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Advanced Materials

Araldite® LY 8615 Resin
Aradur® 8615 Hardener

HIGH-TEMPERATURE EPOXY SYSTEM

DESCRIPTION :
Araldite® LY 8615 resin/Aradur® 8615 hardener epoxy system is a two-component, low-viscosity material developed for production of advanced composites using vacuum-assisted resin transfer molding (VARTM), resin transfer molding (RTM), Seemans Composite Resin Injection Molding Process (SCRIMP), and other infusion processes. The low mixed viscosity and wet-out properties of Araldite® LY 8615 resin/Aradur® 8615 hardener epoxy system provide for good processability.

Araldite® LY 8615 resin/Aradur® 8615 hardener epoxy system is a high-temperature performance material for infusion. Composites produced with Araldite® LY 8615 resin/Aradur® 8615 hardener epoxy system can achieve a glass transition temperature of over 350°F (177°C) following a postcure.

TYPICAL HANDLING PROPERTIES*

Property	Araldite® LY 8615/Aradur® 8615	Test Method
Color	Light Amber, Transparent	Visual
Specific Gravity, Resin	1.22	
Hardener	0.94	
Viscosity, cP at 77°F (25°C)		ASTM-D-2393
Resin	1,550	
Hardener	120	
Mixed	550	
Gel time, at 77ºF (25°C)		ASTM-D-2471
150 gram mass/4 fl. oz., hours.	20	

* Tested at 77°F (25°C)

MIX RATIO :
Araldite® LY 8615 resin/Aradur® 8615 hardener 100:50 by weight

Measure each component accurately (±5%) into clean containers. Thoroughly mix resin and hardener together (minimum of two minutes), scraping container sidewalls, bottom and mixing stick several times to assure a uniform mix.

CURING INSTRUCTIONS :
24 hours at 77°F (25°C), plus six hours at 250°F (121°C), plus six hours at 400°F (204°C), unless noted otherwise.

NOTE : Other cure schedules may be used to obtain comparable physical properties. Please call the Huntsman Advanced Materials Technical Information Hotline, 800-759-7165, to discuss your application.

NOTE: Material will cure to a hardened, non self supporting, brittle state after 40 - 48 hrs. @ R.T. cure. Before demolding, a minimum self-support cure must be applied of 16 Hrs. @ 125°F. After this, the infused tool or part can be pulled off the master model or tool if needed and post-cured with partial or full substructure support. In some cases, depending on infused tool or part configuration and application, no substructure may need to be built in before post-curing.

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NEAT SYSTEM*

TYPICAL CURED PROPERTIES

Cured for 24 hrs. at 77°F (25°C) plus 2 hrs. at 250°F (121°C) + 3 hrs. at 350°F (177°C). Tested at 77°F (25°C) unless otherwise noted..

	Test Value	Test-Method
Specific Gravity	1.06	ASTM D-792
Cubic Inch per Pound	26	ASTM D-792
Hardness, Shore D	87	ASTM D-2240
Ultimate Flexural Strength, at 77ºF (25°C), psi (MPa)	9,995 (69)	ASTM D-790
Flexural Modulus, at 77°F (25°C), psi (MPa)	429,672 (2,963)	ASTM D-790
Tg by DMA, E' onset, dry, °F (°C)	422 (217)	ASTM D-4065
Compressive Strength, at 77°F (25°C), psi (MPa)	36,439 (251)	ASTM D-695
Compressive Modulus, at 77°F (25°C), psi (MPa)	320,851 (2,213)	ASTM D-695

* NOTE: All properties are for the neat product form (non-composite).

LAMINATE SYSTEM

TYPICAL CURED PROPERTIES*

	Test Value	Test-Method
Hardness, Shore D	92	ASTM D-2240
Ultimate Flexural Strength, at 77ºF (25°C), psi (MPa)	100,837 (695)	ASTM D-790
Flexural Modulus, at 77°F (25°C), psi (MPa)	6.22×10^6 (42,896)	ASTM D-790
Tg by DMA, E' onset, dry, °F (°C)	422 (217)	ASTM D-4065
Tg by DMA, E' onset, wet, °F (°C)	373 (189)	ASTM D-4065
% weight gain**	0.698	
Ultimate Compressive Strength, at 77°F (25°C), psi (MPa)	62,366 (430)	ASTM D-695
Compressive Modulus, at 77°F (25°C), psi (MPa)	11.3×10^6 (77,931)	ASTM D-695

* Tested at 77°F (25°C) unless otherwise noted..
** Hot/wet conditioning is 48 hours in tap water boiling at 208°F to 216°F (98°C to 102°C). Sample weight measured before and after sample boils to determine % weight gain.

LAY-UP PROCESS

Panel Type:	Approximately 3 ft. x 2 ft. (0.92m x 0.61m) flat panel
Cloth Type:	8 layers, 1581 glass cloth
Cloth Rotation:	0, 90°
Procedure:	Vacuum bagged, flat panel
Laminate Resin Content:	32.3%

NOTE : The Araldite® LY 8615 resin/Aradur® 8615 hardener epoxy system will self-support during curing after 8 hours at 125°F (52°C) minimum cure after infusing material. The material will cure hard after 48 hours at room temperature, however, the 125°F (52°C) minimum cure should be used for self support. Postcure can then be continued partially supported off the master or foam model used.

Provisional product information is provided on experimental products. Samples were tested at room temperature unless otherwise noted. All samples were cured for 24 hours at room temperature plus six hours at 250°F (121°C), plus six hours at 400°F (204°C). Composite samples were from a room-temperature infused, 14 in. x 14 in. (35.6cm x 35.6cm) flat panel. The lay-up was 8 layer, 0° rotation, TPI style #4114, Lot #7027, 5HS carbon fabric, 12 in. x 12 in. (30cm x 30cm), T-300-6K-309 yarn. Samples were cut and tested in the warp (lengthwise) direction.

Provisional Data

Araldite® LY 8615/Aradur® 8615

Property	ASTM Method	Araldite® LY 8615/ Aradur® 8615 Neat System	Araldite® LY 8615/ Aradur® 8615 Graphite Laminate*
Reaction Ratio (by wt.)		100R/50H	
Specific Gravity (g/cc)	ASTM D-792 Resin - Hardener - Mixed -	 1.18 .94 1.20 (cured)	
Viscosity (cps.) @ Room Temp. Resin Hardener Mixed Mixed @ 1 50°F		 1,500 120 550 < 200	
Gel Time (minutes)	D-2471 (150 g.)	20.0 Hours	
RDA Scan - Time to gel @ 150°F	150°F isothermal run	7.0 hrs.	
Tg (Dry) ** (Hot/Wet) % Wt. gain	DMA E' onset D-4065	422	422 373 .698
Deflection Temperature HDT	D-648 @ 264 psi	> 420°F	N/A
Hardness	D-2240	87 Shore D	92 Shore D
Flexural Strength (psi)	D-790	9,995	100,837
Flexural Modulus (psi)	D-790	429,672	6.22×10^6
Compressive Strength (psi) @ R.T. .2% offset (psi)	D-695	 37,507 13,200	 62,366
Compressive Modulus (psi) @ R.T	D-695	 396,410	 11.3×10^6

NOTE: Please read MSDS carefully before using the product. Proper storage and handling is essential for safe operation. The Araldite® LY 8615 resin/Aradur® 8615 hardener epoxy system will self-support cure with only an 8 hr. @ 125°F minimum cure after infusing material. The material will cure hard after 48 hours @ R.T., however the 125°F minimum cure should be used for self-support. Post-cure can then be applied partially supported off of the master or foam model used.

* Provisional product information is provided on experimental products. Samples were tested at room temperature unless noted. All samples were cured 24 hrs. @ R.T + 6 hrs. @ 250°F + 6 hrs. @ 400F. Composite samples were from a room temperature infused 14" x 14" flat panel. The lay-up was 8 layer, 0° Rotation, TPI style #4114, lot #7027, 5HS carbon fabric 12 x 12, T-300-6K-309 yarn. Samples were cut and tested in the warp, (lengthwise), direction.

** Hot/Wet conditioning is 48 hr. tap water boil (98°C - 102°C). Sample weight measured before and after sample boils. % weight gain is measured.

400° F Use Tooling Prepreg Comparison Data

Araldite® LY 8615/Aradur® 8615 (400°F Use Araldite® LY System)

Property	ASTM Method	Araldite® LY 8615/Aradur® 8615 Glass Laminate*	Araldite® LY 8615/ Aradur® 8615 Graphite Laminate**
% Resin content (TGA Burnoff)		31.0	30.6
Fiber volume		Not Run	Not Run
Laminate thickness (in.)		.275	.220
DMA Tg (E' onset)	D-4065	215 (420)	216 (420)
Flexural strength (psi) R.T. tested -250°F tested -350°F tested	D-790	59,907 53,868 31,744	71,064 63,349 33,069
Flexural modulus (psi) R.T. tested -250°F tested 350°F tested	D-790	1.82×10^6 1.44 $\times 10^6$ 1.36 x 10^6	3.40×10^6 3.10 $\times 10^6$ 2.38 x 10^6
Tensile strength (psi)	D-638	37,650	49,750
Tensile modulus (psi)	D-638	3.02×10^6	6.81×10^6
Tensile % elongation	D-638	6.3	.8
Compressive strength (psi)	D-695	31,666	Not Run
Compressive modulus(psi)	D-695	4.01×10^6	Not Run

NOTE:

Composite samples were done from a room temperature mixture of Araldite® LY 8615 resin/Aradur® 8615 hardener epoxy system infused into a 14" x 14" composite flat panel. The flat plate was heated underneath to 125°F during the infusion. The goal is to compare properties using the same typical lay-up used in a LTM 10 type 400°F use prepreg tooling system with these vacuum infused panels using the Araldite® LY 8615 resin/Aradur® 8615 hardener epoxy system.

The glass fabric panel was a 12 layer balanced layup: (1) 0° rotation 7781 8HS (300 gram) (2) 0° 1210 2 x 2 twill (810 gram) (3) + 45° same fabric (4) -45° same fabric (5) 90° same fabric (6) 0° same fabric (7) 0° same fabric (8) 90° same fabric (9) -45 same fabric (10) + 45 same fabric (11) 0° same fabric (12) 0° 7781 8HS (300 gram)

**The graphite fabric panel was a 10 layer balanced lay-up: (1) 0° rotation 3K 2x2 twill (195 - 205 gram) (2) 0° rotation 12K 2 x 2 twill (640 - 670 gram) (3) +45 same fabric (4) -45 same fabric (5) 90° same fabric (6) 90° same fabric (7) -45 same fabric (8) +45 same fabric (9) 0° same fabric (10) 0° 3K 2 x 2 twill (195 - 205) gram. Final cure in oven after initial 125°F infusion cure was 6 hrs. @ 250°F + 6 hrs. @ 400°F. NOTE: A 6 hr. @ 250°F + 6 hr. @ 350°F top end cure appears to be enough to obtain optimum or very near optimum properties. Tg's generated with this cure yield the same results as with the 400°F top end cure.

Tg Build Data

Araldite® LY 8615/Aradur® 8615 (400°F Use Araldite® LY System)

Property	ASTM Method	Araldite® LY 8615/Aradur® 8615 Neat System
Tg 48 Hr @ R.T.	DMA E' onset D-4065	Not measured (non-self supporting)
6 hrs. @ 125° F		217°F
6 hrs. @ 200° F		294°F
6 hrs. @ 250° F		343°F
6 hrs. @ 300° F		392°F
6 hrs. @ 350° F		420°F
6 hrs. @ 400° F		422°F

NOTE: All samples were cured the 6 hrs. @ 125°F first, then directly to the 6 hours times at the different heat cure temperatures listed above before testing. All were neat material samples

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Neat Shrinkage Data

Araldite® LY 8615/Aradur® 8615 (400°F Use Araldite® LY System)

Property	ASTM Method	Araldite® LY 8615/ Aradur® 8615 Neat System
Shrinkage (in./in.) (Cast shrinkage # 0 mold)	D-2566	
48 Hr @ R.T.		Nil (not measurable)
+ 6 hrs. @ 125°F		0.0006
+ 6 hrs. @ 250°F		.0029
+ 6 hrs. @ 400°F		.0035

STORAGE

Araldite® LY 8615 resin should be stored in a dry place, in the sealed original container, at temperatures between +2°C and +8°C (+35.6°F and 46.4°F). Under these storage conditions, the shelf life is 2 years from the date of manufacture. The product should not be exposed to direct sunlight.

Aradur® 8615 hardener should be stored in a dry place, preferably in the sealed original container, at temperatures between +2°C and +40°C (+35.6°F and 104°F). Under these storage conditions, the shelf life is 2 years from the date of manufacture. The product should not be exposed to direct sunlight.
NOTE: A small amount of sedimentation is sometimes found in the hardener and this is considered normal. If sedimentation is found, the material may be heated at 110°F to re-dissolve any solids.

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

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Main Offices :
Huntsman Corporation
10003 Woodloch Forest Dr.
The Woodlands
Texas 77380
(281) 719-6000

Huntsman Advanced Technology Center
8600 Gosling Rd.
The Woodlands
Texas 77381
(281) 719-7400