

**ANCAMIDE<sup>®</sup> 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.

**TYPICAL PROPERTIES**

Property	Value	Unit	Method
Appearance	Amber liquid		
Color	8	Gardner	ASTM D 1544-80
Viscosity			
@ 77°F	680	cP	ASTM D-445-83, Brookfield, RVTD, Spindle 4
@ 50°F	5,000	cP	ASTM D-445-83, Brookfield, RVTD, Spindle 4
Amine Value	350	mg KOH/g	Perchloric Acid Titration
Specific Gravity @ 77°F	0.993		ASTM D 1475-85
Flash Point (closed cup)	267	°F	Seta Flash Closed Cup
Equivalent Wt{H}	93		
Recommended Use Level	49	phr	EEW=190

**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.**

## TYPICAL HANDLING PROPERTIES

Property	A*	B*	Value	Method
Mixed Viscosity @ 77°F	3,700	1440	cP	ASTM D-445-83, Brookfield, RVTD, Spindle 4
Gel Time (150g mix @ 77°F)	102	145	min	Techne GT-4 Gelation Timer
Gel Time (150g mix @ 50°F)	137	245	min	Techne GT-4 Gelation Timer
Thin Film Set Time				
@ 77°F	8.5	12	h	BK Drying Recorder
@ 50°F	14	35	h	BK Drying Recorder
@ 40°F	28	35	h	BK Drying Recorder
Peak Exotherm (150 g mix @ 77°F)	178	116	°F	ASTM D 2471-71

## TYPICAL PERFORMANCE

Property	A*	B*	Value	Method
<b>7 day cure @ 77°F</b>				
<b>Glass Transition Temperature</b>	137	126	°F	ASTM D 3418-82
<b>Compressive Strength @ Yield</b>	13,600	10,900	psi	ASTM D 695-85
<b>Compressive Modulus</b>	345	279	thousand psi	ASTM D 695-85
<b>Tensile Strength</b>	8,600	8,700	psi	ASTM D 638-86
<b>Tensile Modulus</b>	243	190	thousand psi	ASTM D 638-86
<b>Tensile Elongation @ Break</b>	4.3	8.6	%	ASTM D 638-86
<b>Flexural Strength</b>	17,300	13,600	psi	ASTM D 790-86
<b>Flexural Modulus</b>	496	389	thousand psi	ASTM D 790-86
<b>Hardness (Shore D)</b>	82	81		ASTM D 2240-86

## 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 (C<sub>12</sub>-C<sub>14</sub> 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.

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



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 h recover → 24 h imm → test → 24 h 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	Test After 3 hr		Test After 24 hr		Test After 3 days		Test After 7 days		Test After 28 days		Test After 90 days	
	Hard	% wt	Hard	% wt	Hard	% wt	Hard	% wt	Hard	% wt	Hard	% wt	Hard
10% Acetic Acid	81	0.34	81	1.30	77	2.55	75	4.13	73	7.11	70	11.2	62
Toluene	81	0.06	80	3.20	72	13.5	47	Destroyed					
Xylene	81	0.01	81	0.55	79	2.86	74	6.33	68	14.3	56	25.9	49
Trichloroethane	81	0.00	80	0.44	79		77	6.27	73	13.9	64	25.7	62
Methanol	81	1.90	71	5.45	52	10.2	42	15.7	27	14.5	22	13.8	22
Ethanol	81	0.71	78	2.35	69	4.49	64	6.95	59	12.5	50	13.8	37
Butyl Cellosolve	81	0.11	80	1.19	76	3.78	71	6.96	64	13.2	57	Destroyed	
Methyl Ethyl Ketone	81	2.48	70	14.8	35	Destroyed							
Skydrol	81	0.06	80	0.15	79	0.33	79	0.62	79	1.06	79	1.73	78
70% Sulfuric Acid	81	0.07	81	0.13	81	0.21	80	0.37	81	0.62	81	0.96	81
98% Sulfuric Acid	81	-5.59	69	Destroyed									
Deionized Water	81	0.02	80	0.12	80	0.32	80	0.57	80	1.48	80	1.52	80
50% Sodium Hydroxide	81	-0.01	81	-0.03	81	-0.03	81	0.01	81	-0.01	81	-0.04	81
Bleach	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.

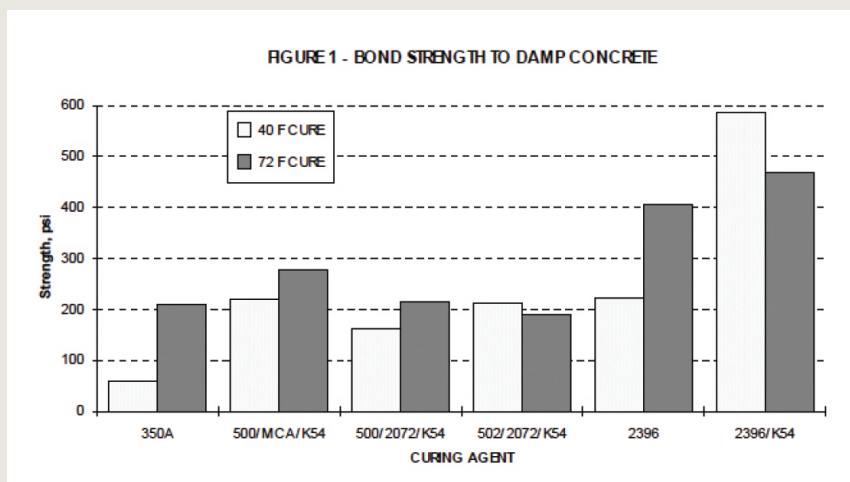
To speed up thin film set time and hardness development at ambient temperatures, Ancamide 2396 curing agent can be accelerated with the addition of 3-5% Ancamine K54 or aliphatic amine curing agents such as 10% Ancamine 1638, 10% Ancamine 1768 or 10% Ancamine 2205 curing agent. Either Ancamine 1856 or 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 Evonik’s 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).



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