

**ANCAMIDE® 2396** Curing Agent**DESCRIPTION**

Ancamide 2396 curing agent is a modified amidoamine intended for use at ambient temperature with liquid epoxy resins. Compared with standard amidoamines, it imparts better chemical resistance, improved film appearance, better low temperature cure and resistance to blush. Ancamide 2396 curing agent is ideal for systems applied to concrete, such as trowelable flooring, self-leveling flooring, grouts and concrete primers.

**ADVANTAGES**

- Very good chemical resistance
- Excellent adhesion to cold, damp concrete
- Improved film appearance
- Long pot life
- Good strength and modulus

**APPLICATIONS**

- Concrete primers, adhesives and bonding agents
- Self-leveling and trowelable flooring
- Tile grouts
- Chemically-resistant mortars and grouts

**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 Ancamide 2396 curing agent.

**TYPICAL CURE SCHEDULE**

7 days at ambient temperature.

**TABLE 1: TYPICAL PROPERTIES**

<b>Appearance</b>	Amber Liquid
<b>Color (Gardner) <sup>1</sup></b>	8
<b>Viscosity @ 77°F (cP) <sup>2</sup></b>	
@ 77°F	680
@ 50°F	5,000
<b>Amine Value (mg KOH/g) <sup>3</sup></b>	350
<b>Specific Gravity @ 77°F <sup>4</sup></b>	0.993
<b>Flash Point (closed cup) (°F) <sup>5</sup></b>	267
<b>Equivalent Wt/{H}</b>	93
<b>Recommended Use Level (phr, EEW=190)</b>	49

**TABLE 2: TYPICAL HANDLING PROPERTIES**

	A*	B*
<b>Mixed Viscosity @ 77°F (cP) <sup>2</sup></b>	3,700	1,440
<b>Gel Time (150g mix @ 77°F) (min) <sup>6</sup></b>	102	145
<b>Gel Time (150g mix @ 50°F) (min) <sup>6</sup></b>	137	245
<b>Thin Film Set Time (hr) <sup>7</sup></b>		
@ 77°F	8.5	12
@ 50°F	14	35
@ 40°F	28	35
<b>Peak Exotherm (°F) (150 g mix @ 77°F) <sup>8</sup></b>	178	116

**TABLE 3: TYPICAL PERFORMANCE\***

	A*	B*
<b>(7 day cure @ 77°F)</b>		
<b>Glass Transition Temperature (°F) <sup>9</sup></b>	137	126
<b>Compressive Strength @ Yield (psi) <sup>10</sup></b>	13,600	10,900
<b>Compressive Modulus (thousand psi) <sup>10</sup></b>	345	279
<b>Tensile Strength (psi) <sup>11</sup></b>	8,600	8,700
<b>Tensile Modulus (thousand psi) <sup>11</sup></b>	243	190
<b>Tensile Elongation @ Break (%) <sup>11</sup></b>	4.3	8.6
<b>Flexural Strength (psi) <sup>12</sup></b>	17,300	13,600
<b>Flexural Modulus (thousand psi) <sup>12</sup></b>	496	389
<b>Hardness (Shore D) <sup>13</sup></b>	82	81

A\* Ancamide 2396 formulated with DGEBA (EEW=190) resin

B\* Ancamide 2396 with 90% DGEBA resin (EEW=190) and 10% Epodil® 748 diluent (C<sub>12</sub>-C<sub>14</sub> alkyl glycidyl ether) blend

Note: Please see last page for footnotes.

## SUPPLEMENTARY DATA

**Chemical Resistance:** Chemical immersion studies following ASTM D543 were performed on coupons formulated with Ancamide 2396 and Ancamide 500 (a standard amidoamine) curing agents. Both were formulated with DGEBA (EEW=190) resin and cured for 7 days at 77°F. Table 4 shows the percent weight change after 3 days and 28 days in various chemicals at 77°F.

Spillage resistance studies were conducted on Ancamide 2396 curing agent formulated with a 90% DGEBA 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 5. Percent weight change and Shore D hardness were measured after each of the immersion periods. Hardness retention is relevant in flooring applications because it indicates the ability of the floor to support traffic after exposure. Results of this study are presented in Table 6.

These studies show that compared with standard amidoamines, Ancamide 2396 curing agent imparts superior chemical resistance to a variety of solvents, inorganic acids and bases. This resistance makes Ancamide 2396 a cost-effective alternative to standard amidoamines when moderate chemical resistance is required.

**TABLE 4: CHEMICAL RESISTANCE FOR ANCAMIDE 2396 FORMULATION VS. ANCAMIDE 500 FORMULATION**  
**% WEIGHT CHANGE AS A FUNCTION OF TIME—CONTINUOUS IMMERSION**

Reagent	3 day % Weight Change		28 day % Weight Change	
	Ancamide 2396	Ancamide 500	Ancamide 2396	Ancamide 500
Deionized Water	0.26	0.53	0.96	1.53
Methanol	8.55	Not Tested	15.93	Not Tested
Ethanol	3.56	8.91	8.63	20.16
Toluene	12.80	Destroyed <24 hours	Destroyed between 7 and 14 days	
Xylene	1.12	Not Tested	11.61	Not Tested
Butyl Cellosolve	3.52	6.05	13.55	18.42
MEK	Destroyed between 1 and 3 days	Destroyed <24 hours		
10% Lactic Acid	0.87	4.49	3.16	10.35
10% Acetic Acid	2.78	8.15	7.68	19.03
10% Sulfuric Acid	0.38	1.19	1.21	3.08
70% Sulfuric Acid	0.26	1.09	1.05	3.86
98% Sulfuric Acid	Destroyed < 24 hours	Not Tested		Not Tested
50% Sodium Hydroxide	-0.10	Not Tested	-0.10	Not Tested
10% Sodium Hydrochlorite	0.25	Not Tested	0.67	Not Tested
1,1,1, Trichloroethane	0.25	Destroyed between 1 and 3 days	1.17	
10% Hydrochloric Acid	0.25	0.72	0.83	2.04
40% Nitric Acid	3.28	3.79	Destroyed between 14 and 28 days	Destroyed between 14 and 28 days

Note: Samples were formulated with DGEBA (EEW=190) resin and cured for 7 days at 77°F before testing. They were tested in accordance with ASTM D543-84.

**TABLE 5: 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 6: SPILLAGE RESISTANCE FOR ANCAMIDE 2396 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
<b>10% Acetic Acid</b>	81	0.34	81	1.30	77	2.55	75	4.13	73	7.11	70	11.2	62
<b>Toluene</b>	81	0.06	80	3.20	72	13.5	47	DESTROYED					
<b>Xylene</b>	81	0.01	81	0.55	79	2.86	74	6.33	68	14.3	56	25.9	49
<b>Trichloroethane</b>	81	0.00	80	0.44	79		77	6.27	73	13.9	64	25.7	62
<b>Methanol</b>	81	1.90	71	5.45	52	10.2	42	15.7	27	14.5	22	13.8	22
<b>Ethanol</b>	81	0.71	78	2.35	69	4.49	64	6.95	59	12.5	50	13.8	37
<b>Butyl Cellosolve</b>	81	0.11	80	1.19	76	3.78	71	6.96	64	13.2	57	DESTROYED	
<b>Methyl Ethyl Ketone</b>	81	2.48	70	14.8	35	DESTROYED							
<b>Skydrol</b>	81	0.06	80	0.15	79	0.33	79	2.62	79	1.06	79	1.73	78
<b>70% Sulfuric Acid</b>	81	0.07	81	0.13	81	0.21	80	0.37	81	0.62	81	0.96	81
<b>98% Sulfuric Acid</b>	81	-5.59	69	DESTROYED									
<b>Deionized Water</b>	81	0.02	80	0.12	80	0.32	80	0.57	80	1.48	80	1.52	80
<b>50% Sodium Hydroxide</b>	81	-0.01	81	-0.03	81	-0.03	81	0.01	81	-0.01	81	-0.04	81
<b>Bleach</b>	81	0.04	81	0.14	80	0.29	79	0.45	79	-0.57	79	-0.45	78

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

**Cure Speed:** The thin film set time of Ancamide 2396 curing agent with DGEBA resin in a 3 mil film was 8.5 hours at 77°F and 28 hours at 40°F. Using a 90% DGEBA resin/10% Epodil 748 diluent blend, the thin film set time was 12 hours at 77°F and 35 hours at 40°F. This demonstrates that Ancamide 2396 develops better through-cure at low temperatures than standard amidoamine curing agents.

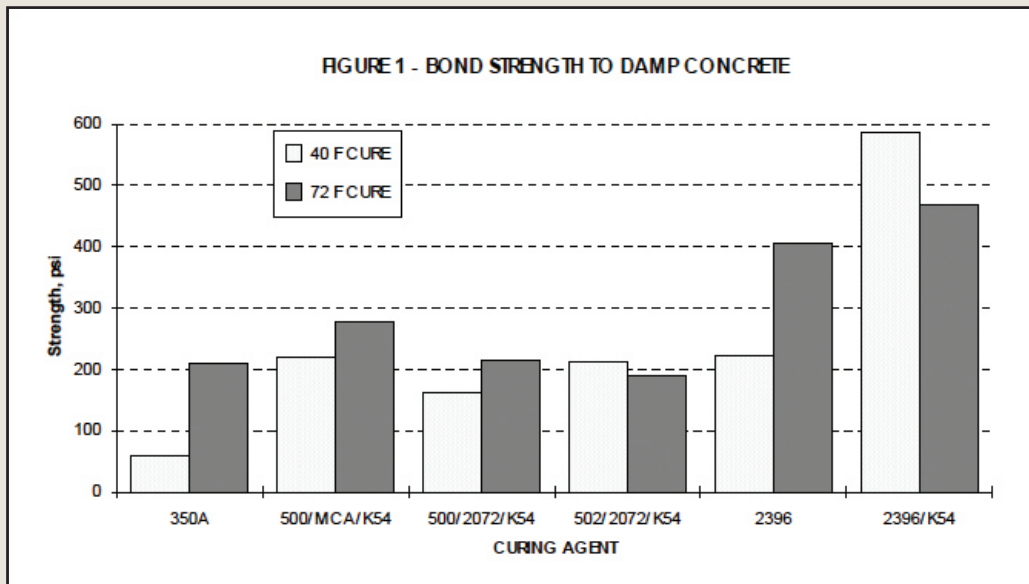
To speed up thin film set time and hardness development at ambient temperatures, Ancamide 2396 curing agent can be accelerated with the addition of 3-5% Ancamine K54 or aliphatic amine curing agents such as 10% Ancamine 1638, 10% Ancamine 1768 or 10% Ancamine 2205 curing agent. Either Ancamine 1856 or Ancamine 2205 curing agent is recommended for low-temperature (<55°F) acceleration.

Ancamide 2396 curing agent gives improved film appearance over standard amidoamine curing agents. In civil engineering coatings applications, a 25-minute induction time is recommended for optimal film formation without amine exudate.

**Bond Strength:** Compared with standard amidoamines or polyamides, Ancamide 2396 curing agent imparts superior adhesion to damp concrete at ambient and low temperature conditions. Ancamide 2396 was tested against Ancamide 350A (a standard polyamide) and two amidoamine blends (Ancamide 500 and Ancamide 502). All curing agents were formulated with 100% standard DGEBA resin (EEW=190).

Figure 1 shows the results of dolly pull-off tests conducted in accordance with ASTM D4541. Samples were prepared by immersing blocks of ASTM C 109 cement mortar in water for 24 hours. Blocks were then removed from the water, the excess water was wiped from the surface, and formulated epoxy was applied immediately.

The data show the excellent bond strength of Ancamide 2396-cured formulations at ambient and low temperature cure conditions. The bond strength with Ancamide 2396 exceeds that of the Ancamide 500/Ancamine MCA/K54 blend, which had been Air Products' standard recommendation for adhesion to cold, damp concrete. The adhesion of Ancamide 2396 curing agent is further improved by adding Ancamine K54 at 3–5% of formulation binder.



Note: Curing agents formulated with DGEBA resin (EEW=190).

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 2471-71
- (9) ASTM D 3418-82
- (10) ASTM D 695-85
- (11) ASTM D 638-86
- (12) ASTM D 790-86
- (13) ASTM D 2240-86

Epoxy Curing Agents and Modifiers

# ANCAMIDE® 2396 Curing Agent

**EVONIK CORPORATION**

7201 Hamilton Blvd.  
Allentown, PA 18195  
1 800 345-3148  
Outside U.S. and Canada 1 610 481-6799

**For Technical Information and Support:**

Americas: [picus@evonik.com](mailto:picus@evonik.com)  
EMEA: [apcse@evonik.com](mailto:apcse@evonik.com)

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