

Ancamine[®] 2280 Curing Agent

DESCRIPTION

Ancamine 2280 curing agent is a modified cycloaliphatic polyamine intended for use as an ambient curing agent for liquid epoxy resin. It exhibits high chemical resistance and has the potential to replace aromatic amines that have been used previously. Chemical resistance properties can be further enhanced when multifunctional bisphenol F based resins are used. Besides that, Ancamine 2280 curing agent also exhibits an exceptional carbamation and early water spotting resistance.

Its high Gardner colour and tendency to yellowing upon UV radiation need to be considered in the final application.

ADVANTAGES

- Excellent chemical resistance
- Good low temperature cure
- Excellent resistance to amine blush and water-spotting especially at low temperature
- Non-corrosive according to EC Directives and not regulated for transport

APPLICATIONS

- Industrial flooring
- Chemically resistant tank lining and mortars
- High solids coatings
- Secondary containment

For enhanced low temperature reactivity it is recommended that Ancamine 2280 curing agent is accelerated with a co-curing agent or Ancamine K54 curing agent.

SHELF LIFE

At least 24 months from the date of manufacture in the original sealed container at ambient temperature.

PACKAGING AND HANDLING

Refer to the Safety Data Sheet for Ancamine 2280 curing agent.

TYPICAL PROPERTIES

Appearance	Amber Liquid
Colour¹ (Gardner)	max 13
Viscosity² @ 25°C, [mPa.s]	350-700
Amine Value³ (mg KOH/g)	235-275
Specific Gravity @ 21°C	1.08
Equivalent Wt/{H}	110
Recommended use Level⁴, [PHR]	58

TYPICAL HANDLING PROPERTIES

Mixed Viscosity² at 25°C, [mPa.s]	3,300
Gel Time⁵ (150g mix at 25°C), [mins]	50
Peak Exotherm (150g mix at 25°C), [°C]	121
Time to Peak Exotherm [mins]	80
Thin Film Set Time⁶ 25°C, [h]	7
Shore D⁷ 20°C (24 h)	70
Typical cure schedule 2- 7 days	

TYPICAL PERFORMANCE PROPERTIES

Compressive Strength⁸, [MPa]	71
Compressive Modulus⁸, [GPa]	2.0
Tensile Strength⁹, [MPa]	52
Tensile Modulus⁹, [GPa]	2.7
Flexural Strength¹⁰, [MPa]	94
Flexural Modulus¹⁰, [GPa]	2.1
Heat Distortion Temperature¹¹, [°C]	50
Carbamation Test¹²	5

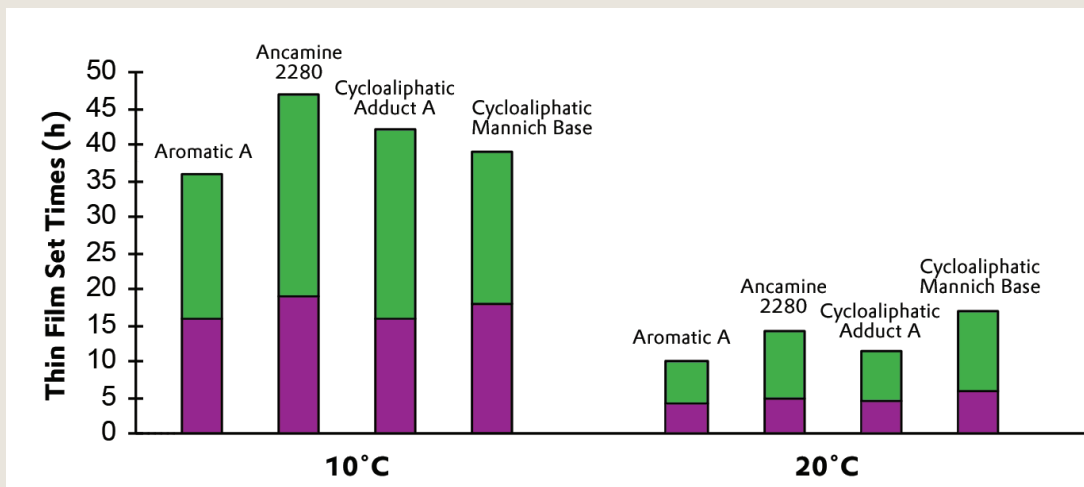
Footnotes:

- (1) ASTM D 1544-80
- (2) Brookfield RVTD, Spindle 4
- (3) Perchloric Acid Titration
- (4) With Bisphenol A diglycidyl ether (EEW=190)
- (5) Techne GT-3 Gelation Timer
- (6) BK Drying Recorder Phase III
- (7) DIN 53505
- (8) ISO 604
- (9) ISO 527
- (10) ISO 178
- (11) ASTM D648
- (12) Scale 1-5 (5 is best)

SUPPLEMENTARY DATA

RATE OF CURE: Thin film cure times are shown in Figure 1 for Ancamine 2280 curing agent and other standard cycloaliphatic and aromatic amine-based curing agents. Tack-free and hard-dry times were determined using a BK drying recorder at 10°C and 20°C for a 75micron film based on curing agent and an undiluted liquid bisphenol-A diglycidyl ether epoxy resin (EEW 190). At 20°C Ancamine 2280 curing agent shows similar cure speeds to standard cycloaliphatic products while slightly slower than the fast-setting aromatic. At 10°C Ancamine 2280 curing agent maintains similar cure speeds to the standard cycloaliphatic products and still compares favourably with the aromatic product.

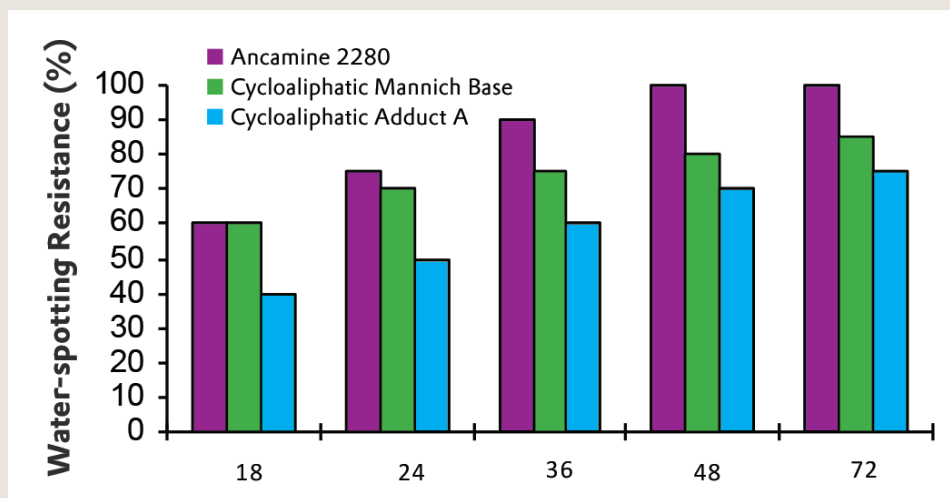
FIGURE 1: THIN FILM SET TIMES OF MODIFIED AROMATIC AND CYCLOALIPHATIC AMINES



EXCELLENT WATER-SPOTTING RESISTANCE: Curing agents were combined at recommended mix ratios with liquid epoxy resin (EEW 190); 200 micron films were applied to degreased steel panels and cured at 5°C, 90% RH. After 18, 24, 36, 48 and 72 hours, water-saturated cotton was placed on each film for 24 hours. The coatings were then evaluated for water-spotting resistance.

Although not providing the same degree of resistance to water-spotting as aromatic amines, which achieve 100% resistance within 18 hours, Figure 2 highlights the excellent performance of Ancamine 2280 curing agent in comparison with other standard cycloaliphatics. Ancamine 2280 curing agent is clearly superior to other standard cycloaliphatic curing agents and rapidly develops resistance to amine blush and exudation even when cured at reduced temperature (5°C) and high humidity (90% RH).

FIGURE 2: WATER-SPOTTING RESISTANCE OF CYCLOALIPHATIC AMINE CURING AGENTS



ADHESION: Data for adhesion on steel and concrete is presented for Ancamine 2280 curing agent and the standard cycloaliphatic and aromatic amines. Adhesion on steel is measured by the 'cross-hatch' method i.e. curing agent and liquid resin (EEW 190) is mixed at the recommended use levels and then applied as a coating to the steel substrate and allowed to cure for 7 days at 25°C. After this time cross-hatches are cut into the coating and the adhesion of the coating at the edges of the cut is assessed and rated accordingly to ASTM and DIN standards. Adhesion on concrete is measured by the 'pull-off' method i.e. curing agent and liquid resin (EEW 190) is mixed at the recommended use level and then applied as a coating to the concrete substrate and allowed to cure at 25°C until tack-free (but not hard-dry). Degreased aluminium 'dollies' are then bonded to the coating. The test piece is then allowed to cure for 7 days at 25°C, at which time a force-measuring device is used to pull off the dollies - the force at failure and type of failure are recorded. Table 1 confirms the excellent adhesion properties of Ancamine 2280 curing agent on steel. Ancamine 2280 curing agent displays adhesion comparable to the other cycloaliphatics and is clearly superior to the aromatic products. On concrete, in all cases substrate failure occurred before the coating/substrate bond failed.

TABLE 1: ADHESION OF CYCLOALIPHATIC AND AROMATIC AMINE CURING AGENTS

Substrate	Aromatic A	Aromatic B	Ancamine 2280	Cyclo Adduct A	Cyclo Adduct B	Cyclo Mannich Base
Steel						
ASTM	0	2	4	4	4	4
DIN	5	3	1	1	1	1
NB. ASTM scale: 0 = poor; 5 = very good. DIN scale: 0 = very good; 5 = poor						
Concrete						
kg/cm ²	48	47	47	45	42	40
Substrate Failure in all cases.						

EXCELLENT CHEMICAL RESISTANCE: Curing Agents were mixed with bisphenol A-based liquid epoxy (EEW 190) at recommended use levels and cured for 7 days at ambient temperature before immersion in various reagents. Table 2 presents immersion resistance data for Ancamine 2280 curing agent in comparison with standard cycloaliphatic products and a standard aromatic product — following 3 weeks and 3 months immersion at ambient temperature the % weight loss or gain was recorded.

This test regime can be used to test for suitability to tank-lining applications and many of the reagents chosen reflect the types of materials commonly encountered in such storage applications. Results in Table 2 indicate that Ancamine 2280 curing agent when combined with bisphenol A epoxy, provides excellent chemical resistance to many typical solvents, acids and bases and is comparable to standard aromatic product performance. Furthermore, it develops chemical resistance at a rate comparable to, or slightly faster than other standard cycloaliphatic products and it maintains its performance over a long time period. This data also confirms the suitability of Ancamine 2280 curing agent as a cost-effective replacement for other standard cycloaliphatic products in many flooring and coating applications.

TABLE 2: COMPARATIVE CHEMICAL RESISTANCE WITH BISPHENOL A EPOXY

Reagent	Immersion Time	Aromatic B	Ancamine 2280	Cyclo Mannich Base	Cyclo Adduct C
Xylene	3 week	—	0.1	0.4	1.0
	3 month	—	0.01	0.9	-1.0
Toluene	3 week	Destroyed	2.3	3.3	6.6
	3 month	—	6.5	11.8	17.3
Trichlorethane	3 week	0.2	0.1	0.0	0.3
	3 month	1.1	0.1	0.0	0.5
Ethylene Glycol Monobutyl Ether	3 week	—	2.4	6.5	2.5
	3 month	—	5.1	13.5	5.5
Methyl Ether Ketone	3 week	Destroyed	Destroyed	Destroyed	Destroyed
	3 month	—	—	—	—
Ethanol	3 week	—	6.9	10.7	5.0
	3 month	—	3.5	5.8	3.2
Skydrol	3 week	—	-0.3	-0.1	-0.3
	3 month	—	-0.7	-0.3	-0.8
D.I. Water	3 week	0.3	1.2	0.9	1.1
	3 month	0.5	1.7	1.7	1.6
10% Acetic Acid	3 week	0.3	5.4	5.0	4.6
	3 month	0.5	9.6	9.1	8.2
5% Acetic Acid	3 week	—	2.6	2.1	2.8
	3 month	—	4.4	3.6	4.8
10% Lactic Acid	3 week	—	1.9	2.5	1.7
	3 month	—	3.4	4.6	2.9
70% Sulphuric Acid	3 week	0.2	0.2	0.2	0.0
	3 month	1.2	0.2	0.1	-0.1
50% NaOH	3 week	0.1	-0.2	-0.2	-0.2
	3 month	-0.1	-0.2	-0.3	-0.3

SUMMARY: In summary, the performance for Ancamine 2280 curing agent confirms that it can be considered as a safer alternative to standard aromatic curing agents for many applications requiring high chemical resistance e.g. tank linings, mortars. Furthermore, Ancamine 2280 curing agent can be considered as a cost-effective replacement for standard cycloaliphatic curing agents for many applications such as industrial floorings and coatings.

A starting formulation for a high build grey enamel-like coating is displayed at the back of this technical bulletin (Appendix 1). In addition, information regarding Ancamine 2280 curing agent compatibility with a range of coal tars is also included at the back of this bulletin (Appendix 2) and highlights the compatibility of Ancamine 2280 curing agent with most common coal tars in ratios up to 3 parts coal tar to 1 part curing agent. Coal tar based formulations are commonly used in applications requiring high resistance to water e.g. ballast tank linings, sewer pipe coatings, waste-water pipe coatings.

APPENDIX 1: HIGH BUILD GREY ENAMEL STARTING POINT FORMULATION

Component A	Parts by weight
Liquid DGEBA (EEW190)	450
Cresyl Glycidyl Ether	100
Titanium Dioxide	150
Black iron oxide	2.0
Wetting agent Nuospense 657	1.5
Flow control additives (ByK 320)	1.0
Defoamer (3M FC430)	0.6
	705.1
Component B	
Ancamine 2280 curing agent	303
Mixed Properties	
Mixed Viscosity	75
Pot life (150 g mass), min.	6.5
Thin film set time at 25°C, h	4.6
PVC, %	4.6
Cured Film Properties — after 7-day ambient cure	
Pencil hardness	HB
Gloss 60'	105
MEK Double Rubs	200+

APPENDIX 2: COAL TAR COMPATABILITY OF ANCAMINE 2280 — COAL TAR COMPATIBILITY AT 60 °C

Modifier		Aromatic B	Aromatic B	Ancamine 2280	Cyclo Mannich Base
Orgol No. 1	1/1	1	1	1	1
	2/1	1	1	1	1
	3/1	1	1	1	1
Special Pitch No. 5	1/1	1	1	1	1
	2/1	1	1	1	1
	3/1	1	1	1	1
Coalite PS523	1/1	1	1	1	1
	2/1	0	0	1	1
	3/1	0	0	1	1
Ruta Mod 5	1/1	1	1	1	1
	2/1	1	1	1	1
	3/1	1	1	1	1
Ruta Mod 1 & 5	1/1	1	1	0	0
	2/1	1	1	0	0
	3/1	1	1	0	0

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