

ANCAMIDE® 2634 Curing Agent**DESCRIPTION**

Ancamide 2634 is a modified polyamide curing agent designed for use in two component solvent borne epoxy coatings where high performance and cost effectiveness are key requirements.

Ancamide 2634 offers high corrosion and chemical resistance along with good heat resistance, cathodic disbondment resistance, high blush resistance, good flexibility and good adhesion.

Ancamide 2634 can be used over a broad temperature range. Its ability to cure at low temperatures and develop a high T_g when heat cured, makes Ancamide 2634 an excellent candidate for both low temperature and high temperature applications.

ADVANTAGES

- High corrosion and chemical resistance
- Broad application and service temperature range
- Very cost effective
- High blush resistance
- Good cathodic disbondment resistance
- Good flexibility and adhesion

APPLICATIONS

- Metal primers
- Build coats and barrier coats
- Gloss enamels

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 2634 curing agent.

TYPICAL PROPERTIES

Appearance	Amber resinous liquid, slight haze
Colour¹ (Gardner)	7
Viscosity² @ 25°C, [mPa.s]	1,700
Amine Value³ (mg KOH/g)	335
Specific Gravity⁴ @ 25°C	0.96
Flash Point⁵ [°C]	44
Non-volatile [wgt %]	80
Solvent [n-butanol wgt %]	20
Equivalent Wt/{H}	90
Recommended Use Level (phr, EEW=190)	48

TYPICAL CURE SCHEDULE

2-7 days at ambient temperature

2-4 hrs at 95-115°C

TYPICAL PERFORMANCE PROPERTIES*

Mixed Viscosity² @ 25°C [mPa.s]	4,000
Gel Time⁶ @ 25°C (150 g mix) [min]	>180
Thin Film Set Time [h]	7
Hard Dry Time [h]	12
Glass Transition Temperature⁷ [C°]	115

*Cured with liquid Bisphenol-A based epoxy 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) ASTM D 3418-82
- (7) Maximum T_g = 115°C when sample is fully heat cured

SUPPLEMENTARY DATA

Corrosion Protection

Ancamide 2634 provides significantly higher corrosion protection than conventional polyamides allowing the formulator to reduce expensive anticorrosive pigments and save money.

Ancamide 2634 and a conventional polyamide Ancamide 260A were compared in similar formulations as shown below. In the Ancamide 2634 formulation the anticorrosive pigment was reduced by 50%. As the salt fog results demonstrate, performance can be improved and costs reduced by utilizing Ancamide 2634.

ANCAMIDE 2634 PRIMER

A Side	kg	litres
Liquid Epoxy	33.84	29.17
Anti-terra U80	0.31	0.31
Modaflow Resin	0.92	0.92
Xylene	6.60	7.68
MPK	3.38	4.22
Westmin 30E	21.50	7.70
Total	66.55	50.0
B Side		
Ancamide 2634	15.43	15.58
Epodil L	3.07	3.01
Benzyl Alcohol	2.30	2.20
n-Butanol	10.21	12.66
Bayferrox 140M	6.00	1.16
Halox SZP 391	6.00	1.99
Imsil A8 Silica	35.33	13.38
Total	78.34	50.0
Total A + B	144.89	100.0
PVC	34%	
VOC (g/l)	235	
Wt Solids	84%	
Vol Solids	72%	
Cost Savings	€0.75 / Litre	

ANCAMIDE 260A PRIMER

A Side	kg	litres
Liquid Epoxy	30.01	25.87
Anti-terra U80	0.28	0.28
Modaflow Resin	0.82	0.82
Xylene	5.86	6.82
MPK	3.00	3.74
Westmin 30E	19.06	6.83
Total	59.12	44.36
B Side		
Ancamide 260A	15.97	16.46
Epodil L	2.72	2.67
Benzyl Alcohol	2.04	1.95
n-Butanol	13.83	17.15
Bayferrox 140M	6.00	1.16
Halox SZP 391	12.00	3.98
Imsil A8 Silica	32.41	12.27
Total	84.97	55.64
Total A + B	144.09	100.0
PVC	34%	
VOC (g/l)	228	
Wt Solids	84%	
Vol Solids	72%	

CORROSION RESISTANCE

500 h Salt Fog	
50 microns DFT on shot blasted steel	
Overall Rating:	8
	Blisters #6 Few
	0-1 mm Scribe Creep

CORROSION RESISTANCE

500 h Salt Fog	
50 microns DFT on shot blasted steel	
Overall Rating:	6
	Blisters # 4 and # 6 Medium
	0-1 mm Scribe Creep

Chemical Resistance

Ancamide 2634 based coatings exhibit good resistance to organic solvents. A white gloss enamel formulation based on Ancamide 2634 and liquid epoxy resin (see appendix) was exposed to representative solvents and acids for 7 days then evaluated for hardness retention, gloss retention, and blistering. When exposed to ketones, alcohols, and aromatic solvents, Ancamide 2634 based coatings maintain high gloss with no signs of blistering or delamination. Softening of the coatings due to solvent exposure is largely reversible when the coatings are allowed to recover. For optimum resistance to organic and mineral acids, Ancamide 2634 based coatings should incorporate Bis F and Novolac epoxy resins with a stoichiometric excess of epoxy.

Reagent	Initial Hardness	Hardness 7 Day Exposure	Hardness 1 h Recovery	Hardness 4 h Recovery	Appearance
MEK	HB	B	B	B	No Blistering, No Gloss Loss
Toluene	HB	HB	HB	HB	No Blistering, No Gloss Loss
PM Solvent	HB	<6B	5B	4B	No Blistering, V. Slight Gloss Loss
Methanol	HB	HB	HB	HB	No Blistering, No Gloss Loss
10% Acetic Acid	HB	Destroyed	—	—	Dense Blistering
20% Sulphuric Acid	HB	Destroyed	—	—	Dense Blistering

Cathodic Disbondment Resistance

Ancamide 2634 based formulations exhibit very good cathodic disbondment resistance at both ambient and elevated temperatures. Resistance was tested by applying an Ancamide 2634 based formulation (see appendix) at 250 microns DFT onto Shot Blasted Steel (50 microns profile) and curing 7 days at ambient temperature. The coatings were prepared with a 6mm radius holiday then immersed in 3% NaCl electrolyte at 20°C and 50°C with an impressed current of 1.5 volts for 28 days. The coatings were rinsed, scribed and tested for adhesion loss and blistering with the following results:

Immersion Temperature	Voltage	Electrolyte	Disbondment Radius	Blistering	Visual Appearance
20°C	1.5 V	3% NaCl	0 mm	None	No Effect
50°C	1.5 V	3% NaCl	0 mm	None	No Effect

Hot Water Resistance

Ancamide 2634 based coatings (see appendix) were applied at 150 microns DFT to Shot Blasted Steel (50 microns profile), cured 24 h at 115°C, then scribed and immersed in D.I. Water at 90°C. After 3 days and 7 days immersion, the panels were tested for hardness, X-Hatch adhesion, and appearance.

Test Method	0 Immersion	3 Day Immersion	7 Day Immersion
Pencil Hardness	F	HB	HB
X-Hatch Adhesion	5B	5B	5B
Gloss/Appearance	—	No Change	No Change
Scribe Creep	—	0 mm	0 mm

FORMULATING GUIDELINES

Stoichiometry: Ancamide 2634 develops optimum properties when used at or near 1:1 stoichiometry. A slight (5-10%) excess of epoxy improves corrosion resistance whereas a slight (5-10%) excess of curing agent improves solvent resistance.

Low Temperature Cure: Plasticisers such as Epodil L, Nevchem LR, or Benzyl Alcohol should be added to the formulation to improve ambient and sub-ambient through cure. The typical plasticiser level is 15-25% based on the Ancamide 2634 weight.

High Temperature Resistance: When formulating Ancamide 2634 for high temperature service, avoid using plasticisers and epoxy diluents. Ancamide 2634 can develop a T_g of 115°C when cured at 1:1 stoichiometry with Bis A liquid epoxy. For optimum properties, a heat cure of 2 h or longer at 95°C or higher is recommended.

Accelerating Cure: Dry times can be accelerated by adding Ancamine K.54 (5% based on Ancamine 2634 weight) or by adding a fast cocuring agent such as Ancamine 1767, 1768, 2089M, or 2432 (10-20% based on Ancamine 2634 weight). Lacquer dry characteristics can be achieved by using a blend of liquid and solid epoxy resin as shown in the **4:1 Fast Dry Gloss Enamel Starting Point Formulation** in the appendix.

Additives: Flow and levelling additives such as Modaflow resin, Cymel U-216-8, or Byk 307 can be used to eliminate any cratering and improve substrate wetting. Typical use levels are 0.1-0.5% based on total formulation weight.

Solvent Selection: Ester solvents should be packaged with epoxy and not packaged with amine curing agents to avoid side reactions. Alcohols such as butanol are strong solvents for Ancamide 2634 but should not be packaged with epoxy resins. Ketones, strong solvents for solid epoxy resins, should be packaged with the epoxy to avoid side reaction with amines.

APPENDIX – STARTING POINT FORMULATIONS

HIGH SOLIDS BUILD COAT STARTING POINT FORMULATION

A Side	kg	litres	Supplier
Liquid Epoxy (EEW 190)	47.1	40.6	
Epodil L	2.6	2.6	Evonik
MIBK	3.2	4.0	
TiPure R 960	11.0	2.8	DuPont
Total	63.9	50.0	
B Side			
Ancamide 2634	22.3	21.9	Evonik
Benzyl alcohol	1.7	1.7	
Butanol	6.9	8.5	
Epodil L	1.5	1.5	Evonik
MPA 2000X	0.3	0.4	Rheox
Cymel U-216-8	1.3	1.2	Cytec
Finntalc M40	20.4	7.2	OMYA
Imsil A10	20.4	7.7	North Cape Minerals
Total	74.9	50.0	
Total A + B	138.8	100.0	
PVC	22%	Pencil Hardness	3H
VOC (g/l)	165	Mandrel Bend	1" Pass
Wt Solids	88%	Set to Touch	6 h
Vol Solids	80%	Visc. A side	2112 mPa.s
Stoichiometry	1:1	Visc. B side	4750 mPa.s

GLOSS ENAMEL STARTING POINT FORMULATION BASED ON LIQUID EPOXY

A Side	kg	litres	Supplier
Liquid Epoxy	45.4	39.13	
MIBK	2.3	2.87	
Xylene	6.9	8.01	
Total	54.6	50.0	
B Side			
Ancamide 2634	19.6	19.80	Evonik
Ancamine 1767	2.2	2.25	Evonik
Ancamine K54	1.0	1.01	Evonik
Xylene	2.2	2.53	
Epodil L	3.8	3.75	Evonik
Aromatic 100	3.1	3.47	
n-Butanol	3.1	3.85	
Byk 307	0.3	0.30	Byk Chemie
Modaflow	0.3	0.31	UCB
TiPure R960	22.8	5.84	DuPont
Westmin 30E	9.6	3.36	OMYA
Barytes	15.6	3.54	
Total	83.6	50.0	
Total A + B	138.2	100.0	
PVC	18%	A Side Viscosity	240 mPa.s
VOC (g/l)	216	B Side Viscosity	1650 mPa.s
Wt Solids	84%	Mixed Viscosity	1300 mPa.s
Vol Solids	75%	Pot Life	3 h
Stoichiometry	1:05	Thin Film Set Time	6.5 h
		Hard Dry Time	9.5 h

4:1 FAST DRY GLOSS ENAMEL STARTING POINT FORMULATION BASED ON LIQUID AND SOLID EPOXY

A Side	kg	litres	Supplier
Liquid Epoxy (EEW 190)	20.4	17.6	
1001X75	30.6	28.0	
Anti-terra U80	0.5	0.5	Byk Chemie
Byk 307	0.5	0.5	Byk Chemie
Xylene	6.1	7.1	
MIBK	10.8	13.4	
TiPure R 960 TiO2	21.6	5.5	DuPont
Westmin 30E	10.8	3.8	OMYA
Imsil A 10 Crystalline Silica	9.6	3.6	North Cape Minerals
Total	110.9	80.0	
B Side			
Ancamide 2634	13.3	13.0	Evonik
Ancamine K54	0.7	0.7	Evonik
Benzyl alcohol	3.1	2.9	
Butanol	2.7	3.3	
Total	19.8	20.0	
Total A + B	130.7	100.0	
PVC	21%		
VOC (g/l)	331		
Wt Solids	75%		
Vol Solids	61%		
Stoichiometry	105%		

**CATHODIC DISBONDMENT FORMULATION
HOT WATER RESISTANCE FORMULATION**

A Side	kg	litres	Supplier
Epon 828	39.2	33.81	
Nuosperse 657	0.6	0.63	Sasol Servo B.V.
Xylene	8.6	10.05	
MIBK	3.9	4.90	
Aromatic 100	8.6	9.81	
TiPure R 960 TiO2	15.7	4.02	DuPont
Nytral 300 talc	47.9	16.79	NYCO
Total	124.5	80.0	
B Side			
Ancamide 2634	19.2	20.0	Evonik
Total A + B	143.7	100.0	
PVC	29%		
VOC (g/l)	250		
Wt Solids	83%		
Vol Solids	71%		
Stoichiometry	1		
Cathodic Disbondment	28 Days at 20°C	0 mm	
	28 Days at 50°C	0 mm	

ANTICORROSIVE PRIMER FORMULATION

A Side	kg	litres	Supplier
Liquid Epoxy (EEW 190)	33.8	29.17	
Anti-terra U80	0.3	0.31	Byk Chemie
Modaflow	0.9	0.92	UCB
Xylene	6.6	7.68	
MPK	3.4	4.22	
Westmin 30E	21.5	7.70	OMYA
Total	66.5	50.0	
B Side			
Ancamide 2634	15.4	15.58	Evonik
Epodil L	3.1	3.01	Evonik
Benzyl alcohol	2.3	2.20	
n-Butanol	10.2	12.66	
Bayferrox 140M	6.0	1.16	Bayer
SZP 391	6.0	1.99	Halox
Imsil A8 Silica	35.3	13.38	North Cape Minerals
Total	78.3	50.0	
Total A + B	144.8	100.0	
PVC	34%		
VOC (g/l)	235		
Wt Solids	84%		
Vol Solids	72%		
Stoichiometry	1.05		

EVONIK RESOURCE EFFICIENCY GMBH

Business Line Crosslinkers
Paul-Baumann-Straße 1
45764 Marl
Germany

apcsepx@evonik.com
www.evonik.com/crosslinkers

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