HUNTSMAN

Enriching lives through innovation

Advanced Materials

Aradur® 976-1*

SOLID AROMATIC AMINE HARDENER

GENERAL

Aradur® 976-1, also referred to as Eporal 'DDS' or 'DAPS', is a high performance hardener used with Araldite® epoxy resins.

CHEMICAL DESCRIPTION

4,4'-Diaminodiphenyl sulfone

APPLICATIONS

- Adhesives
- Castings
- Printed circuit board laminates
- High temperature laminates
- Prepregs
- Composites/Advanced composites
- Coatings/high performance

ADVANTAGES

- Excellent thermal stability
- Outstanding chemical resistance
- Excellent high temperature properties

TYPICAL PROPERTIES

(ARE BASED ON HUNTSMAN'S TEST METHODS. COPIES ARE AVAILABLE UPON REQUEST)

Visual appearance	white to off- white	
Melting point	176 - 185	[°C]
Amine content	99 - 100	[%]
Water content	0.0 - 0.15	[%]
Particle size, less than 150 µm	95 - 100	[%]

PACKAGING & STORAGE

Aradur® 976-1 is supplied in 25 kg drums. This product has a minimum shelf life of one year when stored away from excessive heat and humidity.

FORMULATION

Casting Application 1

When using a liquid resin and Hardener HT 976-1, the following procedure is suggested:

Product	Parts by weight
Araldite® GY 6005	100
Aradur® 976-1	36.

Procedure

Heat the resin to 135°C (275°F) and then add the Aradur® 976-1 while stirring. Continue stirring until a homogeneous mixture is obtained. Cool the solution to 120°C (248°F), then pour into the mold

When using Aradur® 976-1/liquid resin/accelerator, the following procedure is suggested:

Product	Parts by weight
Araldite® GY 6005	100
Aradur® 976-1	36
BF_3MEA	0.5-1.0

Procedure

Heat the resin to 135°C (275°F) and add the Aradur® 976-1 while stirring until a homogeneous mixture is obtained. Cool the resin/hardener mixture to 100°C (212°F), then add the accelerator and stir until the mixture is again uniform.

Gel Time (30 gram mass) at Various Temperatures

	pbw	100°C	120°C	140°C
Araldite® GY 6005	100			
Aradur® 976-1	36	180 min	130 min	75 min
Araldite® GY 6005	100			
Hardener HT 976-1	36			
BF_3MEA	0.5	180 min	116 min	50 min
Araldite® GY 6005	100			
Hardener HT 976-1	36			
BF_3MEA	1	30 min	21 min	11 min

Cured Properties

System: Araldite® GY 6005/Hardener HT 976-1(100/36)
Cure: 24 hrs @ 120°C (248°F) + 4 hrs @ 175°C (350°F)

Physical Properties @ 25°C (77°F)

Tensile strength, psi	8550
Tensile modulus, psi	3.4×10^5
Elongation at break, %	3.3
Water absorption, 2 hr boil, %	0.6

Electrical Properties

Volume resistivity (ohm·cm)

@ 25°C (77°F)	7.1×10^{16}
@ 150°C (302°F)	1.6×10^{13}

FORMULATIONS (CONTINUED)

Dielectic constant, 60 Hz	
@ 20 °C (68 °F)	4.4
@ 100 °C (212 °F)	4.5
@130 °C (265 °F)	4.5
@ 150 °C (302 °F)	4.6
Dielectric factor, 60 Hz	
@ 20 °C (68 °F)	0.008
@ 100 °C (212 °F)	0.004
@ 130 °C (265 °F)	0.007
@ 150 °C (302 °F)	0.015

Casting Application 2

When using Araldite® MY 720 and Aradur® 976-1 to produce an unfilled casting, the following procedure is suggested:

	Parts by weight
Araldite® MY 720	100
Aradur® 976-1	44

Procedure

Carefully heat the Araldite® MY 720 to 135°C (275°F) and slowly stir in the Aradur® 976-1 until a clear mixture is obtained. (The total mass is 500g) Maintain a temperature of 135°C, and degas the mixture for 20 minutes at 30 inches of mercury. Then pour the material into molds and cure at the cure schedule below.

For larger quantities up to 5 kg, the temperature should not be allowed to go above 125°C (256°F) because a violent exotherm may result.

Unfilled batches scaled-up to >5 kg should be carefully investigated by the user for possible exotherms. In all cases, hot spots should be avoided when heating. Accelerators are not recommended in the formulation where no solvents or fillers are used. If accelerators are evaluated, extreme caution should be exercised.

Cured Properties	**Tested @ 25°C**	**150°C**
Tensile strength, psi	8540	6460
Tensile modulus, psi	5.4×10^5	3.8×10^5
Tensile elongation, %	1.8	1.9
Flexural strength, psi	13,000	12,300
Flexural modulus, psi	5.0×10^5	3.9×10^5
Ultimate compressive strength, psi	34,000	
Compressive yield strength, psi	29,000	
Compressive modulus, psi	2.8×10^5	
Charpy impact, unnotched, ft-lb	5.7	
Heat deflection temperature, °C (°F)	238 (460)	
Tg, °C (°F)	177 (350)	
Cure	2 hrs @ 80°C (176°F) + 1 hr @ 100°C (212°F) + 4 hrs @ 150°C (302°F) + 7 hrs @ 200°C (392°F)	

HANDLING PRECAUTIONS

Personal hygiene	
Safety precautions at workplace	
protective clothing	yes
gloves	essential
arm protectors	recommended when skin contact likely
goggles/safety glasses	yes
Skin protection	
before starting work	Apply barrier cream to exposed skin
after washing	Apply barrier or nourishing cream
Cleansing of contaminated skin	
	Dab off with absorbent paper, wash with warm water and alkali-free soap, then dry with disposable towels. Do not use solvents
Disposal of spillage	
	Soak up with sawdust or cotton waste and deposit in plastic-lined bin
Ventilation	
of workshop	Renew air 3 to 5 times an hour
of workplaces	Exhaust fans. Operatives should avoid inhaling vapours

FIRST AID

Contamination of the *eyes* by resin, hardener or mix should be treated immediately by flushing with clean, running water for 10 to 15 minutes. A doctor should then be consulted.

Material smeared or splashed on the *skin* should be dabbed off, and the contaminated area then washed and treated with a cleansing cream (see above). A doctor should be consulted in the event of severe irritation or burns. Contaminated clothing should be changed immediately.

Anyone taken ill after *inhaling* vapours should be moved out of doors immediately.

In all cases of doubt call for medical assistance.

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 behaviour 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.

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