HUNTSMAN
Enriching lives through innovation

Advanced Materials

Araldite® LY 5052 / Aradur® 5052*

COLD-CURING EPOXY SYSTEM

Araldite® LY 5052 is a low-viscosity epoxy resin
Aradur® 5052 is a mixture of polyamines

APPLICATIONS

Aerospace and industrial composites, tooling, aircraft repair

PROPERTIES

- Low viscosity, easy impregnation of reinforcement materials.
- Long pot life (2 hours for 100 ml at ambient), ample processing time allows production of big objects.
- High temperature resistance (glass transition temperature) after ambient cure: 60 °C, after post-cure at 100:120 °C.
- Excellent mechanical and dynamic properties after ambient cure with potential for even higher properties after post-cure at elevated temperatures.
- Also laminates show outstanding mechanical and dynamic properties. This system is qualified by the Luftfahrtbundesamt (German Aircraft Authority) for the production of gliders.

Adequate skin protection is indispensable.

PROCESSING

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

KEY DATA

Araldite® LY 5052

Aspect (visual)	clear liquid	
Color (Gardner, ISO 4630)	≤ 2	
Viscosity at 25 °C (ISO 12058-1)	1000 - 1500	[cps.]
Density at 25 °C (ISO 1675)	1.17	[g/cm^3]
Flash point (ISO 2719)	≥ 140	[°C]

Aradur® 5052

Aspect (visual)	clear liquid	
Color (Gardner, ISO 4630)	≤ 4	
Viscosity at 25 °C (ISO 12058-1)	40 - 60	[cps.]
Density at 25 °C (ISO 1675)	0.94	[g/cm^3]
Flash point (ISO 2719)	≥ 110	[°C]

Components	Parts by weight	Parts by volume
Araldite® LY 5052	100	100
Aradur® 5052	38	47

The components must be weighed accurately and mixed thoroughly to obtain optimal properties. The sides and bottom of mixing vessels must be included in the mixing process. Large mix quantities will show considerable exotherm, leading to short pot lives. Preferably mix smaller quantities or divide large mixes into smaller containers.

INITIAL MIX VISCOSITY (ISO 12058-1)	*[°F]*	*[cps.]*
	at 64	1150 - 1350
	at 77	500 - 700
	at 104	200 - 250

VISCOSITY BUILD-UP (ISO 12058-1)	*[°F]*	*[cps.]*	*[min]*
	at 77	to 1500	50 - 60
	at 77	to 3000	90 - 110
	at 104	to 1500	40 - 45
	at 104	to 3000	50 - 60
	at 140	to 1500	15 - 18
	at 140	to 3000	18 - 22

POT LIFE (TECAM, 100 ML, 65 % RH) LONG POTLIFE MEANS AMPLE TIME TO PRODUCE EVEN BIG OBJECTS.	*[°F]*	*[min]*
	at 64	280 - 320
	at 77	110 - 160
	at 104	45 - 55

GEL TIME (HOT PLATE)	*[°F]*	*[min]*
	at 77	420 - 500
	at 104	150 - 170
	at 104	40 - 55
	at 176	14 - 17
	at 212	4 - 6
	at 248	2 - 3

The values shown are for small amounts of pure resin/hardener mix. In practice, fiber content and laminate thickness may modify the gel time to a very significant extent. In composite structures the gel time can differ significantly from the given values depending on the fiber content and the laminate thickness.

GELATION AT 23 °C (IN THIN LAYERS: 0.4 - 0.7 MM)		*[h]*
	Start	5 - 6.5
	End	7 - 8

TYPICAL CURE CYCLES	1 day 23 °C + 15 h 50 °C or 1 day 23 °C + 4 h 100 °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 (IEC 1006, DSC, 10 K/MIN)	*Cure:*	*T_G onset [°F]*	*T_G [°F]*
	2 days 78 °F	122 - 126	126 - 131
	8 days 78 °F	140 - 147	144 - 151
	4 month 73 °F	147 - 154	153 - 160
	1 day 73 °F + 10 h 104 °F	154 - 162	158 - 169
	1 day 73 °F + 20 h 104 °F	162 - 169	166 - 176
	1 day 73 °F + 10 h 122°F	172 - 180	176 - 185
	1 day 73 °F + 15 h 122°F	178 - 185	180 - 190
	1 day 73 °F + 10 h 140°F	198 - 205	201 - 219
	1 day 73 °F + 15 h 140°F	201 - 208	205 - 223
	1 day 73 °F + 2 h 176°F	223 - 230	226 - 237
	1 day 73 °F + 8 h 176°F	234 - 241	237 - 252
	1 day 73 °F + 1 h 194°F	219 - 226	226 - 244
	1 day 73 °F + 4 h 194°F	234 - 241	241 - 259
	1 day 73 °F + 1 h 212°F	241 - 248	244 - 266
	1 day 73 °F + 4 h 212°F	244 - 255	248 - 273
	Even if post-cured at elevated temperature after a prolonged cure at ambient, a good increase of the glass transition temperature is obtained as follows :		
	4 months 73 °F + 4 h 266°F	223 - 234	248 - 270
	The maximum attainable glass – transition temperature for this system is in the range of 266°F		

TENSILE TEST (ISO 527)		*Cure:*	*7 days RT*	*15 h 122°F*	*8 h 176°F*
	Tensile strength	[Ksi]	7.1 – 10.3	11.9 - 12.5	12.2 – 12.5
	Elongation at tensile strength	[%]	1.5 - 2.5	3.1 - 3.7	5.7 - 5.9
	Ultimate strength	[Ksi]	7.1 – 10.3	11.6 – 12.0	11.6 – 12.2
	Ultimate elongation	[%]	1.5 - 2.5	3.5 - 5.5	7.0 - 8.5
	Tensile modulus	[Ksi]	486 – 515	500 – 529	435 - 464
FLEXURAL TEST (ISO 178)		*Cure:*		*15 h 122°F*	*8 h 176°F*
	Flexural strength	[Ksi]		18.9 – 20.3	16.8 – 17.7
	Elongation at flexural strength	[%]		5.8 - 6.3	6.5 - 7.2
	Ultimate strength	[Ksi]		13.1 – 16.7	12.6 – 16.4
	Ultimate elongation	[%]		8.0 - 9.5	8.5 - 13.4
	Flexural modulus	[Ksi]		435 - 479	392 - 435
FRACTURE PROPERTIES BEND NOTCH TEST (PM 258-0/90)		*Cure:*			*8 h 176°F*
	Fracture toughness K_{1C}	[vin*lb/in^2]			846 -912
	Fracture energy G_{1C}	[In*lb/in ^{2}]			1.09 – 1.21
WATER ABSORPTION (ISO 62)	*Immersion:*	*Cure:*		*7 days RT*	*8 h 176°F*
	4 days H_2O 23 °C	[%]		0.45 - 0.50	0.40 - 0.45
	10 days H_2O 23 °C	[%]		0.70 - 0.80	0.65 - 0.70
	30 min H_2O 100 °C	[%]		0.55 - 0.60	0.45 - 0.50
	60 min H_2O 100 °C	[%]		0.70 - 0.80	0.60 - 0.70
COEFFICIENT OF LINEAR THERMAL	*Mean value:*	*Cure:*	*7 d RT*	*15 h 122°F*	*8 h 176°F*
	α from 20 - 50 °C	10^{-6}/°F[/K]	54 [97]	-	-

EXPANSION (DIN 53 752)	α from 20 - 90 °C	10^{-6}/°F[/K]	-	39 [71]	-
	α from 20 - 120 °C	10^{-6}/°F[/K]	-	-	39 [71]
POISONS'S RATIO		[ ]			0.35

PROPERTIES OF THE CURED, REINFORCED FORMULATION

FLEXURAL TEST

(ISO 178)

Samples:

16 layers (4 mm) E-glass fabric 1:1, 280-300 g/m^2
Fiber volume content: 45 - 46 %
Cure: 10 h 176°F

		Unconditioned
Flexural strength	[Ksi]	63.8 – 71.1
Elongation at flexural strength	[%]	2.7 - 3.0
Ultimate strength	[Ksi]	60.9 – 66.7
Ultimate elongation	[%]	2.9 - 3.2
Flexural modulus	[Ksi]	2900 - 3190
		After 30 days in H_2O 73°F
Flexural strength	[Ksi]	55.1 – 58.0
Elongation at flexural strength	[%]	2.7 - 3.0
Ultimate strength	[Ksi]	49.3 – 53.7
Ultimate elongation	[%]	1.9 - 3.4
Flexural modulus	[Ksi]	2755 - 3045

TENSILE TEST

(ISO 527)

Samples:

16 layers (4 mm) E-glass fabric 1:1, 280-300 g/m^2
Fiber volume content : 45 - 46 %
Cure: 10 h 176°F

Tensile strength	[Ksi]	52.2 – 56.6
Ultimate elongation	[%]	1.6 - 1.9
Tensile modulus	[Ksi]	4800 - 5670

INTERLAMINAR SHEAR STRENGTH

(ASTM D 2344)

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

	Cure:	*7 days RT*	*8 h 80 °C*
Unconditioned	[psi]	8265 - 8845	8700 - 9425
After 1 h in H_2O 100 °C	[psi]	7975 - 8700	8410 - 8990

STORAGE

Araldite® LY 5052 should be stored in a dry place, in 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.

Aradur® 5052 should be stored in a dry place, in 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.

PRECAUTIONARY STATEMENT

Huntsman Advanced Materials Americas LLC maintains up–to-date Material Safety Data Sheets (MSDS) on all of its products. These sheets contain pertinent information that you may need to protect your employees and customers against any known health or safety hazards associated with our products. Users should review the latest MSDS to determine possible health hazards and appropriate precautions to implement prior to using this material.

First Aid!
Refer to MSDS as mentioned above.

KEEP OUT OF REACH OF CHILDREN

FOR PROFESSIONAL AND INDUSTRIAL USE ONLY

IMPORTANT LEGAL NOTICE

Huntsman Advanced Materials warrants only that its products meet the specifications agreed with the user. Typical properties, where stated, are to be considered as representative of current production and should not be treated as specifications.

The manufacture of materials is the subject of granted patents and patent applications; freedom to operate patented processes is not implied by this publication.

While all the information and recommendations in this publication are, to the best of Huntsman Advanced Material's knowledge, information and belief, accurate at the date of publication, NOTHING HEREIN IS TO BE CONSTRUED AS A WARRANTY, WHETHER EXPRESS OR IMPLIED, INCLUDING BUT WITHOUT LIMITATION, AS TO MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IN ALL CASES, IT IS THE RESPONSIBILITY OF THE USER TO DETERMINE THE APPLICABILITY OF SUCH INFORMATION AND RECOMMENDATIONS AND THE SUITABILITY OF ANY PRODUCT FOR ITS OWN PARTICULAR PURPOSE.

The behavior of the products referred to in this publication in manufacturing processes and their suitability in any given end-use environment are dependent upon various conditions such as chemical compatibility, temperature, and other variables, which are not known to Huntsman Advanced Materials. It is the responsibility of the user to evaluate the manufacturing circumstances and the final product under actual end-use requirements and to adequately advise and warn purchasers and users thereof.

Products may be toxic and require special precautions in handling. The user should obtain Safety Data Sheets from Huntsman Advanced Materials containing detailed information on toxicity, together with proper shipping, handling and storage procedures, and should comply with all applicable safety and environmental standards.

Hazards, toxicity and behavior of the products may differ when used with other materials and are dependent on manufacturing circumstances or other processes. Such hazards, toxicity and behaviour should be determined by the user and made known to handlers, processors and end users.

Except where explicitly agreed otherwise, the sale of products referred to in this publication is subject to the general terms and conditions of sale of Huntsman Advanced Materials LLC or of its affiliated companies including without limitation, Huntsman Advanced Materials (Europe) BVBA, Huntsman Advanced Materials Americas Inc., and Huntsman Advanced Materials (Hong Kong) Ltd.
Huntsman Advanced Materials is an international business unit of Huntsman Corporation. Huntsman Advanced Materials trades through Huntsman affiliated companies in different countries including but not limited to Huntsman Advanced Materials LLC in the USA and Huntsman Advanced Materials (Europe) BVBA in Europe.

Araldite and Aradur are registered trademarks of Huntsman Corporation or an affiliate thereof.

Main Office:
Huntsman Advanced Materials
10003 Woodloch Forest Dr.
The Woodlands, TX 77380
888-564-9318

www.huntsman.com/advanced_materials
advanced_,aterials@huntsman.com