Epoxy Curing Agents and Modifiers

ANCAMINE® 2481 Curing Agent

DESCRIPTION

Ancamine 2481 curing agent is a modified aliphatic amine intended for use with liquid epoxy resins. Ancamine 2481 curing agent imparts rapid cure and development of physical properties at ambient and low temperatures. It yields formulations with excellent film appearance. Compared with other fast cure hardeners, it has very good amine blush resistance, even at low temperatures. These properties make Ancamine 2481 curing agent ideal for formulating flooring, mortars and high-solids coatings. It is also an effective accelerator for other curing agents in epoxy formulations.

BENEFITS

- Rapid cure and property development at ambient and low temperatures
- Excellent blush and waterspot resistance
- Good set time / pot life balance

APPLICATIONS

- Self-leveling flooring
- High-solids coatings
- Concrete adhesives and repair mortars
- Accelerator for other curing agents

SHELF LIFE

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

STORAGE AND HANDLING

Refer to the Safety Data Sheet for Ancamine 2481 curing agent.

TYPICAL CURE SCHEDULE

2–7 days at ambient temperature.

TABLE 1: TYPICAL PROPERTIES

Appearance	Light Yellow Liquid
Color (Gardner) [1]	2
Viscosity @ 77°F (cP) [2]	1,000
Amine Value (mg KOH/g) [3]	415
Specific Gravity @ 77°F [4]	1.03
Flash Point (°F) [5]	248
Equivalent Wt/{H}	90
Recommended Use Level (phr, EEW=190)	47

TABLE 2: TYPICAL HANDLING PROPERTIES

	A*	B*
Use Level (phr)	47.3	45.7
Mixed Viscosity @ 77°F (cP) [2]	4,470	1,620
Gel Time @ 77°F (150 g mix) (min) [6]	18	22
Thin Film Set Time [7]		
@ 77°F (h)	2.7	3.2
@ 40°F (h)	8.5	15

TABLE 3: TYPICAL PERFORMANCE

(7 day cure @ 77°F)	**A***	**B***
Glass Transition Temp (°F) [8]	131	126
Compressive Strength @ yield (psi) [9]	12,500	9,100
Compressive Modulus (thousand psi) [9]	340	258
Tensile Strength (psi) [10]	9,400	7,900
Tensile Modulus (thousand psi) [10]	495	395
Tensile Elongation @ break (%) [10]	2.6	3.9
Flexural Strength (psi) [11]	11,800	11,000
Flexural Modulus (thousand psi) [11]	136	184
Hardness (Shore D) [12]	85	84
60° Specular Gloss cured @ 77°F [13]	119	131
60° Specular Gloss cured @ 40°F [13]	112	123
20° Specular Gloss cured @ 77°F [13]	81	108
20° Specular Gloss cured @ 40°F [13]	76	88

A* Ancamine 2481 formulated with standard bisphenol-A (DGEBA, EEW=190) resin

B* Ancamine 2481 curing agent with 90% Bisphenol-A based resin (EEW=190) and 10% Epodil® 748 reactive diluent (C_{12}–C_{14} alkyl glycidyl ether) blend.

SUPPLEMENTARY DATA

Hardness Development: Gel time and thin film set time define the development of cure, however, they may not predict the development of hardness accurately. Shore D hardness development was measured for Ancamine 2481 curing agent-based formulations at 77°F and 40°F cure temperatures with a casting that was 1/4″ thick and 3″ in diameter. Results are presented below:

TABLE 4: ANCAMINE 2481 FORMULATION HARDNESS DEVELOPMENT

	Number of Days of Cure		
	1 day	3 days	7 days
With bisphenol-A based (EEW=190) resin:			
77°F Cure Shore D Hardness[12]	80	85	85
40°F Cure Shore D Hardness[12]	50	81	84
With 90% bisphenol-A resin / 10% Epodil 748 diluent blend:			
77°F Cure Shore D Hardness[12]	75	82	84
40°F Cure Shore D Hardness[12]	44	80	82

The fast cure and rapid hardness development of formulations cured with Ancamine 2481 curing agent make it ideal for flooring, coatings and mortars applied at ambient or low temperatures. Even at temperatures as low as 40°F, Ancamine 2481 curing agent gave a Shore D hardness of 50 within 24 hours. This indicates that it is possible to formulate a system with Ancamine 2481 curing agent that gives less than a one day return to service even at low temperatures.

Blush Resistance: Unlike many other fast curing agents, Ancamine 2481 curing agent gives high-gloss films with very low or no amine blush when cured at ambient and low temperatures. As an example, Ancamine 2481 curing agent with standard bis-A resin gives a 60° gloss of 119 when cured at 77°F, while Ancamine 1768 curing agent, a standard fast cure modified aliphatic amine gives a gloss of only 36 under the same conditions. Ancamine 2481 curing agent does not lose its high gloss characteristics even under low temperature conditions, with a 60° gloss of 112 when cured at 40°F. Most other "fast cure" aliphatic amine hardeners show heavy amine blush and film haziness under low temperature conditions.

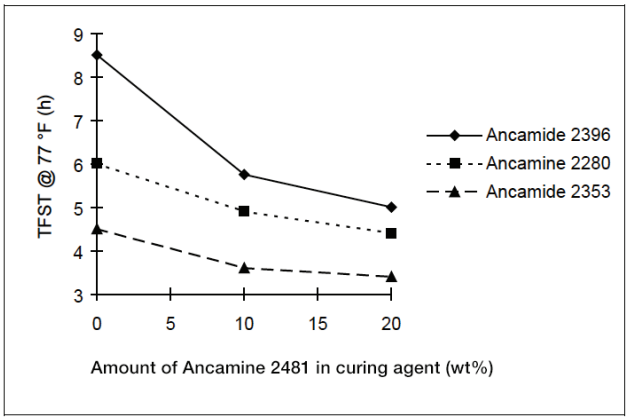
Waterspot Resistance: Ancamine 2481 curing agent provides very good resistance to waterspotting, which is caused by water drops contacting a coating before it is completely cured. To illustrate this, a waterspot test was run by curing a 10 mil film of Ancamine 2481 curing agent with 90% bisphenol-A based resin (EEW=190) and 10% Epodil® 748 diluent blend at 72°F. After eight hours, a cotton ball saturated with water was placed on the film, and the film was then cured further for 24 hours at 72°F and 90% relative humidity. After this period, the 2481 film showed no white spots, indicating very good waterspot resistance.

Accelerating with Ancamine 2481: Ancamine 2481 can be used with other curing agents to accelerate cure at ambient and low temperatures. The effect on thin film set time of Ancamine 2481 curing agent added at 10% and 20% was studied for the following curing agents:

- Ancamine 2280—modified cycloaliphatic amine
- Ancamide® 2353 curing agent—modified polyamide
- Ancamide 2396—modified amidoamine

The following charts show the effect of the Ancamine 2481 curing agent addition (as a percentage of the total curing agent component) on 40 °F and 77 °F thin film set time (TFST) with standard bisphenol-A (DGEBA, EEW=190) resin.

Acceleration with Ancamine 2481 Curing Agent at 77°F



Acceleration with Ancamine 2481 at 40°F

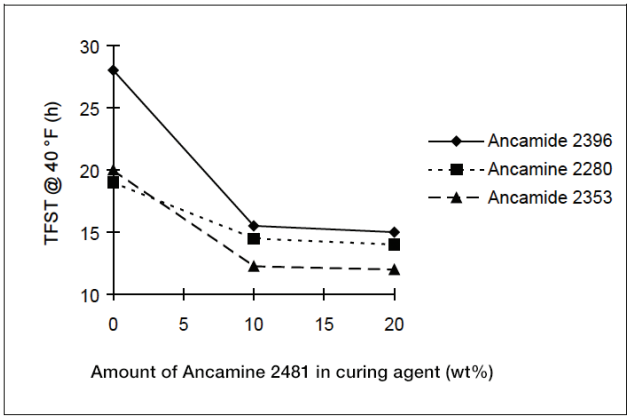


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TABLE 5: CURING AGENTS ACCELERATED WITH ANCAMINE 2481

	Ancamine 2280	Ancamide 2353	Ancamide 2396
77°F Thin Film Set Time[7] (h):			
With no Ancamine 2481	6.0	4.5	8.5
10% Ancamine 2481	4.9	3.6	5.8
20% Ancamine 2481	4.4	3.4	5.0
40°F Thin Film Set Time[7] (h):			
With no Ancamine 2481	19	20	28
10% Ancamine 2481	15	12	16
20% Ancamine 2481	14	12	15

Adding Ancamine 2481 curing agent greatly improves set time, especially at low temperatures. Adding just 10% Ancamine 2481 reduces 40°F thin film set time by 25% or more for these curing agents. Its fast cure makes Ancamine 2481 curing agent an effective accelerator for formulations where quick return to service is important. Because of its blush and waterspot resistance, Ancamine 2481 curing agent will not affect the appearance of the base curing agent as might other accelerators.

Footnotes:

(1) ASTM D 1544-80

(2) ASTM D-445-83, Brookfield, RVTD, Spindle 4

(3) Perchloric Acid Titration

(4) ASTM D 1475-85

(5) Seta Flash Closed Cup

(6) Techne GT-4 Gelation Timer

(7) BK Drying Recorder

(8) ASTM D 3418-82

(9) ASTM D 695-85

(10) ASTM D 638-86

(11) ASTM D 790-86

(12) ASTM D 2240-86

(13) ASTM D 523-85

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