

Advanced Materials

HUNTSMAN

Enriching lives through innovation

Araldite®

Reliable and comprehensive bonding solutions



Raising
performance in
railway industry

Our mission: provide unique bonding technologies that create value for our customers

Araldite®

The adhesives serving worldwide manufacturing industry for more than half a century



Driven by increasing demand for mobility, energy consumption efficiency, and concerns over climate change, a high priority is placed in Europe on developing rail as a key transport mode by promoting step-change innovations for passenger rolling stock, freight transport, and rail infrastructure.

Whilst the level of global business competition is high, manufacturers need solutions to help sustain their competitive edge and secure long-term growth. Production process improvement, innovation in design, weight savings, compliance to stringent safety and environmental standards, and low maintenance costs have become vital to success.

In this context, adhesives can play an even greater role, providing well established solutions as well as more advanced and innovative developments for all kinds of bonding applications.

Adhesives deliver long term performance and durability

Adhesive bonding enables the most efficient use of materials, maximising their long-term potential while optimising manufacturing methods with easy handling and processing.

Compared to mechanical joining, adhesive bonding allows the assembly of dissimilar materials and higher weight loads to be carried while offering more uniform stress distribution across the entire bonded joint and superior fatigue resistance.

Adhesives facilitate the integrity and strength of materials as there are no holes, rivets or fastening elements to weaken the structure. Without any visible joining elements, nothing detracts from the aesthetics of the finished parts and greater lightweight design flexibility can be achieved.

Additionally, adhesives offer the potential to reduce costs in parts production through streamlined assembly processes and hence faster cycle times.

Therefore adhesive bonding has become standard in manufacturing exterior and interior parts in order to deliver superior performance and durability for rolling stocks and infrastructure applications.

We deliver more than just products

Huntsman offers a unique wide range of adhesive solutions for all segments of the rail market, from high speed trains, mainline and regional trains to metro, suburban, freight trains and the infrastructure around them.

As a strategic partner, we tailor our products and services to the evolving needs of this market. Based on epoxy, polyurethane, methyl methacrylate and phenolic technologies, our adhesives have specific characteristics that help end-users improve their manufacturing processes, secure long-term performance and safety of assemblies. This results in reduced maintenance costs, increased design freedoms and the development of lightweight structures for better energy efficiency and aesthetics. As a result of our extensive experience working in the aerospace industry, Huntsman's innovations go beyond improving mechanical properties with the addition of new features such as flame retardancy, low smoke density and low toxic emissions.

Huntsman Advanced Materials' testing laboratories in Basel are accredited according to ISO/IEC 17025 for synthetic materials testing and quantity temperature calibration. This accreditation also ensures that in-house testing methods conform to the **DIN 6702-1** standard requirements for the rail industry. Moreover Huntsman's global manufacturing footprint, local technical support and commercial teams ensure close proximity with our customers.

Strength in bonding

The Araldite® adhesives range for railway contains a selection of adhesives from the latest epoxy, polyurethane, methacrylate and phenolic technologies to meet the great majority of high-performance bonding applications.

Araldite® adhesives range for railway

From adhesives with long open times for large area applications to fast-curing adhesives for early removal from fixtures and rapid through-put, this range includes adhesives which are resistant to high temperature, water and chemicals. Liquid adhesives as well as thixotropic adhesives for gap-filling or vertical applications can be found in this range. Adhesives with highest strength can be selected from this range as well as tough and impact-resistant adhesives with a well-balanced combination of strength and flexibility and also elastic adhesives to cope with different thermal expansions when bonding larger structures of dissimilar materials.

Products from the Araldite® adhesives range for railway are available in a variety of packaging including easy-to-use cartridges with static mixers and working packs for manual applications as well as hobbocks and drums for higher volume applications. The Araldite® adhesives range for railway will continuously be updated to meet the newest demands of innovative design using the bonding technology.



Epoxies

1-C epoxy adhesives

- > excellent adhesion to metals, thermoset and thermoplastic composites
- > outstanding lap shear strength and peel strength
- > high fatigue resistance
- > very high impact resistance
- > excellent chemical resistance
- > easy processing

2-C epoxy adhesives

- > excellent adhesion to metals and thermoset composites
- > high strength and high stiffness
- > high creep resistance
- > high fatigue resistance
- > high temperature resistance (adhesive specific up to 210°C)
- > excellent chemical resistance
- > low shrinkage

Methacrylates

2-C methyl methacrylate adhesives

- > excellent adhesion to metals, thermoset composites and most thermoplastics
- > good adhesion with minimum surface preparation
- > tolerant to mix-ratio variations
- > wide spectrum of available reactivity
- > optimum ratio open-time / cure time
- > mechanical properties from rigid to flexible
- > good long-term durability

No-mix methyl methacrylate adhesives

- > long open-time and rapid cure
- > good adhesion with minimum surface preparation
- > high process flexibility
- > suitable for high production speed
- > high toughness
- > good long-term durability

Polyurethanes

2-C polyurethane adhesive

- > excellent adhesion to most thermoplastics and composite materials
- > good adhesion to metals
- > mechanical properties from rigid to flexible
- > good long-term durability
- > good combination of strength and flexibility

Phenolics

- > excellent adhesion to metals and friction materials
- > outstanding temperature resistance
- > excellent chemical resistance
- > easy to apply
- > virtually «infinite» open time once applied

Product designation	Light and traffic boxes assembly	Carriage structure		Roof, floor covering, doors Semi-structural bonding					Insulated rail joints and repair			Interior furnishings						Brake bonding			Sandwich panel laminating				Sandwich panel assembly			Electrical components			
		Steel	Alu	Steel	Alu	GRP / SMC	Ply-wood	Liquid shimming	Steel	GRP	Rail Repair	Alu	Steel	GRP / SMC	Thermo-plastics	Wood	Rubber	Steel	Alu	Friction Material	Steel	Alu	Foam core	Wood	Steel	Alu	Wood	PCB	Copper	Ferrite	
Araldite® 2013-1	● ●	● ●	● ●	● ●	● ●	● ●	● ●	● ●	● ●	● ●	●	● ●	● ●	● ●	●	● ●	●								● ●	● ●	● ●	● ●	● ●	● ●	
Araldite® 2014-2		● ●	● ●	●	●	●	●		● ●	● ●	●	● ●	● ●	●		●									●	●		● ●	● ●	● ●	
Araldite® 2015-1	● ●	● ●	● ●	● ●	● ●	● ●	● ●	● ●	● ●	● ●	●	● ●	● ●	●	● ●	● ●	●								● ●	● ●	● ●				
Araldite® 2031-1	● ●	● ●	● ●	● ●	● ●	● ●	● ●	● ●	● ●	● ●	●	● ●	● ●	●	● ●	● ●	●								● ●	● ●	● ●				
Araldite® 2033	● ●	●	●	●	●	●	●					● ●	● ●	●	● ●	●									● ●	● ●	● ●	● ●	● ●	● ●	
Araldite® 420		● ●	● ●	● ●	● ●	● ●	● ●					● ●	● ●	● ●	●	● ●	●								● ●	● ●	● ●				
Araldite® AV 170		● ●	● ●																												
Araldite® AV 4600		● ●	● ●																												
Araldite® AW 146 / Hardener HV 957				●	●	●	●					●	●	●		●	●	● ●	● ●	● ●	● ●										
Araldite® AW 2101 / HW 2951				●	●	●	●		● ●	● ●	●	● ●	● ●		● ●																
Araldite® AW 4858 / HW 4858		● ●	● ●	● ●	● ●	● ●	● ●	● ●				● ●	● ●	● ●	●	● ●	●								● ●	● ●	● ●				
Araldite® AW 4859 / HW 4859		● ●	● ●	● ●	● ●	● ●	● ●					●	●	●																	
Araldite® 2028-1												●	●	● ●	● ●	● ●	● ●														
Araldite® 2029-1		●	●	● ●	● ●	● ●	● ●	● ●				● ●	● ●	● ●	●	● ●	● ●								● ●	● ●	● ●				
XB 5090-1 polyol / Arathane® HY 5611-1																		● ●	● ●	● ●	● ●										
Araldite® 2021-1	● ●			●	●	●	●				● ●	● ●	● ●	● ●	●	●	●														
Araldite® 2022-1	● ●			●	●	●	●				● ●	● ●	● ●	● ●	●	●	●														
Araldite® 2047-1				●	●	●	●					● ●	● ●		●														●	●	●
Araldite® 2048-1				●	●	●	●					● ●	● ●	● ●	● ●													●	●	●	
Araldite® 2052-1	● ●	●	●	●	●	●	●		● ●	● ●	● ●	● ●	● ●		●																
Agomet® F 305 A/B hardener powder																												● ●	● ●	● ●	
Agomet® F330 hardener lacquer																												● ●	● ●	● ●	
Araldite® 64-1																		● ●	● ●	● ●											
Araldite® 71																		● ●	● ●	● ●											

●● Recommended | ● Suitable | Non exclusive selection - Ask our experts for other solutions.

Araldite®

Reliable and comprehensive bonding solutions for railway industry

1 Lights and control boxes

Body assembly, lens assembly

Your needs

- > Very good weathering resistance
- > Electrical insulation
- > Good thermal resistance
- > Flame retardancy

Our solutions

Araldite® 2013-1
Araldite® 2015-1
Araldite® 2021-1
Araldite® 2022-1
Araldite® 2033
Araldite® 2052-1

2 Carriage structure

Frame and ceiling reinforcement

Your needs

- > Improve the fatigue resistance of the metal assemblies
- > Reduce overall weight of structure
- > Prevent and reduce corrosion
- > Improve stiffness and shock resistance of the assemblies

Our solutions

Araldite® 2014-2
Araldite® 2015-1
Araldite® AV 170
Araldite® AV 4600
Araldite® AW 4858 / HW 4858
Araldite® AW 4859 / HW 4859

3 Roofs, doors, floors and semi-structural bonding

Floor coverings, seats attachment to floor, doors frames, hinges, HVAC

Your needs

- > Multimaterial assemblies
- > Ease of application
- > Toughness, shock resistance
- > Aesthetical design

Our solutions

Araldite® 420
Araldite® 2013-1
Araldite® 2015-1
Araldite® 2029-1
Araldite® AW 4858 / HW 4858
Araldite® AW 4859 / HW 4859

4 Insulated rail joints

Your needs

- > Very good weathering resistance
- > Fast curing
- > High fatigue and vibration resistance
- > Electrical insulation

Our solutions

Araldite® 2013-1
Araldite® 2014-2
Araldite® 2015-1
Araldite® 2031-1
Araldite® 2052-1
Araldite® AW 2101 / HW 2951

5 Interior furnishings

Fold tables, equipment boxes on carriages, handles, mirrors, luggage racks, ceiling liners

Your needs

- > Multimaterial assemblies
- > Reduce overall weight
- > Ease of application
- > Flame retardancy
- > Aesthetical design

Our solutions

Araldite® 2015-1
Araldite® 2022-1
Araldite® 2028-1
Araldite® 2029-1
Araldite® 2047-1
Araldite® 2048-1

6 Brake bonding

Brake shoes, brake pads, dip-coating

Your needs

- > Very high temperature resistance
- > Very good adhesion to friction material
- > Very good adhesion to steel and aluminum

Our solutions

Araldite® 64-1
Araldite® 71

7 Sandwich panels laminating and assembly

Wall cabinets, partition walls, panelling

Your needs

- > Multimaterial assemblies
- > Long open time for large parts laminating
- > Controlled rheology
- > Fast curing for panels assembly
- > Design freedom

Our solutions for lamination

Araldite® AW 146 / HV 957
XB 5090-1 / Arathane® HY 5611-1

Our solutions for assembly

Araldite® 420
Araldite® 2013-1
Araldite® 2015-1
Araldite® 2029-1
Araldite® 2033
Araldite® AW 4858 / HW 4858

8 Electrical components assembly

Transformers, drivers control panel, cables

Your needs

- > Multimaterial assemblies
- > Good thermal resistance
- > Weathering resistance
- > Electrical insulation

Our solutions

Araldite® 2013-1
Araldite® 2014-2
Araldite® 2033
Agomet® F 305 A/B
Agomet® F 330





1 Trackside traffic control box
Signal lights box



2 Carriage structure



3 Outer/inner door



3 **5** Window



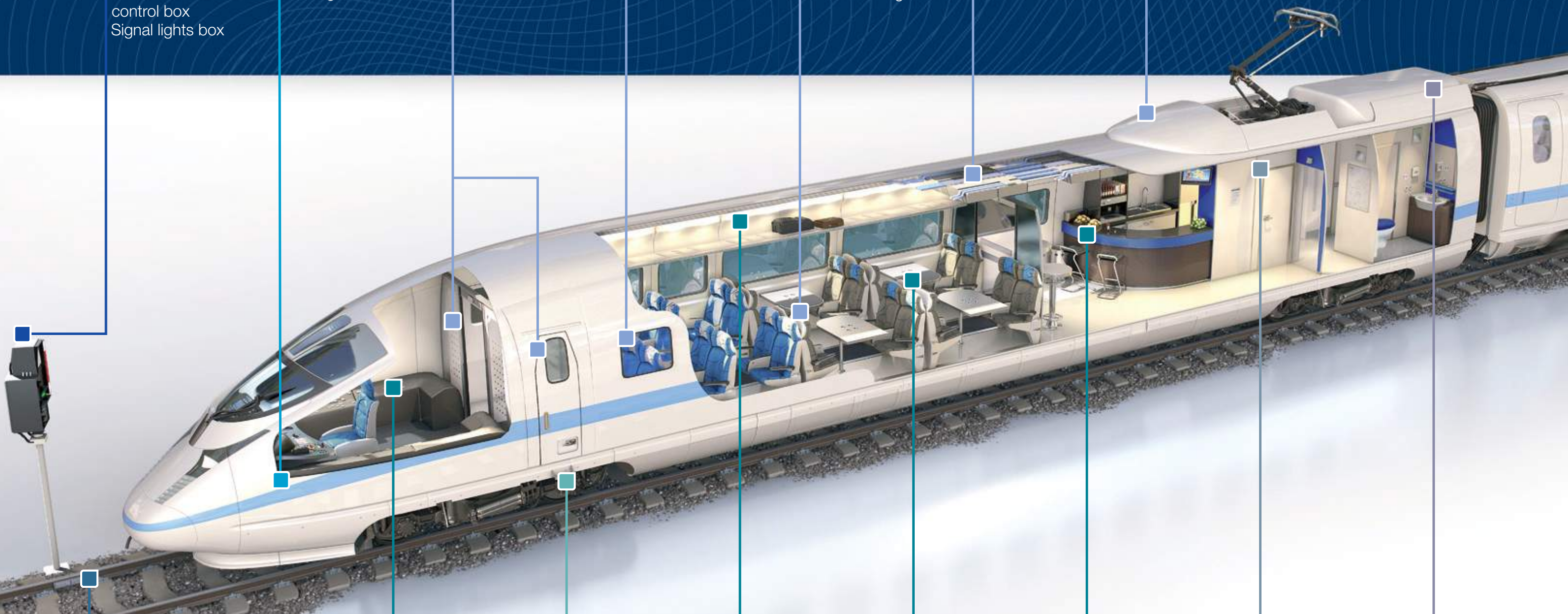
3 Floor coverings



3 HVAC



3 Air dam



4 Rail joint



5 Driving cabin



6 Brake system



5 Luggage carrier



5 Table/chair



5 Kitchen and sanitary blocks



7 Sandwich panels



8 Transformer

Product designation		Technology	Mix ratio	Color	Pot life	Fixture time	Gap filling	Lap shear strength on aluminum*	Tensile modulus**	Elongation at break**	Key benefits
Cartridge	Bulk		volume		min	min	mm	MPa	MPa	%	
Araldite® 2013-1	Araldite® AV 144-2 / Hardener HV 997-1	EP	100 : 100	grey	80	300	5	20	1 400	2	Grey metal colored, non-sagging paste, high toughness. Approved by the French Railways.
Araldite® 2014-2	Araldite® AW 139-1 / Hardener HW 5323-1	EP	100 : 50	dark grey	110	300	5	17	3 000	1	Resistance to high temperature, excellent chemical resistance, room temperature cure.
Araldite® 2015-1	Araldite® AV 5308 / Hardener HV 5309-2	EP	100 : 100	beige	45	240	10	19	1600	4	High toughness, excellent weathering resistance, good temperature resistance on british rail's register of approved adhesives for fishplate and rail bonding. Approved by the French Railways.
Araldite® 2031-1	Araldite® AV 4076-1 BK / Hardener HV 5310 BK	EP	100 : 100	black	60	180	10	22	1 000	10	High toughness, excellent weathering resistance, non sagging paste.
Araldite® 2033	Araldite® AW 4833 / Hardener HW 4833	EP	100 : 100	black	120	240	5	16	2 500	1	Self extinguishing, EN 45545-2 HL3. UL 94 V-0 (4.5 mm), gap filling, long open time.
Araldite® 420	Araldite® 420 A / Araldite® 420 B	EP	100 : 50	green	150	360	< 1	40	1 500	10	High lap shear strength, high peel strength, high toughness.
	Araldite® AV 170	EP	n.a.	pale yellow	n.a. 1 component epoxy	n.a. 1 component epoxy	0.5	28	1 600	1	High peel strength, high toughness, non sagging paste. Approved by the French Railways.
	Araldite® AV 4600	EP	n.a.	orange	n.a. 1 component epoxy	n.a. 1 component epoxy	0.5	43	4 000	5	Excellent Lap shear strength, high chemical resistance, non sagging paste.
	Araldite® AW 146 / Hardener HV 957	EP	100 : 100	pale yellow	100	420	< 1	26	1 900	10	Easy to spread, long pot-life, good temperature resistance.
Araldite® AW 2101 / HW 2951	Araldite® AW 2101 / Hardener HW 2951	EP	100 : 100	grey	6	60	5	20	5 500	1	Fast cure, non-sagging paste, high strength, sandable.
Araldite® AW 4858 / HW 4858	Araldite® AW4858 / Hardener HW4858	EP	100 : 50	black	150	360	10	38	1 600	10	High lap shear strength, high peel strength, high toughness.
Araldite® AW 4859 / HW 4859	Araldite® AW 4859 / Hardener HW 4859	EP	100 : 50	black	100	270	10	33	1 500	5	High temperature resistance, high peel strength, gap filling.
Araldite® 2028-1	Araldite® 8629-1 polyol / Araldite® 8628 isocyanate	PU	100 : 100	crystal clear	6	30	< 1	15	15	60	Transparent clear, UV stable, fast curing.
Araldite® 2029-1	Araldite® AW 4840-1 / Hardener HW 4841	PU	100 : 100	dark grey	40	240	5	24	550	40	High elongation at break, high strength, non sagging paste.
	XB 5090-1 polyol / Arathane® HY 5611-1	PU	100 : 25	beige	100	360	< 1	20	27	40	Easy to spread, long pot-life, good environmental and chemical resistance.
Araldite® 2021-1	Araldite® F 361-1 / Hardener F 361-1	MMA	100 : 100	pale yellow	3	9	3	25	2 000	10	Very fast cure, high strength, high toughness.
Araldite® 2022-1	Araldite® F 362-1 / Hardener F 362-1	MMA	100 : 100	pale yellow	10	12	3	25	2 000	5	Fast cure, high strength, high toughness.
Araldite® 2047-1	Araldite® F 347 / Hardener K 100-1 red	MMA	100 : 10	brown	10	15	3	18	850	30	Good adhesion on difficult to bond metals, fast cure, good flexibility. Approved by the French Railways.
Araldite® 2048-1	Araldite® F 348 / Hardener F 348-1	MMA	100 : 10	black	10	35	8	24	350	90	High flexibility, gap filling, fast cure, low chlorine content.
Araldite® 2052-1	Agomet® F 252 / Hardener K 100-1 red	MMA	100 : 10	red	15	20	3	24	1 700	10	High temperature resistance, high strength, fast cure, toughned.
	Agomet® F 305 A/B	MMA	6% hardener powder	brown	2	5	< 1	23	500	20	«No mix» system, 2 minutes work-life, 5 minute handling strength, low viscosity, ideal for ferrite bonding.
	Agomet® F 330 hardener lacquer	MMA	hardener lacquer	beige	10	20	< 0.5	35	1 500	5	«No mix» system, 10 minutes work-life, 20 minutes handling strength, resistance to high temperature.
	Araldite® 64-1	Phenolic	n.a.	black	n.a.	n.a.	< 0.5	8	n.a.	n.a.	Very high temperature resistance, «infinite» open time, suitable for use as an adhesive or dilution to primer viscosity.
	Araldite® 71	Phenolic	n.a.	brown	n.a.	n.a.	< 0.5	8	n.a.	n.a.	Very high temperature resistance, «infinite» open time, extrudable.

EP = Epoxy | PU = Polyurethane | MMA = Methyl methacrylate | *measured following ISO 4587 (Curing 16h at 40°C) | **measured following ISO 527 (Curing 16h at 40°C) | Cure temperature at RT possible (full cure achieved after 7 days) | Non exclusive selection - Ask our experts for other solutions.



We value your challenge

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 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.



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 selection and quality
- > product trials in-house and with customers
- > customer seminars and trainings
- > technical service and solution-providing

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.



Huntsman Advanced Materials

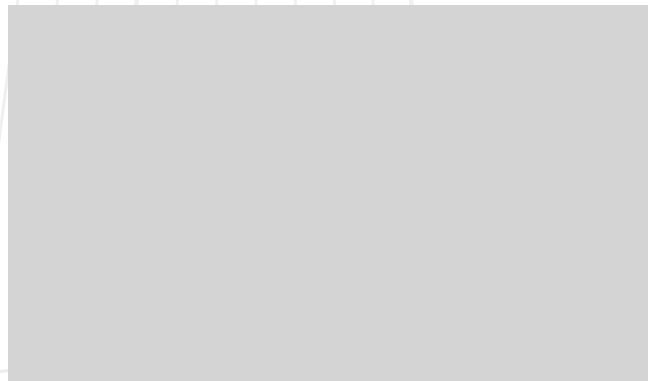
Our Advanced Materials division is a leading global chemical solutions provider with a long heritage of pioneering technologically advanced epoxy, acrylic, phenolic and polyurethane-based polymer products.

Our capabilities in high-performance adhesives and composites, delivered by more than 1 600 associates, serve over 2 000 global customers with innovative, tailor-made solutions and more than 1 500 products which address global engineering challenges.

We operate synthesis, formulating and production facilities around the world



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HUNTSMAN

Enriching lives through innovation

For more information

www.huntsman.com/advanced_materials
advanced_materials@huntsman.com

Europe, Middle East & Africa

Huntsman Advanced Materials (Switzerland) GmbH
Klybeckstrasse 200
P.O. Box
4002 Basel
Switzerland
Tel. +41 61 299 1111
Fax +41 61 299 1112

Asia Pacific & India

Huntsman Advanced Materials (Guangdong) Co., Ltd.
Room 4903-4906, Maxdo Centre,
8 Xing Yi Road,
Shanghai 200336,
P.R.China
Tel. + 86 21 2325 7888
Fax + 86 21 2325 7808

Americas

Huntsman Advanced Materials Americas Inc.
10003 Woodloch Forest Drive
The Woodlands
Texas 77380
USA
Tel. +1 888 564 9318
Fax +1 281 719 4047

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The Product may be or become hazardous. Buyer should (i) obtain Material Safety Data Sheets and Technical Data Sheets from Huntsman containing detailed information on Product hazards and toxicity, together with proper shipping, handling and storage procedures for the Product, (ii) take all steps necessary to adequately inform, warn and familiarize its employees, agents, direct and indirect customers and contractors who may handle or be exposed to the Product of all hazards pertaining to and proper procedures for safe handling, use, storage, transportation and disposal of and exposure to the Product and (iii) comply with and ensure that its employees, agents, direct and indirect customers and contractors who may handle or be exposed to the Product comply with all safety information contained in the applicable Material Safety Data Sheets, Technical Data Sheets or other instructions provided by Huntsman and all applicable laws, regulations and standards relating to the handling, use, storage, distribution and disposal of and exposure to the Product. Please note that products may differ from country to country. If you have any queries, kindly contact your local Huntsman representative.

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