AIR PRODUCTS

Epoxy Curing Agents and Modifiers

Ancamine® 1618 Curing Agent

DESCRIPTION

Ancamine 1618 curing agent is a low color, low viscosity modified cycloaliphatic amine intended for ambient or low temperature curing of liquid epoxy resins. Ancamine 1618 gives high gloss films that are resistant to a variety of chemicals. These properties make it ideal for formulating floorings, maintenance coatings, tank linings, and secondary containment linings. It's very low color and good color stability make it appropriate for clear and pastel shade coatings.

ADVANTAGES

- Very low color and good color stability
- Good chemical resistance (see attached)
- High gloss
- Good resistance to amine blush
- Low viscosity

APPLICATIONS

- High-solids coatings
- Self-leveling and pebble finish flooring
- Chemically resistant tank linings, mortars, and grouts
- Decorative tile grouts

STORAGE LIFE

At least 24 months from the date of manufacture in the original sealed container at ambient temperature. Store away from heat and excessive humidity in tightly closed containers.

HANDLING PRECAUTIONS

Refer to the Material Safety Data Sheet for Ancamine 1618 curing agent.

TYPICAL CURE SCHEDULE

2–7 days at ambient temperature.

TYPICAL PROPERTIES	
Appearance	Water-White Liquid
Color (Gardner)	1
Viscosity @ 77 °F (cP)	400
Amine Value (mg KOH/g)	272
Specific Gravity @ 77 °F	1.03
Density @ 77 °F (lb/gal)	8.6
Flash Point (closed cup) (°F)	205
Equivalent Wt/{H}	113
Recommended Use Level (phr, EEW=190)	60

TYPICAL HANDLING PROPERTIES*	A*	B*
Use Level (phr)	60	58
Mixed Viscosity @ 77 °F (cP)	2,400	1,370
Gel Time (150g mix @ 77 °F) (min)	50	74
Thin Film Set Time		
@ 77 °F (hr)	5.5	7.3
@ 50 °F (hr)	—	19
Peak Exotherm (100g mix @ 77 °F) (°F)	196	—
Peak Exotherm Time (min)	60	—

TYPICAL PERFORMANCE* (7 day cure @ 77 °F)		
Glass Transition Temperature (°F)	123	111
Compressive Strength @ Yield (psi)	—	9,500
Compressive Modulus (thousand psi)	—	312
Tensile Strength (psi)	7,140	6,100
Tensile Modulus (thousand psi)	322	204
Tensile Elongation (%)	—	7.0
Flexural Strength (psi)	13,380	10,100
Flexural Modulus (thousand psi)	344	378
Hardness (Shore D)	81	82
Abrasion Resistance Weight Loss @ 1,000 cycles with wheel no. 10 (gm)	—	0.056
Mar Resistance (kg)	—	1.05
Heat Deflection Temperature (°F)	115	—
Bond Strength (mild steel to mild steel) (psi)	820	—

* Ancamine 1618 curing agent formulated with standard Bisphenol-A based (DGEBA, EEW=190) epoxy resin.

B* Ancamine 1618 curing agent with 90% DGEBA resin (EEW=190) and 10% Epodil® 748 diluent (C_{12}–C_{14} alkyl glycidyl ether).

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SUPPLEMENTARY DATA

Chemical Resistance

Chemical immersion studies following ASTM D543 were performed using Ancamine 1618 formulations cured for 7 days at 77 °F. Ancamine 1618 curing agent was mixed in the recommended use levels with the following resins:

- 100% Bisphenol-A based liquid resin (EEW=190)
- 100% Bisphenol-F based liquid resin (EEW=172)
- 60 % Bisphenol-F (EEW=172) / 40% multifunctional epoxy novolac (EEW=176) resin blend
- 10% Cresyl glycidyl ether (CGE - Epodil 742) diluted Bisphenol-A resin (EEW=188)

Three samples were tested for each reagent. Table 1 shows the percent weight gain or loss after 3 days and 28 days for each of these formulations immersed in various chemicals at 77 °F.

Table 1

Chemical Resistance for Ancamine 1618 Formulations
% Weight Change as a Function of Time

REAGENT	with Bis-A Based Resin (EEW=190)		with Bis-F Based Resin (EEW=172)		with 60% Bis-F / 40% Novolac Blend		with 10% CGE Diluted Bis-A Resin	
	3 days	28 days	3 days	28 days	3 days	28 days	3 days	28 days
Deionized Water	0.49	1.50	0.58	1.74	0.59	1.68	0.53	1.53
Methanol	7.93	-2.41	13.01	Dest.	11.88	1.26	12.90	2.52
Ethanol	3.98	10.28	3.61	9.58	2.98	8.58	4.26	10.01
Toluene	0.40	2.86	0.05	0.78	4.99	0.68	0.46	5.64
Xylene	0.04	0.19	0.11	0.09	-0.03	0.05	0.04	0.58
Butyl Cellosolve	1.65	5.31	1.03	3.62	0.75	2.80	1.97	7.74
MEK	Dest.	Dest.	16.63	Dest.	18.25	13.20	Dest.	Dest.
10% Lactic Acid	1.81	5.42	1.51	4.80	1.75	5.09	0.92	3.04
10% Acetic Acid	2.92	8.23	2.29	6.95	2.83	7.68	1.95	5.95
70% Sulfuric Acid	0.08	0.14	0.11	0.45	0.22	0.35	0.02	0.10
98% Sulfuric Acid	Dest.	Dest.	0.77	-9.32	0.36	-6.10	Dest.	Dest.
50% Sodium Hydroxide	-0.01	-0.04	-0.01	-0.01	-0.04	-0.05	-0.03	-0.09
10% Sodium Hypochlorite	0.51	1.36	0.54	1.48	0.51	1.31	0.51	1.33
1,1,1 Trichloroethane	0.02	-0.02	0.02	0.29	0.05	0.34	0.05	0.32

Dest. = Samples destroyed

Spillage resistance studies were conducted on Ancamine 1618 curing agent formulated with a 90% bis-A resin (EEW=190) and 10% Epodil 748 diluent (C12-C14 alkyl glycidyl ether) blend. Samples were cured for 7 days at 77 °F; three samples were tested for each reagent. The immersion/recovery schedule for the testing is shown in Table 2. Percentage weight change and Shore D hardness were measured after each of the immersion periods. The samples were then allowed to recover before reimmersion for the next time period. Hardness retention is relevant in flooring applications where it indicates the ability of the floor to support traffic after exposure to chemical spills. Results of this study are presented in Table 3.

Table 2

Spillage Resistance Test Method Schedule

Castings of 1/8" thickness are immersed for specified time period.
Sample is then removed, weighed, and hardness tested immediately.
Sample is then allowed to recover for specified time before re-immersion.

3 hr imm → test → 24 hr recover → 24 hr imm → test → 24 hr recover → 3 day imm → test → 3 day recover → 7 day imm → test → 7 day recover → 28 day imm → test → 7 day recover → 90 day imm → test

Table 3

Spillage Resistance for Ancamine 1618 with 90% DGEBA / 10% Epodil 748
% Weight Change and Shore D Hardness as a Function of Time

REAGENT	Initial Hard.	After 3 hr		After 24 hr		After 3 days		After 7 days		After 28 days		After 90 days	
		% wt.	Hard	% wt.	Hard	% wt.	Hard	% wt.	Hard	% wt.	Hard	% wt.	Hard
10% Acetic Acid	82	0.32	80	1.07	74	2.12	72	3.31	73	5.44	69	7.82	58
10% Lactic Acid	82	0.17	81	0.59	80	1.25	80	1.94	78	3.07	76	4.07	67
Toluene	82	0.01	79	0.82	72	3.83	68	9.18	62	17.75	53	19.15	48
Xylene	82	0	79	0.02	76	0.32	74	1.20	68	6.90	66	13.05	56
Trichloroethane	82	0.32	77	0.64	76	2.72	72	5.92	65	18.49	64	35.93	58
Methanol	82	3.08	65	8.06	35	6.89	26	DESTROYED					
Ethanol	82	0.91	75	2.64	71	5.06	67	7.93	60	5.77	54	2.60	69
Butyl Cellosolve	82	0.19	78	1.10	74	3.20	65	5.40	61	10.79	56	26.9	46
Methyl Ethyl Ketone	82	6.19	60	DESTROYED									
Skydrol	82	0.06	77	0.10	77	0.30	77	0.71	77	1.36	78	2.55	67
70% Sulfuric Acid	82	0.13	81	0.06	80	0.05	81	0.06	79	-0.01	81	-0.10	80
98% Sulfuric Acid	82	-14.45	75	DESTROYED									
Deionized Water	82	0.16	82	0.35	82	0.57	81	0.94	82	1.54	80	1.47	79
50% Sodium Hydroxide	82	0.07	80	-0.05	82	-0.08	81	-0.10	81	-0.19	80	-0.28	66
Bleach	82	0.28	80	0.48	80	0.73	81	1.01	81	1.24	79	1.37	68

Note: Samples cured for 7 days at 77 °F before testing.

These studies show that Ancamine 1618 curing agent provides very good chemical resistance to a variety of solvents, acids, and bases, which makes it useful in formulating flooring, linings, and grouts. Chemical resistance of 1618-based formulations can be optimized for specific chemicals using different resin blends. For information on the chemical resistance of many other Air Products curing agents, please refer to publication number 125-9326 (Rev 1996): "Chemical Resistance for Ambient Cure Epoxy Formulations."

Cure Speed

The thin film set time of Ancamine 1618 curing agent with standard bisphenol-A resin (DGEBA, EEW=190) in a 6 mil film is 5.5 hours at 77 °F. Using a 90% bisphenol-A resin / 10% Epodil 748 diluent blend, the thin film set time is 7.3 hours at 77 °F and 19 hours at 50 °F. To speed thin film set time and hardness development, Ancamine 1618 can be accelerated with modified aliphatic amine curing agents such as 10% Ancamine 2089M, 10% Ancamine 2432, or 10% Ancamine 2481.