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Advanced Materials

Araldite® LY 1564* / Aradur® 2954*

HOT CURING EPOXY SYSTEM

Araldite® LY 1564 is a low-viscosity epoxy resin
Aradur® 2954 is a cycloaliphatic polyamine

APPLICATIONS

Wide range of industrial composites, aerospace composites

PROPERTIES

Due to the excellent handling behaviour the system is suitable for various production processes. It combines low viscosity with long pot life at elevated temperatures. The cured system shows excellent mechanical, dynamic and thermal (hot/wet) properties and good chemical resistance.

PROCESSING

- Resin Transfer Moulding (RTM)
- Filament Winding
- Pressure Moulding
- Pultrusion
- Wet lay-up

PRODUCT DATA

Araldite® LY 1564		
Aspect (visual)	clear liquid	
Viscosity at 25 °C (ISO 12058-1)	1200 – 1400 **	[mPa s]
Density at 25 °C (ISO 1675)	1.1 - 1.2	[g/cm^3]
Epoxy index (ISO 3001)	5.8 - 6.05 **	[Eq/kg]
Aradur® 2954		
Aspect (visual)	clear liquid	
Viscosity at 25 °C (ISO 12058-1)	85 – 100 **	[mPa s]
Density at 25 °C (ISO 1675)	0.94 - 0.95	[g/cm^3]
Amine value (ISO 9702)	8.30 – 8.50 **	[°C]

*** Specified data are on a regular basis analysed. Data which is described in this document as 'typical' is not analysed on a regular basis and is given for information purposes only. Data values are not guaranteed or warranted unless if specifically mentioned.*

STORAGE

Provided that Araldite® LY 1564, Aradur® 2954 are stored in a dry place in their original, properly closed containers at the storage temperatures mentioned in the MSDS 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,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.*

TYPICAL SYSTEM DATA

PROCESSING DATA

MIX RATIO

Components	*Parts by weight*	*Parts by volume*
Araldite® LY 1564	100	100
Aradur® 2954	35	42

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
(HOEPPLER, ISO 12058-1B)

[°C]	*[mPa s]*
at 25	500 - 700
at 40	200 - 300
at 60	70 - 130

VISCOSITY BUILD-UP
(HOEPPLER, ISO 12058-1B)

[°C]	*[mPa s]*	*[min]*
at 25	to 1500	150 - 180
at 40	to 1500	100 - 130

POT LIFE
(TECAM, 100 ML, 65 % RH)

[°C]	*[min]*
at 23	480 - 600
at 40	140 - 160

GEL TIME
(HOT PLATE)

[°C]	*[min]*
at 60	90 - 120
at 80	35 - 45
at 100	16 - 18
at 140	3 - 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.

PROCESSING RECOMMENDATION

The temperature where gelation is being carried out should not be higher than necessary. A high gelation temperature induces shrinkage and generates internal stress within the part.

TYPICAL CURE CYCLES

2 h 60 °C + 4 - 8 h 120 °C
or 1 h 80 °C + 2 - 8 h 140 °C
or 0.5 h 100 °C + 2 - 8 h 160 °C

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

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PROPERTIES OF THE CURED, NEAT FORMULATION

GLASS TRANSITION TEMPERATURE (T_G) (ISO 11357-2, DSC, 10 K/MIN)	*Cure:*		*T_G (TMA) [°C]*	*T_G (DSC) [°C]*
	4 h 80 °C		80 - 87	99 - 105
	1 h 80 °C + 4 h 120 °C		123 - 130	130 - 133
	1 h 80 °C + 8 h 120 °C		127 - 135	132 - 137
	1 h 80 °C + 12 h 120 °C		134 - 139	138 - 142
	1 h 80 °C + 2 h 140 °C		123 - 127	129 - 134
	1 h 80 °C + 8 h 140 °C		140 - 144	143 - 148
	1 h 80 °C + 2 h 160 °C		128 - 135	134 - 142
	1 h 80 °C + 4 h 160 °C		136 - 143	143 - 150
	1 h 80 °C + 8 h 160 °C		145 - 149	150 - 153
TENSILE TEST (ISO 527)		*Cure:*	*1 h 80 °C + 8 h 140 °C*	*1 h 80 °C + 4 h 160 °C*
	Tensile strength	[MPa]	71 - 77	78 - 82
	Elongation at tensile strength	[%]	4.5 - 5.5	6.3 - 7.3
	Ultimate strength	[MPa]	71 - 77	78 - 82
	Ultimate elongation	[%]	4.5 - 5.5	6.3 - 7.3
	Tensile modulus	[MPa]	2550 - 2650	2450 - 2550
FLEXURAL TEST (ISO 178)		*Cure:*	*1 h 80 °C + 8 h 140 °C*	
	Flexural strength	[MPa]	120 - 124	
	Ultimate elongation	[%]	6.5 - 7.5	
	Flexural modulus	[MPa]	2600 - 2800	
FRACTURE PROPERTIES BEND NOTCH TEST (ISO 13586)		*Cure:*	*1 h 80 °C + 8 h 140 °C*	
	Fracture toughness K_{1C}	[MPa√m]	0.69 -0.76	
	Fracture energy G_{1C}	[J/m^2]	149 - 181	
WATER ABSORPTION (ISO 62)	*Immersion:*	*Cure:*	*1 h 80 °C + 8 h 140 °C*	
	10 days H_2O 23 °C	[%]	0.23	
	1 h H_2O 100 °C	[%]	0.20	
COEFFICIENT OF LINEAR THERMAL EXPANSION (DIN 53 752)		*Cure:*	*1 h 80 °C + 8 h 140 °C*	
	Mean value up to 80 °C	[10^{-6}/K]	70 - 75	
POISON'S RATIO		[μ]	0.35	

PROPERTIES OF THE CURED, REINFORCED FORMULATION

INTERLAMINAR SHEAR STRENGTH (ASTM D 2344)

Short beam: E-glass unidirectional specimen
Laminate thickness t = 3.2 mm
Fibre volume content: 60 %

	Cure:	*1 h 80 °C + 8 h 140 °C*
Shear strength	[MPa]	59 - 63

TENSILE, COMPRESSIVE AND TORSIONAL TEST

(TCT)

Test specimen
Roving: E-glass, 1200 tex, silane finish
Fibre volume content: 63-65 %

Transverse tensile test	*Cure:*	*1 h 80 °C + 8 h 140 °C*
Tensile strength	[MPa]	43 - 49
Tensile strain	[%]	1.8 - 2.0
Elastic modulus	[MPa]	15700 - 15900
Transverse compressive test	*Cure:*	*1 h 80 °C + 8 h 140 °C*
Compressive strength	[MPa]	110 - 140
Elastic modulus	[MPa]	15500 - 16000
Torsional test	*Cure:*	*1h 80 °C + 8 h 140 °C*
Shear strength	[MPa]	60 - 64
Shear modulus	[MPa]	5000 - 6000

HANDLING PRECAUTIONS

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.

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