

Advanced Materials

TECHNICAL DATA SHEET

Aradur® 38-1 Epoxy Curing Agent

WATERBORNE COATINGS

Formulated polyamine adduct, dissolved in water

APPLICATIONS

Used with liquid epoxy resins such as Araldite® GY 776 Resin, or the emulsion PZ 33757/67, Aradur® 38-1 Epoxy Curing Agent is suitable for the formulation of water-dilutable coatings for application to mineral and metallic substrates.

Particularly suitable for solvent-free dispersion coatings with a high solids content.

PROPERTIES

Aradur 38-1 Epoxy Curing Agent contains no organic solvents. It represents an optimum solution in terms of high solids content combined with minimum hardener requirement.

When Aradur 38-1 Epoxy Curing Agent is diluted with water, turbidity may occur. In pre-pigmented form, however, more stable hardener solutions can be produced.

In combination with suitable epoxy resins, relatively slow-drying films with good flow properties, good adhesion and a high gloss finish can be achieved. With (proportional) use of solid resin dispersions such as Araldite® PZ 3961-1 Epoxy Resin, drying times can be significantly shortened.

The pot life of dispersion coatings formulated with Aradur 38-1 Epoxy Curing Agent is typically limited to a maximum of 1 - 2 hours (loss of gloss finish). A clear increase in viscosity occurs later especially in heavily diluted mixtures.

Aradur 38-1 Epoxy Curing Agent being free of Nonylphenol was developed to succeed Aradur 38 Epoxy Curing Agent.

KEY DATA

Specified key data

Aspect (visual)	Clear liquid	
Colour (Gardner, ISO 4630)	≤ 6	
Amine number (ISO 9702)	170 - 210	[mg KOH/g]
Water content (ISO 760)	19 - 21	[%]
Viscosity at 25°C (Rotary viscosity, ISO 3219)	12.0 - 20.0	[Pa.s]

Specified key data are individually checked throughout and guaranteed.

Typical key data

H+ active key data	~150	[g/Eq]
Density at 23°C (ISO 1675)	~1.1	[g/cm ³]
Flash point (Pensky Martens, ISO 2719)	> 100	[°C]
Recommended mix ratio with Araldite® PY 33757	85	[g/100g]
Odour	yes(faint of amine)	
Shelf life (at storage temperature between 2 - 40°C) (see expiry date on original container)	One year	
Hazardous decomposition products (when disposed of in life)	Carbon monoxide, carbon dioxide, nitrogen oxides and other toxic gases and vapours	
Disposal	regular procedures approved by local authorities	

Typical key data are spot checked; the values are typical for the product and are indicated for information only. The values are not guaranteed.

TYPICAL DATA

Typical varnish formulation and data (by phr)

Part A (resin)	Description	Formulation 1	Formulation 2
Araldite® GY 9708-3	Epoxy resin	100	100
Araldite® DY-E	Reactive diluent	0	10
Part B (hardener)			
Aradur 38-1 Epoxy	Waterborne curing agent	81	85.5
Curing Agent			
Deionized water	Solvent	0	85
BYK019	Defoamer	0	0.4
BYK345	Surfactant	0.24	0.5
Raybo 60	Flash-rust inhibitor	0	2.8

Basic parameters

Solid content	%/%, by calculation	91%	63%
Mixing viscosity	mPa.s, 25°C rotary viscometer	53,600	12,600

Reaction & curing properties

Gel time	min, 100g gel timer	41.4	72.4
Tack-free / Cure-through time	hr, 23°C, 50% humidity, BYK dry time recorder	2.1/5.3	2.5/5.4
Tack-free / Cure-through time	hr, 10°C, 70% humidity, BYK dry time recorder	3/13.6	3.65/>24
Perozh hardness development	sec, 23°C, 50% humidity, 1/3 /5/7/14 days, GB/T 1730-93	N/A (surface is too rough)	55/135/138/156/170
Pencil hardness development	B-F-H23°C, 50% humidity, 1/3 /5/7/14 days, GB/T 6739-1996	H/2H/2H/3H/3H	H/2H/2H/3H/3H

TYPICAL DATA

Film properties after 7 days curing at 23°C, 50% humidity			
Gloss	°, 20°, glass substrate, GB/T 9754-2007	59	143
Cross-cut adhesion	0-5 level, fibre cement substrate, 120µm WFT, GB/T 9286-1998	0	1
Pull-off adhesion	MPa, concrete substrate, GB/T 5210-2006	>8.6, substrate failure	>7.6, substrate failure
Bending test	mm, tinplate substrate, 120µm WFT, GB/T 11185-2009	<3.7	<3.7
Impact test (dir./rev.)	Kg-cm, tinplate substrate 120µm WFT, GB/T 1732-1993	>100/>100	>100/>100
Abrasion test	mg, 1Kg mass, tinplate substrate, GB/T 1768-2006	56.3	38 - 1.8
Acid resistance	Appearance, 10% sulphuric acid 24hr, Q-Panel R35, 120µm WFT, GB/T 1763-1979 (immersing method)	Attack, small pits on the surface	Attack, small pits on the surface
Base resistance	Appearance, 20% sodium hydroxyl, 72hr, Q-Panel R35, 120µm WFT, GB/T 1763-1979 (immersing method)	Good	Good

OPERATION GUIDELINE

1. Aradur 38-1 Epoxy Curing Agent diluting

Aradur 38-1 Epoxy Curing Agent's solid content of is as high as 80% and its viscosity is about 15Pas. Customer can dilute Aradur 38-1 Epoxy Curing Agent according to certain requirement. The viscosity vs. water addition amount and viscosity vs. solid content curve like following figures:

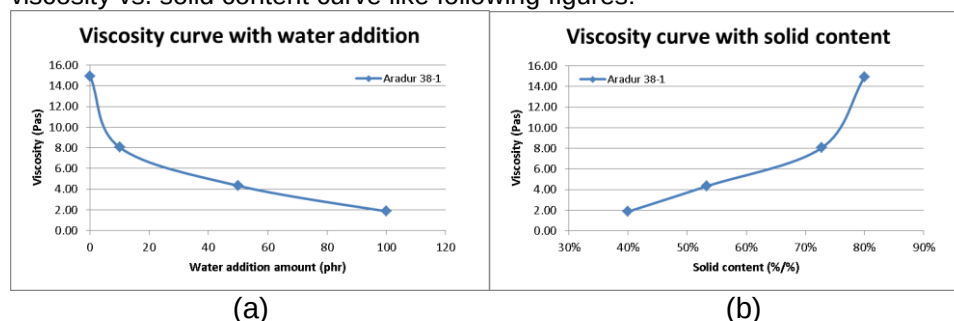


Fig.1 Aradur 38-1 Epoxy Curing Agent viscosity diluting curve:
(a) viscosity vs. Water addition amount; (b) viscosity vs. solid content

If necessary, customer can use polar solvent to diluent Aradur 38-1 Epoxy Curing Agent, such as alcohol.

**OPERATION
GUIDELINE**

2. Pigment & filler dispersing

2.1 Select pigment & filler

Aradur 38-1 Epoxy Curing Agent is water-based polyamine and behaves weak alkaline. Aradur 38-1 Epoxy Curing Agent should be formulated with neutral or alkaline pigment and filler. And pigment/filler should be compatible with amine system. In most cases, titanium dioxide like inorganic pigment is compatible with Aradur 38-1 Epoxy Curing Agent well. When using organic pigment, please confirm if it is compatible with water based system.

In most cases, TALC, barium sulfate, wollastonite, nepheline and calcium carbonate should be compatible with Aradur 38-1 Epoxy Curing Agent. However, the compatibility is highly dependent on the surface treatment of filler.

Pigment and filler's content, particle size will determine Aradur 38-1 Epoxy Curing Agent's formulation rheology, appearance and process properties. Generally speaking, higher viscosity is attributed to filler's higher content, lower size, higher oil absorption or better dispersing. Customer should adjust the pigment/filler type and content according to real process requirement.

2.2 Select dispersing agent

When dispersing pigment and filler in Aradur 38-1 Epoxy Curing Agent solution, suitable dispersing agent and right adding sequence is necessary. Water based silicone dispersing agent can disperse pigment and filler effectively, such as Disperbyk® 192. The amount of dispersing agent is depended on the filler volume.

2.3 Select dispersing process

Normally, high speed disperser and dispersing pan can disperse many kinds of pigment and filler effectively. The dispersing speed is dependent on the disperser capability and real field condition. If necessary, ball mill or triple roll mill should be used to disperse pigment & filler.

3. Additives selection and adding sequence

Water based silicone defoamer can eliminate foam in Aradur 38-1 Epoxy Curing Agent formulated system effectively while keep good compatibility, such as BYK 019, BYK 024 and etc. Water based silicone surfactant can wet substrate effectively, such as BYK 345, BYK 346 and etc. The addition amount of defoamer and surfactant is dependent on the total formulation amount.

When formulating Aradur 38-1 Epoxy Curing Agent system, following sequence can be followed :

- 1st step: add defoamer, dispersing agent and water, mix evenly with high speed ;
- 2nd step: add pigment, filler and increase mixing speed. Grid the mixture til the fineness is acceptable ;
- 3rd step: decrease mixing speed. Add surfactant, flash rush inhibitor, thickener or other additives. Then add water to decrease viscosity.

OPERATION GUIDELINE

4. Formulation tips

4.1 Adjust reacting/drying speed

To shorten tack-free period, alcohol or other fast drying polar solvent can be used. To shorten both tack-free period and cure-through period, Accelerator® 960-1 Hardener can be added into formulation. It also can be achieved by adding other faster drying curing agents, such as Aradur® 39 Hardener and Aradur® 3985 Epoxy Curing Agent.

To extend pot life, more solvent can be added, such as water, alcohol or propylene glycol monomethyl ether. It also can be achieved by adding acetic acid.

However, all of above method will change other performance.

4.2 Adjust film hardness

To increase film hardness, multi-functional epoxy can be added into formulation, such as Araldite® EPN1183 Resin, Araldite® EPN1179 Resin; To decrease the hardness and improve flexibility, reactive diluent can be added into formulation, such as Araldite DY-E diluent, Araldite® DY-38-101 diluent, Araldite® DY-D diluent.

4.3 Improve chemical resistance

Following approaches can be used to improve chemical resistance:

Method 1, increase epoxy stoichiometric ratio in formulation. 10% to 20% excess of epoxy part will improve the acid resistance while not decreasing other properties greatly;

Method 2, select right reactive diluent. Araldite® DY-K diluent have good acid resistance ;

Method 3, select multi-functional epoxy, such as Araldite EPN1183 Resin, Araldite EPN1179 Resin or Araldite® PZ 323 Epoxy Resin.

5. Application environment

Temperature below 10°C or humidity above 70% should be avoided. Good ventilation should be provided during application.

START FORMULATION

1. Clear coating-primer or topcoat

Part A (resin)	Description	phr	Supplier
Araldite GY 9708-3	Epoxy resin	100	Huntsman
Araldite DY-E	Reactive diluent	10	Huntsman
Part B (hardener)			
Aradur 38-1 Epoxy Curing Agent	Waterborne curing agent	85.5	Huntsman
Deionized water	Solvent	85	Local
BYK019	Defoamer	0.4	BYK
BYK345	Surfactant	0.5	BYK

Refer "typical data" part for more performance data

**START
FORMULATION****2. ECC - Epoxy Cement Concrete**

Part A (resin)	Description	phr	Supplier
Araldite PZ 33756/67	Epoxy resin	20.8	Huntsman
Deionized water	Solvent	11.4	Local
Part B (hardener)			
Aradur 38-1 Epoxy Curing Agent	Waterborne curing agent	10.7	Huntsman
Deionized water	Solvent	2.1	Local
Part C (filler)			
White cement	Cement	224.6	Local
Sand (0 - 3mm)	Filler	674.2	Local
Part D (water)			
Water	Solvent	56.2	Local

MIX RATIO

The optimum mix ratio for Araldite PY 33757 Resin and Aradur 38-1 Epoxy Curing Agent is 100: 85 parts by weight.
The optimum mix ratio for Araldite PZ 3961-1 Epoxy Resin and Aradur 38-1 Epoxy Curing Agent is 100 : 15 parts by weight.

Dependant on application and required properties the use of only 80% of recommended hardener amount might be preferable.

STORAGE

Aradur 38-1 Epoxy Curing Agent should be stored in a dry place, preferably in the sealed original container, at temperatures between 2 and 40°C. The product should not be stored exposed to direct sunlight. Stir before use.

**HANDLING
PRECAUTIONS**

Mandatory and recommended industrial hygiene procedures should be followed whenever our products are being handled and processed. For additional information please consult the corresponding product safety data sheets.

Legal Notice

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