

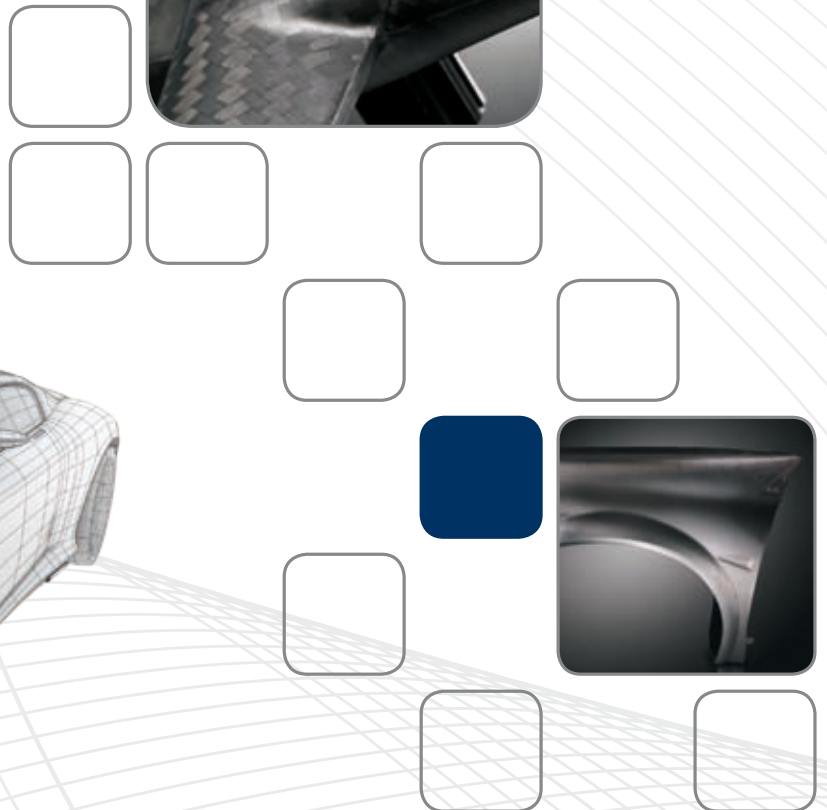


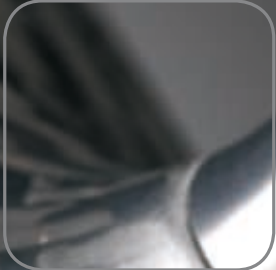
Advanced Materials

Light on weight - heavy on strength

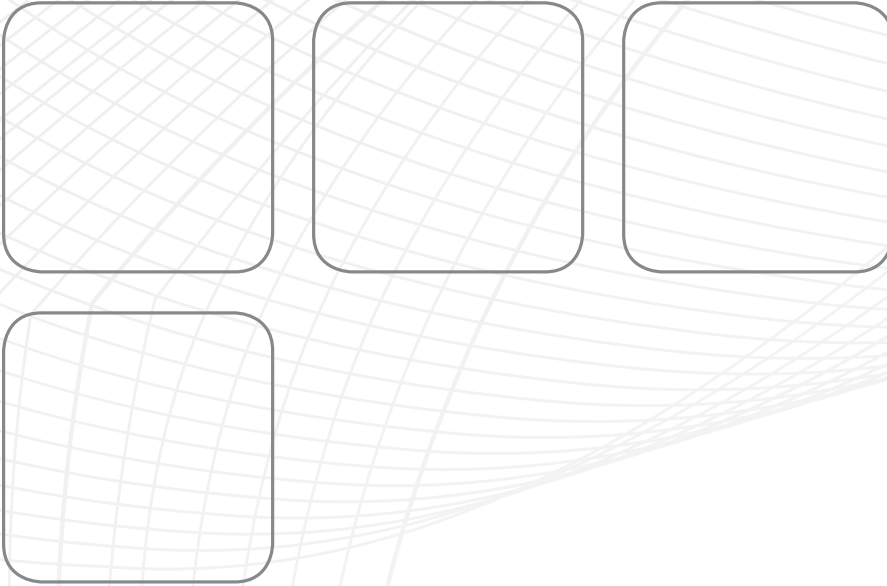


Selector guide
for composite
resin systems





Rely on
us with
confidence



A global partner

As a global partner and innovator working in close collaboration with all major industries using fiber reinforcement : we offer our customers a unique range of innovative high value thermosetting formulated systems combined with a strong technical support. This comprehensive range is used throughout the world's manufacturing industries but particularly in the automotive, aerospace, marine, wind energy, sport and leisure and consumer electronics.

We deliver more than just products

Our process know-how and over 60 years expertise help us to develop standard products as well as custom-made solutions formulated to answer project requirements.

Huntsman Advanced Materials has a worldwide team of experts








- > to identify with you the best system meeting your needs
- > to develop when needed new material solutions
- > to reduce manufacturing and production costs through process time reduction based on shorter cure cycles
- > to help you to improve the quality, the durability and the performance of your products such as lightness but also mechanical, temperature, fire, chemical or corrosion resistance and more
- > to quickly bring your product to market through material and process optimization.

Araldite®

The original brand
serving worldwide composite
industry for more than
half a century.



Formulated systems for direct liquid processes

Product designation	Wet lay - up	RTM	Infusion	Filament winding	Pultrusion	Pot life	Gel time	Mix viscosity	
Conditions						RT, 100ml	80°C	25°C	
Norm									
Unit						min	min	mPa.s	
Araldite® LY 1564 / Hardener XB 3403	●●●		●●●	●●		870 - 1050	40 - 50	150 - 230	
Araldite® LY 1564 / Aradur® 3405		●●●				47 - 57	6 - 9	420 - 520	
Resin XU 3508 / Hardener XB 3403	●●●	●●				600 - 720	30 - 36	650 - 800	
 Araldite® LY 1568 / Aradur® 3489	●●	●●	●●●	●●	●●	850 - 950	43 - 46	200 - 300	
 Araldite® LY 1568 / Aradur® 3492	●●	●●	●●●			300 - 350	23 - 25	250 - 350	
 Araldite® LY 3505 / Hardener XB 3404-1	●●●					80 - 100	11 - 18	550 - 800	
 Araldite® LY 3505 / Hardener XB 3403	●●●					600 - 720	36 - 48	300 - 400	
 Araldite® LY 3505 / Aradur® 3405	●●●					26 - 36	5 - 11	1 000 - 1 200	
 Araldite® LY 1564 / Aradur® 3486	●●	●●	●●●	●●	●●	560 - 620	33 - 43	200 - 300	
 Araldite® LY 1564 / Aradur® 3487	●●	●●	●●●			130 - 160	18 - 25	220 - 320	
Araldite® LY 3598 / Aradur® 3498	●●	●●●				40 - 70	7 - 10	400 - 900	
Araldite® LY 3297 / Aradur® 3298	●●●	●●●	●●			120 - 135	18 - 26	320 - 380	
Araldite® LY 3297 / Aradur® 3299	●●	●●●	●●			40 - 50	10 - 16	350 - 400	
Resin XU 3508 / Aradur® 3486	●●●	●●●	●●	●●	●●	380 - 480	9 - 14 at 100°C	720 - 860	
Araldite® LY 1564 / Hardener XB 3458		●●●				13 - 17	2 - 4	220 - 320 at 40°C	
Resin XB 3585 / Hardener XB 3458		●●●				14 - 18	2 - 4	450 - 550 at 40°C	
Araldite® LY 1564 / Aradur® 5003-1	●●	●●●				42 - 52	6 - 8	200 - 260 at 40°C	
Araldite® LY 5052 / Aradur® 5052	●●●	●●	●●			110 - 160	14 - 17	500 - 700	
Resin XB 3585 / Aradur® 5003-1	●●●	●●				40 - 48	6 - 8	440 - 500 at 40°C	
RenLam® LY 113 / Ren® HY 98	●●●	●●●	●●●			90 - 100	18 - 20	300 - 320	
Araldite® LY 1564 / Aradur® 917 / Accelerator 960-1			●●	●●●	●●●	80 - 90h	30 - 40	450 - 700	

Continued on next page

- Highly recommended
- Recommended



Germanischer Lloyd (GL) certified

Applied cure schedule	Tg	Flexural strength	Ultimate flexural elongation	Fracture properties K _{1c} G _{1c}	Description / comments
	DSC, 10 K/min				
	IEC 1006	ISO 178			
	°C	MPa	%	MPa/m J/m ²	
8h at 80°C	68 - 72	104 - 115	10.5 - 11.5	1.0 - 1.1 360 - 380	} Hardener XB 3403 and Aradur® 3405 can be mixed to adjust reactivity at constant resin/hardener mix ratio. High toughness
8h at 80°C	68 - 72	116 - 130	9.0 - 10.0	1.1 - 1.3 460 - 480	
4h at 60°C + 6h at 80°C	70 - 75	100 - 125	9.0 - 11.0	2.1 - 2.3 1250 - 1400	latent, very high toughness
8h at 80°C	78 - 80	120 - 130	9.0 - 10.0	0.7 - 0.8 170 - 210	} Aradur® 3489 and Aradur® 3492 can be mixed to adjust reactivity at constant resin/hardener mix ratio. Aradur® 3489 based system provides low exothermic behavior. GL certified
8h at 80°C	80 - 85	125 - 135	7.0 - 7.5	0.7 - 0.8 210 - 230	
4h at 60°C + 6h at 80°C	76 - 81	125 - 145	6.5 - 9.5	0.8 - 1.0 160 - 200	} Hardener XB 3404-1, XB 3403 and Aradur® 3405 can be mixed to adjust reactivity at constant resin/hardener mix ratio. GL certified
4h at 60°C + 6h at 80°C	78 - 83	110 - 130	10.5 - 13.0	0.9 - 1.1 250 - 280	
4h at 60°C + 6h at 80°C	87 - 92	135 - 155	7.0 - 9.0	0.8 - 0.9 150 - 190	
8h at 80°C	80 - 84	118 - 130	10.5 - 12.5	0.9 - 1.1 260 - 310	} Aradur® 3486 and Aradur® 3487 can be mixed to adjust reactivity at constant resin/hardener mix ratio - GL certified
8h at 80°C	81 - 86	118 - 130	10.0 - 12.0	0.9 - 1.1 255 - 305	
30 min at 100°C	87 - 93	100 - 110	7.0 - 8.5	1.7 - 1.9 900 - 1100	very fast, very high toughness
8h at 80°C	92 - 98	125 - 130	7.0 - 8.0	0.8 - 1.0 215 - 245	} Aradur® 3298 and Aradur® 3299 can be mixed to adjust reactivity. Good mechanical properties after 23°C curing
8 h at 80°C	94 - 100	123 - 128	9.0 - 12.0	0.8 - 0.9 195 - 225	
5h at 100°C	95 - 102	110 - 125	10.0 - 12.5	2.2 - 2.4 1500 - 1700	very high toughness
10 min at 80°C + 20 min at 100°C	92 - 102	125 - 140	6.5 - 9.0	1.2 - 1.5 420 - 520	well suited for high pressure RTM
10 min at 80°C + 20 min at 100°C	100 - 110	120 - 140	5.0 - 7.0	1.0 - 1.2 280 - 325	well suited for high pressure RTM
30 min at 80°C + 2h at 120°C	108 - 115	108 - 118	7.0 - 9.0	0.9 - 1.0 230 - 290	well suited for high pressure RTM
8h at 80°C	114 - 122 (max 120 - 134)	116 - 122	8.5 - 13.5	0.7 - 0.9 192 - 212	very good mechanical properties after 23°C curing. Aerospace qualified
30 min at 80°C + 2h at 120°C	120 - 130	115 - 125	6.0 - 9.0	0.8 - 0.9 180 - 230	well suited for high pressure RTM
24h at 23°C + 4h at 120°C	120 - 125	127 - 130	7.0 - 8.0	0.8 - 0.9 220 - 250	suitable for tooling application: free stand post-cure after 23°C pre-cure conditions
4h at 80°C + 4h at 120°C	122 - 130	140 - 150	6.0 - 7.0	0.6 - 0.7 100 - 125	low temperature cure anhydride curing system

Formulated systems for direct liquid processes

Continued

Product designation	Wet lay-up	RTM	Infusion	Filament winding	Pultrusion	Pot life	Gel time	Mix viscosity	
Conditions						RT, 100ml	80°C	25°C	
Norm									
Unit						min	min	mPa·s	
Resin XB 3518 / Aradur® 22962	●●	●●●	●●			210 - 290	15 - 20	400 - 500	
Araldite® LY 1564 / Aradur® 22962	●●	●●●	●●●			110 - 150	20 - 30	400 - 600	
Araldite® LY 1564 / Aradur® 2954	●●	●●●	●●	●●	●●	480 - 600	35 - 45	500 - 700	
Resin XU 3508 / Aradur® 22962	●●	●●●				90 - 150	24 - 40	1 800 - 2 100	
Araldite® LY 1564 / Ren® HY 5211	●●●	●●	●●●	●●	●●	27 - 31h	200 - 220	1 350 - 1 550	
Araldite® LY 556 / Aradur® 917 / Accelerator DY 070*			●●	●●●	●●●	95 - 105h	140 - 160	600 - 900	
Araldite® LY 556 / Aradur® 22962	●●●	●●				120 - 180	18 - 22	1 800 - 2 000	
RenLam® LY 120 / Ren® HY 99	●●●	●●●	●●●			210 - 230	20 - 25	300 - 350	
Resin XU 3508 / Aradur® 2954	●●	●●●	●●			320 - 380	9 - 14 at 100°C	2 600 - 3 300	
Araldite® LY 1564 / Hardener XB 3473	●●●	●●	●●●	●●●	●●	84 - 88h	410 - 430	1 000 - 1 200	
Araldite® LY 556 / Aradur® HY 906 / Accelerator DY 070*			●●	●●●	●●●	50 - 55h	200 - 280	1 900 - 2 100	
Araldite® LY 556 / Hardener XB 3473		●●	●●	●●	●●	32 - 37h	> 600	5 200 - 6 000	
Resin XB 3292 / Hardener XB 3473	●●	●●●				78 - 86h	360 - 420	1 600 - 2 000	
Araldite® CY 179 / Aradur® 917 / Accelerator DY 070*			●●	●●	●●	> 48h	60 - 80	100 - 200	
Araldite® LY 8615 / Hardener XB 5173		●●●	●●●			300 - 400	24 - 28	270 - 370	
Araldite® LY 8615 / Aradur® 8615	●●	●●	●●●	●●	●●	14 - 16h	34 - 38	480 - 580	
Resin XB 9721 / Aradur® 917 / Accelerator DY 070*				●●	●●●	110 - 130h	6 - 9 at 120°C	550 - 750	
Resin XB 9721 / Hardener XB 3473		●●		●●●	●●	80 - 95h	80 - 100 at 120°C	14 000 - 17 000	

*Adjustable reactivity with DY 070 ratio

●●● Highly recommended

●● Recommended

Applied cure schedule	Tg	Flexural strength	Ultimate flexural elongation	Fracture properties K _{1c} G _{1c}	Description / comments
	DSC, 10 K/min				
	IEC 1006	ISO 178			
	°C	MPa	%	MPa/m J/m ²	
1h at 100°C + 2h at 140°C	128 - 138	120 - 135	8.5 - 10.0	0.6 - 0.8 160 - 180	medium Tg, high elongation at break
15 min at 120°C + 2h at 150°C	130 - 140	124 - 132	9.0 - 11.0	0.8 - 1.0 200 - 260	medium Tg, high elongation at break
1h at 80°C + 8h at 140°C	143 - 148	120 - 124	6.5 - 7.5	0.7 - 0.8 149 - 181	medium Tg, alternative to anhydride for filament winding and pultrusion when Hot/Wet performance is key
1h at 80°C + 2h at 150°C	144 - 154	120 - 135	8.0 - 10.0	0.9 - 1.2 340 - 380	medium Tg, toughened
30 min at 130°C + 12h at 160°C	145 - 155	120 - 130	7.0 - 8.0	0.6 - 0.7 120 - 130	good chemical resistance Ren® HY 5211: faster version of XB 3473
4h at 80°C + 8h at 140°C	148 - 153	125 - 135	6.0 - 8.5	0.5 - 0.6 88 - 96	medium Tg, very latent anhydride curing system
15 min at 120°C + 2h at 150°C	148 - 158	130 - 136	7.5 - 10.0	0.7 - 0.8 140 - 175	good balance between Tg and elongation at break
8h at 40°C + 8h at 150°C	150 - 155	120 - 126	6.5 - 7.5	0.6 - 0.7 170 - 185	suitable for tooling application: free stand post-cure after 40°C pre-cure conditions
1h at 80°C + 8h at 160°C	150 - 158	125 - 135	7.0 - 8.0	0.8 - 1.0 250 - 290	high Tg, toughened
30 min at 130°C + 12h at 160°C	165 - 175	100 - 110	5.5 - 6.5	0.7 - 0.8 170 - 190	good chemical resistance
2h at 120°C + 8h at 160°C	165 - 175	100 - 140	4.0 - 7.0	0.6 - 0.8 100 - 125	high Tg, very latent anhydride curing system
2h at 120°C + 4h at 180°C	185 - 194	110 - 120	5.5 - 6.5	0.7 - 0.9 190 - 220	high chemical resistance
2h at 100°C + 1h at 140°C + 1h at 180°C + 2h at 200°C	195 - 203	98 - 108	4.0 - 4.5	0.5 - 0.6 70 - 75	very high Tg, high chemical resistance
1h at 100°C + 6h at 180°C	200 - 205	75 - 95	2.0 - 3.5	0.4 - 0.5 65 - 75	very high Tg, very latent anhydride curing system
90 min at 80°C + 1h at 150°C + 1h at 180°C	200 - 207	113 - 117	4.0 - 5.0	0.5 - 0.7 130 - 165	suitable for tooling application: free stand post-cure after 40°C pre-cure conditions
90 min at 80°C + 1h at 150°C + 1h at 180°C	200 - 210	82 - 86	2.5 - 4.0	0.6 - 0.8 130 - 165	suitable for tooling application: free stand post-cure after 40°C pre-cure conditions
2h at 120°C + 2h at 160°C + 2h at 200°C + 4h at 220°C	205 - 215	85 - 100	2.5 - 3.0	0.4 - 0.50 45 - 60	very high Tg, very latent anhydride curing system
2h at 120°C + 2h at 160°C + 2h at 200°C + 4h at 220°C	232 - 238	105 - 125	3.0 - 4.5	0.6 - 0.7 95 - 100	high chemical resistance

Formulated systems for pre-impregnation (Prepregs)

Product designation	Mix viscosity	B-Staging or solvent evaporation	Shelf-life	Gel time*	Applied cure schedule
Conditions	25°C		23°C	120°C	
Norm					
Unit	mPa·s			min	

Solvent based process

Araldite® LZ 5021 / Aradur® 1571 / Accelerator 1573	550 - 850	6 - 10 min at 90°C	9 - 12 months	8 - 15	25 min at 125°C
Resin XB 3540 / Aradur® 5021	1 700 - 2 300	7 - 10 min at 90°C	> 4 weeks	15 - 20	30 min at 90°C + 1h at 120°C
Resin XB 3542 / Aradur® 5021	1 900 - 2 500 at 50°C	8 - 13 min at 90°C	> 5 weeks	10 - 13	1h at 120°C + 2h at 140°C

Chemical B-stage process

 Araldite® LY 1556 / Aradur® 1571 / Accelerator 1573 / Hardener XB 3403	4 000 - 6 000	24 - 48h at 23°C	> 6 weeks	6 - 11	2h at 120°C
Araldite® LY 1556 / Aradur® 1571 / Accelerator 1573 / Hardener XB 3471	5 000 - 5 900	2 - 3 min at 80 - 90°C	> 6 weeks	5 - 12	2h at 120°C
 Resin XU 3508 / Aradur® 1571 / Accelerator 1573 / Hardener XB 3403	6 650 - 7 450	24h at 23°C	> 4 weeks	4 - 12	4h at 120°C
Resin XU 3508 / Aradur® 1571 / Accelerator 1573 / Hardener XB 3471	5 900 - 6 200	2 - 3 min at 90°C	> 4 weeks	4 - 8	4h at 120°C
Araldite® LY 5150 / Aradur® 1571 / Accelerator 1573 / Hardener XB 3471	3 500 - 4 500 at 50°C	1 - 3 min at 80 - 90°C	> 8 weeks	10 - 28	1h at 140°C

Hot-melt process

Resin XB 3515 / Aradur® 5021	24 000 - 28 000 at 55°C	n.a.	> 5 weeks	10 - 13	1h at 120°C + 2h at 140°C
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* Adjustable reactivity with Accelerator 1573 ratio

n.a.: not applicable / n.m.: not measured

Expandable Epoxy Systems (EES) for fast* compression molding

Product designation	Maximum Tg	Density of composites **
Conditions	DSC, 10 K/min	
Norm	IEC 1006	
Unit	°C	g/cm³
Araldite® LY 1135-1A / Aradur® 1135-1B	135 - 145	0.65 - 0.85
Araldite® LY 5310 / Aradur® 1135-1B	135 - 145	0.65 - 0.85
Araldite® LY 3007 T1.5 / Aradur® 5003-1	120 - 130	0.50 - 0.70
Araldite® LY 5054 / Foaming agent DY 5054 / Aradur® 5003-1	120 - 130	0.50 - 0.70

* Typical processing time: 45-60 seconds at 150 - 160°C

** With natural fiber mats density: ~ 1.4 g/cm³ - Epoxy resin rate in weight: ~ 35 %



Germanischer Lloyd (GL) certified

Tg	Flexural strength	Ultimate flexural elongation	Fracture properties K _{1C} G _{1C}
DSC, 10 K/min			
IEC 1006	ISO 178		
°C	MPa	%	MPa√m J/m ²
85 - 115	118 - 120	13.0 - 16.0	n.m.
115 - 125	135 - 150	8.0 - 9.5	0.8 - 0.9 210 - 240
140 - 145	120 - 140	4.5 - 6.5	1.2 - 1.3 400 - 440
105 - 115	125 - 140	7.0 - 10.0	0.7 - 0.9 130 - 250
115 - 125	125 - 145	5.5 - 8.5	0.7 - 0.9 210 - 390
115 - 125	110 - 120	5.5 - 8.0	1.4 - 1.7 850 - 1000
120 - 140	110 - 133	6.0 - 10.0	1.2 - 1.5 500 - 800
140 - 155	130 - 160	4.0 - 8.0	0.6 - 0.8 100 - 140
140 - 145	120 - 140	4.5 - 6.5	1.2 - 1.3 400 - 440

process

Key characteristics
high Tg
high Tg, low emission system
higher foaming effect, recommended for sandwich composites
higher foaming effect, recommended for sandwich composites - foaming agent concentration adjustable



With innovation

Every day, all over the world, our Technical Competence centers engage in intensive research and development focusing on one goal : to deliver innovative solutions by working hand-in hand with our business partners. Together through a continual exchange of ideas, supported by an experienced team of sales and technical specialists, we strive to deliver innovative and regulatory compliant (eg REACH compliant) solutions.

We track both new market expectations and changing regulations. Protection of the environment, as well as health and safety are paramount concerns, playing an integral part in our development projects.

By providing unique, certified or patented technologies, combined with high quality and reliability, our chemists and experts bring enhanced value to our customers, ensuring their success.

With customer intimacy

We market a unique product portfolio and a broad range of forward-looking solutions for our customers. Customers and partners benefit from an advanced level of service in:

- > product development and quality
- > product trials in-house and with customers
- > customer seminars and training
- > trouble-shooting and problem-solving

Partnership with our customers is more than simply «putting them first». It requires long-term commitment to forging close relationships that create synergies of knowledge, security and adaptability to create a successful, shared future.

With care

Sustainability is a fundamental part of our corporate and business strategy. We see a better world in which our innovations help reduce consumption of natural resources and improve the quality of life for people everywhere. We are identifying the long - term trends that affect our markets and looking to see how products and applications can play a part in supporting and providing solutions to the challenges those markets face.





We value
your
challenge



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Our Advanced Materials division is a leading global chemical solutions provider with a long heritage of pioneering technologically advanced epoxy, acrylic and polyurethane-based polymer products.

Our capabilities in high-performance adhesives and composites, delivered by more than 2300 associates, serve over 3000 global customers with innovative, tailor-made solutions and more than 1500 products which address global engineering challenges.

HUNTSMAN

Enriching lives through innovation

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