulus	[Kpsi]		319 - 355	
6H 212°F			73°F		

	Flexural strength	[Kpsi]		17.4 – 19.6	18.9 – 21.8
	Ultimate elongation	[%]		4.5 - 5.5	4.4 - 6.6
	Flexural modulus	[Kpsi]		428 - 457	442 - 471
2H 248°F	Flexural strength	[Kpsi]	73°F	19.6 -21.0	19.6 – 21.0
	Ultimate elongation	[%]		7.6 - 9.4	6.0 - 9.2
	Flexural modulus	[Kpsi]		421 - 450	413 - 442

FRACTURE PROPERTIES BEND NOTCH TEST
(PM 258-0/90)

CURE 10H 194°F	Fracture toughness K_{1C}	[psi√inch]	73 °F	769 - 934	769 - 879
	Fracture energy G_{1C}	[in-lb/inch^2]		0.71 – 1.0	0.74 – 0.91
CURE 6H 212°F	Fracture toughness K_{1C}	[psi√inch]	73 °F	714 - 824	824 - 934
	Fracture energy G_{1C}	[in-lb/inch^2]		0.68 – 0.86	0.88 – 1.03
CURE 2H 248°F	Fracture toughness K_{1C}	[psi√inch]	73 °F	824 - 934	0.75 - 0.85
	Fracture energy G_{1C}	[in-lb/inch^2]		0.97 – 1.14	0.97 – 1.17

PROPERTIES OF THE CURED, REINFORCED FORMULATION

INTERLAMINAR SHEAR TEST

Samples: 12 layers of unidirectional E-glass fabric (425 g/m^2)
Laminate thickness: 3.1 - 3.3 mm

(ASTM D 2344)

CURE CYCLE			Tested at	System 1	System 2
10H 158 °F	Shear strength	[Kpsi]	73°F	1.7 - 2.3	
10H 158°F + 8H 176°F	Shear strength	[Kpsi]	73°F	8.7 - 9.3	7.7 – 8.3
24H 176 °F	Shear strength	[Kpsi]	73°F	8.7 – 9.3	
10H 194 °F	Shear strength	[Kpsi]	73°F	9.0 – 9.6	8.7 – 9.3
10H 194 °F	Shear strength	[Kpsi]	158°F	6.8 – 7.4	
10H 194 °F	Shear strength	[Kpsi]	158°F	5.4 – 6.0	

STORAGE

Araldite® LY 556 should be stored in a dry place, the sealed original container, away from heat and humidity, at temperatures between +2°C and +40°C (+35.6°F and +104°F). Under these storage conditions, the shelf life is 5 years. The product should not be exposed to direct sunlight.

Like many liquid epoxy resins, Araldite® LY 556 may crystallize when stored below room temperature. Heating the resin to 60-70°C (140-160°F), preferably in a water bath, for several hours, will reliquify it and restore its original properties.

Aradur® 5021 should be stored in a dry place, the sealed original container, away from heat and humidity, at temperatures below 8°C (46°F). Under these storage conditions, the shelf life is 6 months. The product should not be exposed to direct sunlight.

Hardener XB 3403 should be stored in a dry place, the sealed original container, away from heat and humidity, at temperatures between +2°C and +40°C (+35.6°F and +104°F). Under these storage conditions, the shelf life is 3 years. The product should not be exposed to direct sunlight.

Hardener XB 3471 should be stored in a dry place, the sealed original container, away from heat and humidity, at temperatures between +2°C and +40°C (+35.6°F and +104°F). Under these storage conditions, the shelf life is 3 years. The product should not be exposed to direct sunlight.

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First Aid!
Refer to MSDS as mentioned above.

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