Advanced Materials

Structural Composites

MATRIX SYSTEMS FOR INDUSTRIAL COMPOSITES **DATA SHEET**

Warm to hot curing epoxy system based on Araldite® LY 3505* / Aradur™ 5003-1*

Araldite LY 3505 is an epoxy resin
Aradur 5003-1 is a polyamine based hardener

Applications

- Industrial composites
- Structural composites

Properties

The system exhibits excellent mechanical properties and good thermal resistance. Due to its high reactivity short cure cycles can be realized.

Processing

- Wet lay-up
- Resin Transfer Moulding (RTM)
- Pressure moulding

Key data

Araldite LY 3505

Aspect (visual)	clear liquid	
Colour (Gardner, ISO 4630)	≤ 3	
Viscosity at 25 °C (ISO 12058-1)	6500 - 8000	[mPa s]
Density at 25 °C (ISO 1675)	1.15 - 1.20	[g/cm^3]
Flash point (ISO 2719)	≥ 200	[°C]
Storage temperature (see expiry date on original container)	2 - 40	[°C]

Aradur 5003-1

Aspect (visual)	clear light-yellow liquid	
Viscosity at 25 °C (ISO 12058-1)	70 - 120	[mPa s]
Density at 25 °C (ISO 1675)	0.98 - 1.08	[g/cm^3]
Flash point (ISO 2719)	~ 174	[°C]
Storage temperature (see expiry date on original container)	2 - 40	[°C]

Storage

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.

* *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, 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*	*Parts by volume*
Araldite LY 3505	100	100
Aradur 5003-1	20	22

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
(ISO 12058-1)

[°C]	*[mPa s]*
at 25	1800 - 2300

Pot life
(Tecam, 100 ml, 65 % RH)

[°C]	*[min]*
at 25	42 - 56

Gel time
(Hot plate)

[°C]	*[min]*
at 40	40 - 58
at 60	15 - 20
at 80	4.5 - 7
at 90	2 - 4

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.

Gelation at 23 °C
(in thin layers: 0.4 - 0.7 mm)

	[h]
Start	1.5 - 2
End	2.5 - 3.5

Typical cure cycles

30 min 80 °C
or 30 min 80 °C + 30 min 100 °C
or 30 min 80 °C + 30 min 120 °C

The optimum cure cycle has to be determined case by case depending on the processing and the economic requirements.

Properties of the cured, neat formulation

Glass transition temperature (T_G) (IEC 1006, DSC, 10 K/min)	*Cure:*		*T_G [°C]*
	4 h 60 °C		77 - 85
	20 min 80 °C		83 - 90
	30 min 80 °C		88 - 95
	2 h 80 °C		95 - 102
	15 min 90 °C		94 - 102
	30 min 90 °C		98 - 106
	1 h 90 °C		100 - 108
	15 min 100 °C		100 - 108
	30 min 80 °C + 30 min 100 °C		106 - 114
	30 min 80 °C + 1 h 100 °C		108 - 118
	30 min 80 °C + 2 h 100 °C		110 - 120
	30 min 80 °C + 1 h 120 °C		120 - 126
	30 min 80 °C + 30 min 140 °C		118 - 126
Tensile test (ISO 527)		*Cure:*	*30 min 80 °C + 2 h 100 °C*
	Tensile strength	[MPa]	76 - 90
	Elongation at tensile strength	[%]	3.8 - 4.8
	Ultimate strength	[MPa]	75 - 88
	Ultimate elongation	[%]	3.8 - 5.0
	Tensile modulus	[MPa]	3150 - 3350
Flexural test (ISO 178)		*Cure:*	*30 min 80 °C + 2 h 100 °C*
	Flexural strength	[MPa]	140 - 150
	Elongation at flexural strength	[%]	6.5 - 7.5
	Ultimate strength	[MPa]	138 - 148
	Ultimate elongation	[%]	7.0 - 8.0
	Flexural modulus	[MPa]	3200 - 3400
Fracture properties Bend notch test (PM 258-0/90)		*Cure:*	*30 min 80 °C + 2 h 100 °C*
	Fracture toughness K_{1C}	[MPa√m]	0.90 - 1.05
	Fracture energy G_{1C}	[J/m^2]	210 - 280
Water absorption (ISO 62)	*Immersion:*	*Cure:*	*30 min 80 °C + 2 h 100 °C*
	1 day H_2O 23 °C	[%]	0.05 - 0.15
	10 days H_2O 23 °C	[%]	0.30 - 0.38

Properties of the cured, reinforced formulation

Flexural test (ISO 178)	Samples: 12 layers E-glass fabric UD (425 g/m^2) Laminate thickness: 3.1 - 3.25 mm Fibre volume content: 61 - 64 % Cure: 30 min 80 °C + 2 h 100 °C		
	Flexural strength	[MPa]	1050 - 1300
	Ultimate elongation	[%]	2.6 - 3.0
	Flexural modulus	[MPa]	38000 - 42000
Interlaminar shear strength (ASTM D 2344)	Short beam: 12 layers E-glass fabric UD (425 g/m^2) Laminate thickness: 3.1 - 3.25 mm Fibre volume content: 61 - 64 % Cure: 30 min 80 °C + 2 h 100 °C		
	Shear strength	[MPa]	62 - 68

Handling precautions

Mandatory and recommended industrial hygiene procedures should be followed whenever our products are being handled and processed. For additional information please consult the corresponding product safety data sheets and the brochure "Hygienic precautions for handling plastics products" (Publ. No. 24264/e).

Personal hygiene

Safety precautions at workplace	
protective clothing	yes
gloves	essential
arm protectors	recommended when skin contact likely
goggles/safety glasses	yes
Skin protection	
before starting work	Apply barrier cream to exposed skin
after washing	Apply barrier or nourishing cream
Cleansing of contaminated skin	
	Dab off with absorbent paper, wash with warm water and alkali-free soap, then dry with disposable towels. Do not use solvents
Disposal of spillage	
	Soak up with sawdust or cotton waste and deposit in plastic-lined bin
Ventilation	
of workshop	Renew air 3 to 5 times an hour
of workplaces	Exhaust fans. Operatives should avoid inhaling vapours

First aid

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.

Material smeared or splashed on the *skin* 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.

Anyone taken ill after *inhaling* vapours should be moved out of doors immediately.

In all cases of doubt call for medical assistance.