Product information

ANCAMIDE® 2864

Curing Agent

DESCRIPTION

Ancamide® 2864 is a next generation modified Polyamide curing agent intended to be used in epoxy coatings for high-performance, corrosion resistant coatings. The curing agent exhibits low viscosity and fast through-cure with good blush resistance at both ambient and at low temperature conditions (5°C).

TYPICAL PROPERTIES

Property	Value	Unit	Method
Appearance	Clear Amber Liquid		
Colour	≤ 8	Gardner	ASTM D 1544
Viscosity @ 25°C	1200-2500	mPa.s	Brookfield RVTD, Spindle 6
Amine Value	315-350	mg KOH/g	Perchloric Acid Titration
Specific Gravity @ 21°C	1.04		
Equivalent Wt {active N-H}	135		
Recommended use Level	65	PHR	With bisphenol-A based epoxy resin (EEW=190)

ADVANTAGES

- Fast through-cure
- Good corrosion resistance
- Excellent blush resistance
- Fast mechanical property development

APPLICATIONS

- Marine and protective coatings
- High-solids coating applications

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.

EVONIK
Leading Beyond Chemistry

STORAGE AND HANDLING

Refer to the Safety Data Sheet for Ancamide® 2864 curing Agent.

TYPICAL CURE SCHEDULE

7 days at ambient temperature

TYPICAL HANDLING PROPERTIES

Property	Value	Unit	Method
Gel Time @ 25 °C	32	min	Techne GT-5 Gelation Timer, 150 g mix
Thin Film Set Time @ 23 °C	2.5/4.0	h	ASTM D 5895 - BK Drying Recorder, Phase 2/3, 60% RH
Thin Film Set Time @ 5 °C	7/13	h	ASTM D 5895 - BK Drying Recorder, Phase 2/3, 60% RH
Persoz Pendulum Hardness 7d @ 23 °C	260	s	ASTM D 4366
Carbamation Resistance 5 °C	4	Scale 1-5, 5=best	ISO 2812 (wet patch method), after 24hrs @ applied temperature
Carbamation Resistance 23 °C	4	Scale 1-5, 5=best	ISO 2812 (wet patch method), after 24hrs @ applied temperature
MEK double rubs (24h) @ 5 °C	>200		

SUPPLEMENTARY DATA

HANDLING AND PERFORMANCE PROPERTIES

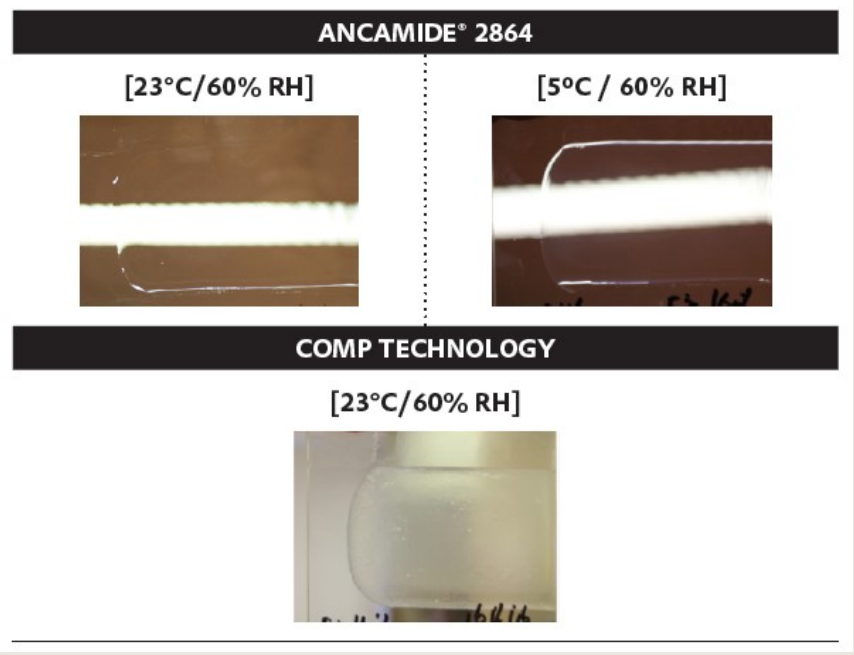
Ancamide® 2864 curing agent is a low viscosity, modifi edpolyamide solution supplied in benzyl alcohol. Ancamide® 2864 curing agent provides through-cure at both ambient and low temperature with outstanding mechanical property development. The performance benefi ts of Ancamide® 2864 curing agent are provided in Table 1, and include a lower initial curing agent viscosity allowing for high-solids coatings. Ancamide® 2864 demonstrates excellent early double MEK resistance, which is an indicator of the rapid through cure property development. (Figure 1)

TABLE 1: HANDLING AND PERFORMANCE PROPERTIES

Property			Value	Unit
Handling	**Viscosity**		2,300	mPa.s
	Loading		65	PHR
	Gel Time		35	Mins
Film Properties	**Film Appearance**		Clear/ Gloss	
@ 25°C	**Water Spot Resistance***	1d	2	
		7d	4	
	Impact	Direct	60	cm.kg
		Reverse	40	cm.kg
Film Properties	**Film Appearance**		Clear/ Gloss	
@ 5°C	**Water Spot Resistance***	1d	1	
		7d	4	
	MEK Double Rubs	1d	>200 Haze	
		3d	>200 Gloss	

*Evonik internal test with water placed on film rating 5 to 0 with 5=excellent, no water stain 0=poor, severe water stain

FIGURE 1: ANCAMIDE® 2864 SURFACE APPEARANCE AT AMBIENT AND LOW TEMPERATURE



LOW TEMPERATURE CURE PROFILE

Further evidence supporting the excellent low temperature cure characteristics of Ancamide® 2864 is shown in Figure 2, by the faster dry speed development obtained in clear coat formulations. When mixed with liquid epoxy resin, the thin film set times (as measured using a Beck Koller instrument) offer a significant improvement over both conventional and high-solids polyamides which are commonly promoted for low temperature cure applications. At lower application temperatures, the performance benefits of Ancamide® 2864 curing agent are clearly demonstrated, where a phase 3 dry time of 14 hours is achieved, compared to 48 hours for Ancamide® 350A curing agent and 30 hours for Ancamide® 2050 curing agent.

FIGURE 2: CLEAR COATS-BK THIN FILM SET TIMES

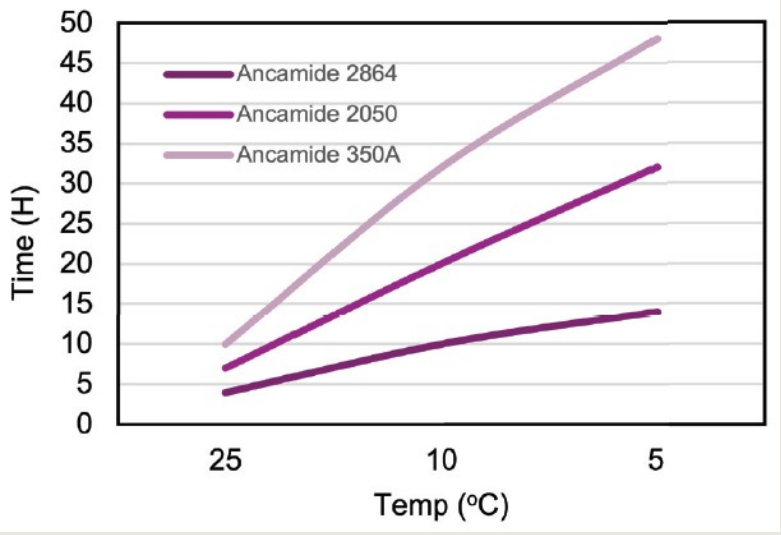


FIGURE 3: DEGREE OF CURE @ 5°C

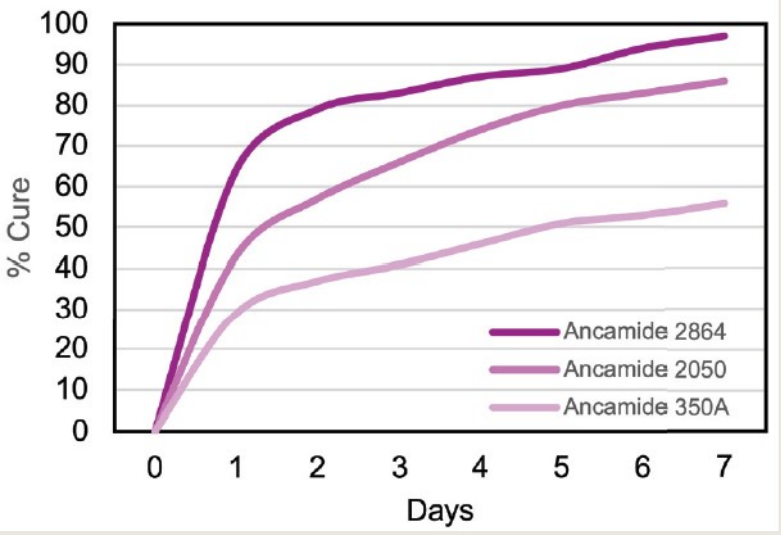


Figure 3 shows the degree of cure development of the polyamides at low application temperature as determined via DSC analysis. Analysis was conducted via measurement of the residual exotherm, during the curing process. Samples were prepared at ambient temperature and then the sealed DSC cells were immediately stored at 5°C, in a climate chamber for a period of 1-7 days. After the allotted cure time, samples were removed and scanned by DSC (TA Instruments - model Q200) at a ramp rate of 10°C/min. The percentage cure for each sample was calculated using the following equation:

$$\text{Degree of System Cure (\%)} = [\ 1 - (\Delta H \text{ residual}) / (\Delta H \text{ max})\ ] * 100$$

Ancamide® 2864 undergoes excellent early cure development at 5°C achieving levels of 64%, after 24 hours which is 2 times faster than Ancamide® 350A, which only achieved 30% conversion. After 7 days cure at 5°C, the extent of cure for Ancamide® 2864 was >95%, compared to 55% and 83% for Ancamide® 350A and Ancamide® 2050 respectively.

The anti-corrosive primer formulation based on Ancamide® 2864 is given in Table 2. The primer was applied to grit blasted hot rolled steel substrate panels. Using conventional spray equipment in double coats to provide 6 mils of DFT. Panels were left to cure for 7 days prior to testing in salt spray. Panels were scribed and evaluated for field Blisters using ASTM B117. Evaluation of scribe creep was rated in accordance with ASTM D1654. One set of duplicate Panels were evaluated for blistering and rusting. After the visual evaluation was completed, the scribe areas were scrapped to expose the underlying metal substrate, allowing for accurate scribe creep measurements. Results for the 2000 hours exposure are shown in Figure 4 and reported in Table 3.

TABLE 2: STARTING POINT FORMULATION

Component A	Weight (lbs.)	Volume (gallons)	Type	Supplier
Epon 828	26.96	23.15	Epoxy resin	Hexion
Epodil® 742	3.10	2.87	Epoxy diluent	Evonik
Antiterra U	0.56	0.59	Dispersant	BYK
Bentone SD-2	0.77	0.48	Thixotrope	Elementis
Xylene	11.60	13.54	Solvent	
n-butanol	4.04	5.04	Solvent	
Bayferrox 130M	4.72	0.94	Filler	Lanxess
Heucophos ZCP Plus	5.94	1.69	Anti-corrosive pigment	Heubach Intl
Blanc Fixe Micro	20.61	4.68	Filler	Sachtleben Chemie
Wollastocoat 10 ES	8.59	2.96	Filler	Nyco Minerals
Plastorit 000	13.11	4.69	Filler	Imerys Talc
Total A	**100.0**	**60.63**		
Component B	**Weight (lbs.)**	**Volume (gallons)**	**Type**	**Supplier**
Ancamide® 2864	19.90	18.96	Curing agent	Evonik
Xylene	0.82	0.95	Solvent	
n-butanol	0.24	0.30	Solvent	
Total B	**20.96**	**20.21**		
Total A + B	**120.96**	**80.84**		

TYPICAL PRIMER PROPERTIES

Property	Value	Unit
Mix Ratio Part A: Part B	3:1	vol
PVC	25.5	%
Vol Solids	85.9	%
VOC	198	g/l
Mix viscosity	± 550	mPa.s

FIGURE 4: ANCAMIDE® 2864 PRIMER AFTER 2000 H OF SALT SPRAY PERFORMANCE

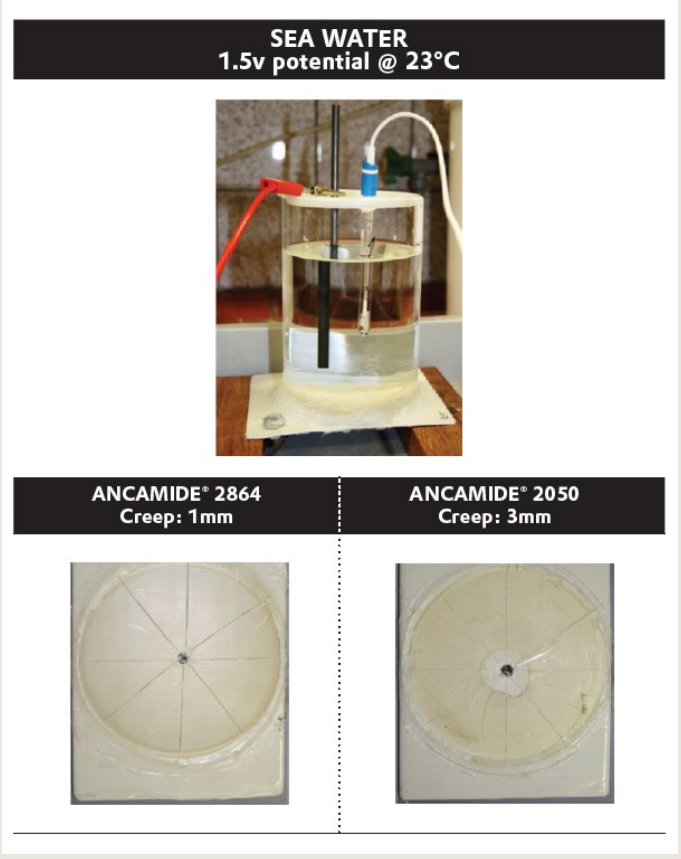
TABLE 3: SALT SPRAY RESISTANCE

Formulation	Degree of Rust	Scribe Creep	Field Blistering	Blister Size
Ancamide® 2864	None	10	10	10 (No Blisters)

CATHODIC DISBONDMENT RESISTANCE

The experimental setup is shown in Figure 5. Each test panel is fitted with one intentional holiday of 3 mm diameter in the paint layer, and then covered with a glass cylinder (inside diameter = 99 mm; high 155 mm) on the painted side. The glass cylinders are placed so that from every panel the intentional holiday is situated in the middle of the test area. The glass cylinder is filled with about 1000 ml of electrolyte (artificial seawater). To establish the electrical circuit, a connection to the steel panel is made with a platinum or graphite electrode that is placed in the center of the tank containing the electrolyte. This acts as the anode and is connected to the positive lead from the power supply (Top Hex Cathodic Disbondment Tester). The bare steel of the panel (cathode) is connected with copper wire to the negative lead of the power supply. A reference electrode (saturated calomel) is placed in the test tank for measuring a continuous potential of 1.5 V. After 28 days at room temperature (23°C), the test was stopped. The exposed coatings were checked for loss of adhesion, blistering (ASTM D714) and other defects (discoloration, cracking, etc.). Loss of adhesion was determined by cutting eight radial pies, extending 3 cm from the center of the intentional holiday, by using a sharp-bladed knife. Starting at the intentional holiday and working outward, the degree of disbondment was measured. After 28 days exposure, coatings formulated with Ancamide® 2864 curing agent and the benchmark Ancamide® 2050 resulted in an average radial creep of 1 mm and 3 mm, respectively. This is well within the requirements of the test and, as such, both coating systems are fit for purpose and meet the ASTM G8-96 standards for pipe coatings requiring excellent cathodic disbondment resistance.

FIGURE 5: CATHODIC DISBONDMENT CELL & TEST PANELS AFTER 28D STUDY



Ancamide® is a registered trademark of Evonik Industries AG or one of its subsidiaries.

EVONIK OPERATIONS GMBH
Business Line Crosslinkers
Paul-Baumann-Str. 1
45764 Marl
Germany

www.evonik.com/crosslinkers
Product Information: APCSE@evonik.com
Sample Request: APCSE@evonik.com

EVONIK CORPORATION
Business Line Crosslinkers
7201 Hamilton Blvd.
Allentown, PA 18195
USA

CrosslinkersProdinfo@evonik.com
Crosslinkers-Samples@evonik.com

EVONIK SPECIALTY CHEMICALS (SHANGHAI) CO., LTD.
Business Line Crosslinkers
55, Chundong Road
Xinzhuang Industry Park
Shanghai, 201108
China
CL-Asiainfo@evonik.com
CL-Asiainfo@evonik.com