

Advanced Materials**Araldite® LY 556* / Aradur® 5021* /
Hardener XB 3403* / Hardener XB3471*****PREPREG SYSTEM FOR LOW 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	Prepregging		
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]
	Storage temperature	2 - 40	[°C]
	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]
	Storage temperature (see expiry date on original container)	2 - 40	[°C]
	Hardener XB 3471		
	Aspect (visual)	transparent liquid	
	Density at 25 °C (ISO 1675)	1.0	[g/cm ³]
	Flash point (ISO 2719)	≥ 100	[°C]
	Storage temperature (see expiry date on original container)	2 - 40	[°C]
STORAGE	<p>Provided that the products described above are stored in a dry place in their original, properly closed containers at the above mentioned storage temperatures they will have the shelf lives indicated on the labels. Partly emptied containers should be closed immediately after use.</p>		

* In addition to the brand name product denomination may show different appendices , which allows us to differentiate between our production sites: e.g , BD = Germany, US = United States, IN = India, CI = China, etc.. These appendices are in use on packaging, transport and invoicing documents. Generally the same specifications apply for all versions. Please address any additional need for clarification to the appropriate Huntsman contact.

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 epoxy Resin LY 556 with the hardener Aradur® 5021 and add the hardener XB 3403 **or** XB 3471 just before the prepregging process. The premix of the resin LY 556 / hardener 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 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 25°C [mPas]	3900 - 4400	3800 - 4300

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

GEL TIME		System 1	System 2
(HOT PLATE)	at 80°C [min]	210 - 240	200 - 230
	at 90°C [min]		60 - 80
	at 100°C [min]	40 - 60	
	at 110°C [min]	17 - 25	15 - 23
	at 120°C [min]	6 - 10	6 - 10
	at 130°C [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	
		25 - 30 °C

B-STAGING		System 1	System 2
(PRE REACTION)		24-48h at 23-25°C	2-3 min at 80-90°C + 6-12h at 23°C

PREPREG SHELF LIFE		System 1	System 2
	at 23 °C	> 6 weeks	> 3 weeks

PROPERTIES OF THE CURED, NEAT FORMULATION

GLASS TRANSITION TEMPERATURE (T _g)		system 1	system 2
(IEC 1006, DSC, 10 K/MIN)		T _g [°C]	T _g [°C]
Cure: after B-Stage	10 h 70 °C	45 - 53	66 - 72
	10 h 70 °C + 4 h 80 °C	82 - 88	
	10 h 70 °C + 8 h 80 °C	87 - 93	98 - 104
	10 h 70 °C + 4 h 90 °C	90 - 96	
	8 h 80 °C	69 - 75	90 - 96
	16 h 80 °C	89 - 95	98 - 104
	24 h 80 °C	90 - 96	100 - 106
	10 h 70 °C + 8 h 90 °C	101 - 107	
	4 h 90 °C	84 - 90	98 - 104
	6 h 90 °C	99 - 105	100 - 106
	8 h 90 °C	102 - 108	104 - 110
	10 h 90 °C	105 - 111	105 - 111
	4 h 100 °C		110 - 116
	6 h 100 °C	113 - 119	116 - 122
	2 h 120 °C	117 - 123	122 - 128

FLEXURAL TEST			system 1	system 2	
(ISO 178)			Tested at		
CURE CYCLE					
10H 70°C + 10H 80°C	Flexural strength	[MPa]	23 °C	140 - 150	140 - 152
	Ultimate elongation	[%]		4.0 - 4.6	4.5 - 5.7
	Flexural modulus	[MPa]		3600 - 3850	3350 - 3600
16H 80°C	Flexural strength	[MPa]	23 °C	145 - 155	
	Ultimate elongation	[%]		4.8 - 5.5	
	Flexural modulus	[MPa]		3600 - 3800	
24H 80°C	Flexural strength	[MPa]	23 °C	140 - 150	
	Ultimate elongation	[%]		4.5 - 5.5	
	Flexural modulus	[MPa]		3400 - 3650	
10H 90°C	Flexural strength	[MPa]	23 °C	146 - 156	150 - 160
	Ultimate elongation	[%]		6.0 - 7.0	6.0 - 8.0
	Flexural modulus	[MPa]		3150 - 3400	3260 - 3500
10H 90°C	Flexural strength	[MPa]	70 °C	100 - 110	
	Ultimate elongation	[%]		5.0 - 5.6	
	Flexural modulus	[MPa]		2500 - 2800	
10H 90°C	Flexural strength	[MPa]	80 °C	94 - 104	
	Ultimate elongation	[%]		4.6 - 5.2	
	Flexural modulus	[MPa]		2500 - 2800	
10H 90°C	Flexural strength	[MPa]	90 °C	80 - 90	
	Ultimate elongation	[%]		4.4 - 5.2	
	Flexural modulus	[MPa]		2200 - 2450	
6H 100°C	Flexural strength	[MPa]	23 °C	120 - 135	130 - 150
	Ultimate elongation	[%]		4.5 - 5.5	4.4 - 6.6
	Flexural modulus	[MPa]		2950 - 3150	3050 - 3250
2H 120°C	Flexural strength	[MPa]	23°C		

Ultimate elongation	[%]	135-145	130 – 145
Flexural modulus	[MPa]	7.6 - 9.4 2900 - 3100	6.0 - 9.2 2850 - 3050

FRACTURE PROPERTIES BEND NOTCH TEST

(PM 258-0/90)

CURE 10H 90°C	Fracture toughness K_{1C}	[MPa√m]	23 °C	0.70 - 0.85	0.70 - 0.80
	Fracture energy G_{1C}	[J/m ²]			
CURE 6H 100°C	Fracture toughness K_{1C}	[MPa√m]	23 °C	0.65 - 0.75	0.75 - 0.85
	Fracture energy G_{1C}	[J/m ²]			
CURE 2H 120°C	Fracture toughness K_{1C}	[MPa√m]	23 °C	0.75 - 0.85	0.75 - 0.85
	Fracture energy G_{1C}	[J/m ²]			

PROPERTIES OF THE CURED, REINFORCED FORMULATION

INTERLAMINAR SHEAR TEST

Samples: 12 layers of unidirectional E-glass fabric (425 g/m²)
Laminate thickness: 3.1 - 3.3 mm

(ASTM D 2344)

CURE CYCLE

CURE CYCLE			Tested at	System 1	System 2
10H 70 °C					
10H 70°C + 8H 80 °C					
24H 80 °C	Shear strength	[MPa]	23°C	12 - 16	
10H 90 °C	Shear strength	[MPa]	23°C	60 - 64	53 - 57
10H 90 °C	Shear strength	[MPa]	23°C	60 - 64	
10H 90 °C	Shear strength	[MPa]	23°C	62 - 66	60 - 64
	Shear strength	[MPa]	70°C	47 - 51	
	Shear strength	[MPa]	70°C	37 - 41	

HANDLING PRECAUTIONS

Personal hygiene

Safety precautions at workplace

protective clothing	yes
gloves	essential
arm protectors	recommended when skin contact likely
goggles/safety glasses	yes

<i>Skin protection</i>	
before starting work	Apply barrier cream to exposed skin
after washing	Apply barrier or nourishing cream
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<i>Cleansing of contaminated skin</i>	
	Dab off with absorbent paper, wash with warm water and alkali-free soap, then dry with disposable towels. Do not use solvents
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<i>Disposal of spillage</i>	
	Soak up with sawdust or cotton waste and deposit in plastic-lined bin
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<i>Ventilation</i>	
of workshop	Renew air 3 to 5 times an hour
of workplaces	Exhaust fans. Operatives should avoid inhaling vapours

FIRST AID	<p>Contamination of the eyes by resin, hardener or mix should be treated immediately by flushing with clean, running water for 10 to 15 minutes. A doctor should then be consulted.</p> <p>Material smeared or splashed on the <i>skin</i> should be dabbed off, and the contaminated area then washed and treated with a cleansing cream (see above). A doctor should be consulted in the event of severe irritation or burns. Contaminated clothing should be changed immediately.</p> <p>Anyone taken ill after <i>inhaling</i> vapours should be moved out of doors immediately.</p> <p>In all cases of doubt call for medical assistance.</p>
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