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Advanced Materials

ARALDITE® 2011 A/B

(ARALDITE AW 106R/HARDENER HV 953U)

MULTI-PURPOSE EPOXY ADHESIVE

Description

ARALDITE 2011 A/B epoxy adhesive is a multi-purpose, viscous material that is suitable for bonding a variety of materials, including metal, ceramic, and wood. The electrically insulating adhesive is easy to apply either manually by spatula and stiff brush or mechanically with meter/mix and coating equipment. ARALDITE 2011 A/B epoxy adhesive cures at temperatures from 68ºF (20ºC) to 356ºF (180ºC) with no release of volatile constituents.

Applications

ARALDITE 2011 A/B epoxy adhesive is suitable for bonding:

Metals
Ceramics
Wood
Vulcanized rubber
Foams
Plastics

Advantages

Long open time
High shear and peel strengths
Easy to apply
Good resistance to static and dynamic loads
Electrically insulating

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Typical Properties

Property	Test Method	Test Values[1] Resin	Hardener
Color/appearance	Visual	Creamy Viscous Liquid	Amber Liquid
Specific Gravity	ASTM D-792	1.17	0.92
Viscosity, cP @ 77°F (25°C)	ASTM D-2393	50,000	35,000

Typical Mixed Properties

Property	Test Method	Test Values[1]
Reaction Ratio (by weight)		100R/80H
Reaction Ratio (by volume)		100R/100H
Pot Life, minutes @ 77°F (25°C), 4 fl. oz. mass	ASTM D-2471	2
Mixed viscosity, cP @ 77°F (25°C)	ASTM D-2393	45,000

[1]Tested @ 77°F (25°C)

Recommended Cure Schedules

Temperature	Handling Strength	Minimum Cure Time
68ºF (20ºC)	12 hours	15 hours
77ºF (25ºC)	7 hours	12 hours
104ºF (40ºC)	2 hours	3 hours
158ºF (70ºC)	30 minutes	50 minutes
212ºF (100ºC)	6 minutes	10 minutes
302ºF (150ºC)	4 minutes	5 minutes

Processing

Application of Adhesive

The resin/hardener mix is applied with a spatula to the pretreated and dry joint surfaces.

A layer of adhesive 0.002 to 0.004-inches (0.05 to 0.10-mm) thick will normally impart the greatest lap shear strength to a joint.

The joint components should be assembled and clamped as soon as the adhesive has been applied. Even contact throughout suffices to ensure proper cure.

Standard Test Specimens

Unless otherwise stated, the figures given below were all determined by testing standard specimens made up by lap-jointing 4-inch x 1-inch x 0.06-inch (10-cm x 2.5-cm x 1.5-mm) strips of aluminum. The joint area was 0.5 x 1 inch (12.5 mm x 2.5 cm) in each case.

Typical Physical Properties

Lap Shear Strength, psi (MPa) — **Test Method**: ASTM D-1002

Effect of Cure Time and Test Temperature

Cure Cycle		Test Values[1]
77ºF (25ºC)	8 hours	710 (4.9)
	15 hours	1990 (13.7)
	24 hours	2130 (14.7)
	72 hours	2280 (15.7)
	5 days	2560 (17.6)
158ºF (70ºC)	1 hour	3130 (21.5)
	2 hours	3410 (23.5)
	3 hours	3200 (22)
212ºF (100ºC)	10 minutes	3700 (25.5)
	20 minutes	3980 (27.4)
	30 minutes	4120 (28.4)
302ºF (150ºC)	5 minutes	4270 (29.4)
	10 minutes	4410 (30.4)
	20 minutes	4410 (30.4)

[1]Tested @ 77°F (25°C)

Lap Shear Strength, psi (MPa) — **Test Method**: ASTM D-1002

Effects of Test Temperature

Load applied 10 minutes after specimens reach test temperature.

Cure Cycle	Test Temp.	Test Values[1]
5 days @ 77ºF (25ºC)	-76ºF (-60ºC)	2840 (19.5)
	-4ºF (-20ºC)	2840 (19.5)
	68ºF (20ºC)	2560 (17.6)
	104ºF (40ºC)	1420 (9.8)
	140ºF (60ºC)	570 (3.9)
20 min @ 212ºF (100ºC)	-76ºF (-60ºC)	3560 (24.5)
	-4ºF (-20ºC)	3410 (23.5)
	68ºF (20ºC)	3980 (27.4)
	104ºF (40ºC)	1990 (13.7)
	140ºF (60ºC)	1000 (6.9)

Typical Physical Properties continued

Lap Shear Strength, psi (MPa)
Effect of Immersion
Cure cycle 16 hours @ 104ºF (40ºC). Immersion for 90 days in media listed.

Properties	Test Values [(1)]
Standard - As prepared	2560 (17.6)
Acetone (30 days)	570 (3.9)
Acetylene	430 (2.9)
Gasoline	2410 (16.6)
Ethyl Acetate (30 days)	570 (3.9)
Acetic Acid 10%	Degraded
Methanol	Degraded
Lubricating Oil - HD30	2560 (17.6)
Kerosene	Degraded
Trichloroethylene	Degraded
Water @ 68°F (20°C)	1420 (9.8)
Water @ 194°F (90°C)	430 (2.9)

Lap Shear Strength, psi (MPa)
Effect of Tropical Exposure
(104ºF/40ºC/92% R.H.)

Cure Cycle	Exposure Time	Test Values [1]
16 hrs @ 104ºF (40ºC)	0 days	2560 (17.6)
	10 days	2560 (17.6)
	30 days	1710 (11.8)
	60 days	1560 (10.7)
	90 days	570 (3.9)
20 min @ 212ºF(100ºC)	0 days	3980 (27.4)
	10 days	2560 (17.6)
	30 days	1710 (11.8)
	60 days	1560 (10.7)
	90 days	1280 (8.8)

[1]Tested @ 77°F (25°C)

Typical Physical Properties continued

Lap Shear Strength, psi (MPa)
Effect of Heat Aging
Cured 16 hours @ 104ºF (40ºC).

Test Method
ASTM D-1002

Aging Temperature	Exposure Time	Test Values(1)
68ºF (20ºC)	0 days	2560 (17.6)
	1 years	2560 (17.6)
	2 years	2280 (15.7)
	3 years	1710 (11.8)
	4 years	1990 (13.7)
	5 year	1990 (13.7)
140ºF (60ºC)	3 days	2560 (17.6)
	10 days	2420 (16.6)
	30 days	2130 (14.7)
176ºF (80ºC)	3 days	2130 (14.7)
	10 days	2130 (14.7)
	30 days	2130 (14.7)
	60 days	2130 (14.7)
	1 year	1280 (8.8)
	2 years	710 (4.9)
	3 years	710 (4.9)

Lap Shear Strength, psi (MPa)
Tested on Metal Substrates
(Cured 20 min @ 212ºF (100ºC)

Metal	Substrate Thickness (in./mm)	Test Values
Carbon Steel	0.039/1.0	3840 (26.4)
Stainless Steel	0.039/1.0	3270 (22.5)
Galvanized Steel[1]	0.6/1.5	1990 (13.7)
Copper	0.6/1.5	3270 (22.5)
Brass	0.6/1.5	2990 (20.6)

[1]Surface degreased only; not roughened

Typical Physical Properties continued

Fatigue Strength
Tested using a load frequency of 90 Hz and a 1 inch (25 mm) joint overlap
Cured 20 min @ 212ºF (100ºC).

Fatigue Limit Load % Static Shear Strength	Cycles to Failure[1]
50	10^3 -10^4
40	10^4 -10^5
30	10^5 -10^6
25	10^5 -10^6
20	10^6 -10^7
15	10^7

Property	Test Method	Test Values[1]
Ultimate Tensile Strength, psi (MPa)	ASTM D-638	4800 (33)
Elongation, %	ASTM D-638	9
Tg per DMA, °F (°C)	ASTM D-4065	146 (63)
Hardness, Shore D	ASTM D-2240	80
Coefficient of Thermal Expansion, (in/in/°C)	ASTM E-831	8.5 X 10^{-5}
Roller Peel Test, pli (N/mm)	ISO 4578	28 (4.9)

[1]Tested @ 77°F (25°C)

Electrical Properties	Test Values
Thermal Conductivity, W/mK	0.22
Surface Resistivity, ohms	1.2 E+16
Dielectric Strength, volt/mil	400
Volume Resistivity, ohms-cm	7.1 E+14
Dielectric Constant, at 50Hz/1KHz/10KHz	3.4/3.2/3.2
Loss Tangent, % at 50Hz/1KHz/10KHz	1.7/1.8/2.6

Storage and Shelf Life

ARALDITE epoxy adhesive components should be stored in their original, sealed containers at room temperature. When stored at temperatures from 59-77°F (15-25°C), the resin and hardener will remain in useable condition for 12 months from date of shipping from Huntsman.

Caution:

Huntsman Advanced Materials Americas Inc. 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. Copies of the latest MSDS may be requested by calling our customer service group at 888-564-9318 or emailing your request to adhesives@huntsman.com.

First Aid!

Eyes and skin: Flush eyes with water for 15 minutes. Contact a physician if irritation persists. Wash skin thoroughly with soap and water. Remove and wash contaminated clothing before reuse.
Inhalation: Remove subject to fresh air.
Swallowing: Dilute by giving water to drink and contact a physician promptly. Never give anything to drink to an unconscious person.

KEEP OUT OF REACH OF CHILDREN

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