Product information ANCAMIDE[®] 2573 Curing Agent

DESCRIPTION

Ancamide 2573 curing agent is a modified polyamide adduct, intended for use as an ambient curing agent for liquid epoxy resin. The product is a low viscosity curing agent which exhibits fast cure at low temperatures (5°C) and over poorly prepared substrates. Ancamide 2573 curing agent can be used to formulate low VOC, anti-corrosive coatings for marine and industrial maintenance applications.

Special features of Ancamide 2573 curing agent systems include rapid property development compared to conventional polyamides, plus excellent barrier properties and good film appearance.

TYPICAL PROPERTIES

Property	Value	Unit	Method
Appearance	Clear brown liquid		
Colour	8	Gardner	ASTM D 1544-80
Viscosity @ 25°C	1,200-2,200	mPa.s	Brookfield RVTD, Spindle 4
Amine Value	275-290	mg KOH/g	Perchloric Acid Titration
Specific Gravity @ 21°C	1.01		
Equivalent	115	Wt/{H}	
Recommended use Level	60-70	PHR	With Bisphenol A diglycidyl ether (EEW=190)
Solids Content	100	%	
Flash Point (closed Cup)	>76	°C	

ADVANTAGES

- Fast dry and rapid property development
- Medium-low viscosity
- High solids coating formulations
- Excellent adhesion to damp concrete and steel

APPLICATIONS

- Marine and industrial maintenance coatings
- Civil engineering concrete primers



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.

PACKAGING AND HANDLING

Refer to the Safety Data Sheet for Ancamide 2573 curing agent.

TYPICAL HANDLING PROPERTIES*

Property	Value	Unit	Method
Gel Time (150g mix at 25°C)	45-50	mins	Techne GT-3 Gelation Timer
Thin Film Set Time 20°C	5.5/11.0	h	BK Drying Recorder Phase II/III
Peak Exotherm (100g mix @ 20°C)	105	°C	
Time to Peak Exotherm	90	mins	

TYPICAL CURE SCHEDULE

2-7 Days at Room Temperature

TYPICAL PERFORMANCE PROPERTIES*

Property	Value	Unit	Method
Perzoz Hardness (1/7 days @ 20°C)	150/300		
Glass Transition Temperature	54	°C	

*With Bisphenol A diglycidyl ether (EEW=190)



SUPPLEMENTARY INFORMATION

Ancamide 2573 curing agent is low viscosity, modified polyamide. When used with liquid epoxy resins, Ancamide 2573 curing agent offers fast dry, rapid mechanical property development, good adhesion to damp substrates and excellent long-term humidity and corrosion resistance. Ancamide 2573 curing agent also has a low level of free, unreacted amine, which helps to improves surface appearance by reducing the tendency of the coating to blush.

High volume solids, low VOC, coatings can be formulated using this product which can be used for a wide variety in industrial maintenance and marine applications. Since Ancamide 2573 offers improved adhesion to damp concrete, the curing agent can also be used for concrete primers in many civil engineering applications.

Ancamide 2573 has a non-critical loading and can be used at levels ranging from 60 to 90 phr when used with a liquid epoxy resin.

COATING CURE DEVELOPMENT

When used in combination with a standard bisphenol A liquid epoxy resin, Ancamide 2573 exhibits fast cure speed. As shown in Figure 1, the thin film set times obtained with Ancamide 2573 curing agent offer a significant improvement over conventional polyamide curing agents including Ancamide 2050 and Ancamide 350A. At room temperature, the thin film set time is reduced to 5.5 h from 8h and 11 h respectively. At lower application temperatures (5°C), set times of approx. 30 h are achievable for Ancamide 2573, compared to 36 h for Ancamide 2050 and 46 hrs for Ancamide 350A.

FIGURE 1: THIN FILM SET TIMES





The above results are based on loadings of 70 phr for Ancamide 2573 and Ancamide 2050 and 80 phr for Ancamide 350A. All results measured using a B-K recorder, 150 micron wet film applied to glass plates.

Further evidence supporting the excellent low temperature cure characteristics of Ancamide 2573 curing agent is also shown in Figure 2. This plot compares the cure development of Ancamide 2573, Ancamide 2050 and Ancamide 350A curing agents by measurement of the residual exotherm during low temperature cure. The test method utilized is to measure residual exotherm using differential scanning calorimetry (DSC).



FIGURE 2: LOW TEMPERATURE (5°C) CURE PROFILES

Ancamide 2573 curing agent reaches approximately 60% of full cure within the first 24 hrs, significantly better than both Ancamide 2050 (43%) and Ancamide 350A (18%). After 7 days cure at 5°C, Ancamide 2573 reaches 90% cure compared to only 85% and 48% cure for Ancamide 2050 and 350A respectively.



FIGURE 3: PERSOZ HARDNESS AND BINDER TG AFTER 14 DAY CURE.



The degree of cure as determined by DSC does necessarily imply development of good mechanical properties of coatings. For this the determination of hardness build up and Tg development are required. Figure 3 highlights the improved Persoz hardness development and increased binder Tg of this new polyamide technology. After 14 day cure at ambient temperature all coating systems have obtained a high degree of cure and display Persoz hardness values (>200 s). At 5°C, both Ancamide 350A and Ancamide 2050 have only achieved relatively low Persoz hardness values (<20 s). Figure 2 indicates coatings based on Ancamide 2050 and Ancamide 2573 curing agents both have a high degree of through cure (>80%), however, Ancamide 2573 curing agent shows a significant improvement in crosslink density as is demonstrated by both a higher observed Persoz hardness (>150 s) and higher binder Tg (54°C). The improved crosslink density thus results in coatings with superior mechanical properties compared to other polyamide coating technologies. An additional benefit is that coatings based on the new polyamide are free of exudate, accounting for the tack free surface, which improved gloss and overcoatability.

The rapid chemical cure leading to a fast development of mechanical properties is an attribute especially important in application areas where a faster physical handling of coated substrates is required. The net benefit is to improve speed and efficiency at the job site.

ADHESION PROPERTIES

An interesting feature of Ancamide 2573 curing agent is that primers based on this curing agent exhibit excellent adhesion on poorly prepared substrates (Appendix 3). A typical method employed to determine adhesion of primers is the use of a manual Erichsen pull-off tester. The results below illustrate the adhesive bond strength of clear coat primers applied and cured on saturated wet concrete tiles [1]. The tiles (30x30x5 cm) are stored under water for a period of seven days and then placed in a vessel containing water (depth ~3 cm). Subsequently, clear coat primers Ancamide 2050, Ancamide 2573 and a waterbased curing agent (Epilink[®] 701) cured with bisphenol A based liquid epoxy resin are applied and left to cure for 10 days.



TABLE 1: ADHESION STRENGTH OF CLEAR COAT PRIMERS TO SATURATED WET CONCRETE

System	Loading (PHR)	Adhesion	
		Strength (MPa)	Mode of Failure
Ancamide 2050 / Bisphenol A LER	70	0.4	100% Delamination failure
Ancamide 2573 / Bisphenol A LER	70	2.0	Concrete cohesive failure
Epilink 701 / Bisphenol A LER	150	2.0	Concrete cohesive failure

FIGURE 4: BOND STRENGTH OF PRIMERS BASED ON ANCAMIDE 2050, ANCAMIDE 2573 AND EPILINK 701 CURING AGENTS WITH BISPHENOL A LIQUID EPOXY RESIN





Results of the bond strength are shown in Table 1. With the primers based on Ancamide 2573 curing agent, adhesion failure is found within the concrete whereas adhesion failure with Ancamide 2050 lies between the primer and the wet concrete, leaving the concrete surface unaffected (Figure 4). The primer based on Ancamide 2573 demonstrates excellent adhesion to the wet concrete, which is significantly better than other types of polyamide chemistries and is comparable to the type of properties observed to alternative waterbased epoxy systems. The results illustrate the improved ability of coatings based on Ancamide 2573 curing agent to offer good adhesion onto difficult substrates, a property valuable in primer applications both on concrete and poorly prepared steel.

[1] Adhesion onto wet concrete was tested following draft norm EN 104 (Determination of Resistance to Moisture from Behind) similar to the method described in the German 'Richtlinie für Schutz und Indstandsetzung von Betonbauteilen' part 4, section 5.5.15.

[2] Epilink 701 Curing Agent Technical Bulletin for Coatings and Civil Engineering Applications, Evonik

CORROSION RESISTANCE

Formulation A2573P1 and A2573T2 were evaluated for salt spray and constant humidity resistance. The results obtained are presented in Tables 3-5. Following 1000 h salt fog exposure, both formulations exhibits good resistance with only a trace of damage along the scribe for the primer formulation exposed in the prohesion cabinet. Coating systems also demonstrate excellent humidity resistance with no signs of field blistering being observed following 1000 h continuous testing.

TABLE 3: SALT SPRAY RESISTANCE — ANCAMIDE 2573

Formulation	Scribe Creep	Field Blistering	Blister Size
A2573P1	9	10	10
A2573T2	9	10	10

5% salt spray, cabinet temperature 35°C - ASTM B-117, film thickness 90-110 micron; Rating: 10 = Best (no blisters), 0 = Worst

TABLE 4: PROHESION EXPOSURE — ANCAMIDE 2573

Formulation	Scribe Creep	Field Blistering	Blister Size
A2573P1	7	10	10
A2573T2	7	10	10

Prohesion ASTM G85-94 Film thickness 100 microns. Rating: 10 = Best, 0 = Worst For blister size, rating 10 = no blisters observed Prohesion data is after 2000 h exposure



TABLE 5: CLEVELAND HUMIDITY EXPOSURE — ANCAMIDE 2573

Formulation	Field Rating	Blister Size
A2573P1	10	10
A2573T2	10	10

Continuous 100% humidity exposure — ASTM D-2247, cabinet temperature 50°C Film thickness 100 microns. Rating: 10 = Best, 0 = Worst For blister size, rating 10 = no blisters observed

APPENDIX 1

ANCAMIDE 2573 START POINT FORMULATION

High Solids Coatings — Red Iron Oxide Primer		Ancamide [®] 2573	Start Formulation
A-Component		A2573P1 (kg)	A2573P1 (litres)
Liquid epoxy resin	DER 331	20.23	17.41
AntiTerra 203	BYK Chemie	0.13	0.14
BYK 066	BYK Chemie	0.10	0.11
Mix well, then add at high spee	ed:		
TiPure R900	DuPont	1.56	0.39
Wollastokup 10AS	NYCO	23.14	7.98
Xylene	local	5.00	5.76
Total A component	÷	50.16	49.84
B-Component			
Ancamide 2573	Evonik	12.24	12.16
AntiTerra 203	Rheox	0.16	0.18
Mix well at high speed, then ac	ld:		
Bayferrox 140M	Bayer	5.63	1.13
Westmin D-30E Talc	Mondo Minerals	9.38	3.40
Heucophos ZPO	Heubach	12.19	3.65
Heucorin RZ	Heubach	1.35	0.40
Diacetone alcohol	local	2.31	2.47
ShellSol A100	local	6.57	7.54
Total B component		49.84	30.53
TOTAL		100.00	62.06



TECHNICAL DATA

Mixing ratio	Comp. A to B	by weight	1:1
Density	Comp. A	g/ml	1.59
	Comp. B	g/ml	1.64
	Comp. A + B	g/ml	1.62
Potlife		h	~1
Non Volatile	Comp. A + B	% by weight	85.9
Non Volatile	Comp. A + B	% by volume	74.5
VOC		g/l	227.8
PVC		%	35.9
Dry to touch	25°C	h	5:45
Dry hard	25°C	h	8:30
Pendulum hardness, Persoz	25°C	1 day	129
Specular gloss	25°C	20°/60°	1/17



APPENDIX 2

ANCAMIDE 2573 START POINT FORMULATION

High Solids Coatings — Red Iron Oxide Primer		Ancamide [®] 2573	Start Formulation
A-Component		A2573P1 (kg)	A2573P1 (litres)
Liquid epoxy resin	DER 331	25.19	21.72
Disparlon 650X20	Internatio	0.55	0.63
Mix well, then add at high speed:	·		
Mistrofil HS-20 Talc	Luzenac	19.05	6.85
ShellSol A100	Shell	5.53	6.31
Total A component	·	50.33	35.51
B-Component			
Ancamide 2573	Evonik	15.36	15.26
BYK 066	BYK Chemie	0.30	0.37
Disparlon NS-30	Internatio	0.28	0.31
mix well then add at high speed	·		
TiPure R706	DuPont	25.19	6.30
n-Butanol	local	6.70	8.27
ShellSol A100	Shell	1.84	2.10
Total B component	·	49.67	32.62
TOTAL		100.00	68.13



TECHNICAL DATA

Mixing ratio	Comp. A to B	by weight	1:1
Density	Comp. A	g/ml	1.42
	Comp. B	g/ml	1.53
	Comp. A + B	g/ml	1.47
Potlife		h	~1
Non Volatile	Comp. A + B	% by weight	85.7
Non Volatile	Comp. A + B	% by volume	75.2
VOC		g/l	210.2
PVC		%	25.8
Dry to touch	25°C	h	4:00
Dry hard	25°C	h	5:00
Pendulum hardness, Persoz	25°C	1 day	173
Specular gloss	25°C	20°/60°	33/80

APPENDIX 3

ANCAMIDE 2573 START POINT FORMULATION

High Solids Coatings — Clear Coat Concrete Primer		Ancamide [®] 2573 Start Formulation	
A-Component		A2573C1 (kg)	A2573C1 (litres)
DER 331	Olin	100.0	86.2
Total A component		100.0	86.2
B-Component			
Ancamide 2573	Evonik	60.0	59.4
Ancamine [®] K54	Evonik	2.4	2.4
Total B component		62.4	61.8
TOTAL		162.4	148.0



TECHNICAL DATA

Mixing ratio	Comp. A to B	by weight	1:0.6
Mixed Viscosity		mPa.s (25°C)	3,000
Density	Comp. A	g/ml	1.16
	Comp. B	g/ml	1.01
	Comp. A + B	g/ml	1.10
Potlife		minutes	45-50
Non Volatile	Comp. A + B	% by weight	100.0
Non Volatile	Comp. A + B	% by volume	100.0
VOC		g/l	0
Bond Strength to Wet Concrete	EN104		
Adhesion Strength	ASTM 4541	MPa (20°C cure)	2.0
Mode of Failure	ASTM 4541	Concrete Cohesive Failure	100%

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

Disclaimer

This information and all further technical advice are based on our present knowledge and experience. However, it implies no liability or other legal responsibility on our part, including with regard to existing third party intellectual property rights, especially patent rights. In particular, no warranty, whether express or implied, or guarantee of product properties in the legal sense is intended or implied. We reserve the right to make any changes according to technological progress or further developments. The customer is not released from the obligation to conduct careful inspection and testing of incoming goods. Performance of the product described herein should be verified by testing, which should be carried out only by qualified experts in the sole responsibility of a customer. Reference to trade names used by other companies is neither a recommendation, nor does it imply that similar products could not be used.

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

EVONIK CORPORATION

Business Line Crosslinkers 7001 Hamilton Boulevard Trexlertown, PA 18087 USA

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

