Epoxy Curing Agents and Modifiers

ANCAREZ® AR555 Waterborne Epoxy Resin

DESCRIPTION

Ancarez AR555 resin is a waterborne solid epoxy resin dispersion delivered at 55% solids in water. The product is designed for two-component, ambient-cure epoxy systems. Ancarez AR555 resin delivers high-performance characteristics associated with conventional solid resin dispersions, but at zero VOC.

ADVANTAGES

- Zero VOC
- Fast dry speed/lacquer dry
- Compatible with universal colorants
- Early water resistance
- Long pot life
- No induction time
- Low resin viscosity
- Low odour

APPLICATIONS

- OEM, industrial maintenance and transportation coatings
- Floor sealers and coatings
- Anticorrosive primers, mid-coats and topcoats
- Institutional coatings

SHELF LIFE

At least 12 months from the date of manufacture in the original sealed container at ambient temperature.

PACKAGING AND HANDLING

Refer to the Safety Data Sheet for Ancarez AR555 resin.

TYPICAL PROPERTIES

Appearance	Milky white liquid
Appearance Film	Clear, glossy
Solids Content [wt%]	55
Solvent	Water
Viscosity[1] at 25°C [mPa.s]	300
Specific Gravity @ 21°C	1.09
Equivalent Wt/{Epoxy}[2]	550
Equivalent Wt/{Epoxy}[3]	1300

TYPICAL HANDLING PROPERTIES[4]

Pot Life [h]	4-6
Volume Solids [%]	47.3
Weight Solids [%]	59.4
Formulation Viscosity[3] at 25°C, [mPa.s]	1,000
Clean-Up	Warm, soapy water
Typical cure schedule	10-14 days

TYPICAL PERFORMANCE PROPERTIES[4]

Pencil Hardness	3H
¼ inch Mandrel Bend	180°
Direct Impact Resistance [kg.cm]	93
Reverse Impact Resistance [kg.cm]	35
Taber Abrasion CS-17 wheel, 1000 cycles, [mg loss]	100

Footnotes:

(1) Brookfield RVTD, Spindle 4

(2) Theoretical EEW; as supplied

(3) Recommended value for use level calculations. In waterborne systems based on solid epoxy resin dispersions, a 60-90% excess epoxy is recommended for maximum corrosion resistance. When EEW of Ancarez AR555 is assumed 1300, the best overall results are obtained in the range of 0.8:1 to 1.2:1 (epoxy:amine) stoichiometry.

(4) Ancarez AR555 resin formulated with Anquamine® 401 curing agent in a high gloss enamel formulation

SUPPLEMENTARY DATA

RESIN CHARACTERISTICS

Ancarez AR555 resin is a unique solid epoxy dispersion stabilized in water with a nonionic surfactant. It is zero-VOC as supplied, and can be formulated to produce high-performance, zero-VOC, low-odor, two-component epoxy topcoats and ultra-low-VOC two-component epoxy primers for metal and concrete. These coatings exhibit excellent corrosion, weathering and chemical resistance.

Because of its unique nature, Ancarez AR555 resin allows the formulation of waterborne epoxy maintenance primers and topcoats that have the rapid dry characteristics and long pot life of conventional solid waterborne epoxy resin emulsions, without the need for high levels of coalescing solvent typical of these systems. Ancarez AR555 resin formulations accept universal tints readily, providing for easy incorporation of waterbased epoxy coatings into existing product lines.

Evonik offers three waterborne hardeners currently for use in systems based on Ancarez AR555 resin. Those hardeners should be used as follows:

Hardener	Recommended Applications
Anquamine® 419 curing agent	Low odor/Ultra-low VOC metal primers
Anquamine 401 curing agent	Zero-VOC/Low-odor concrete primers and pigmented metal and concrete topcoats
Anquawhite® 100 curing agent	Wall and floor coatings and institutional coatings

FORMULATING GUIDELINES

CURING AGENT SELECTION

Anquamine 401 curing agent is recommended where zero-VOC, high-gloss and gloss retention are required. Anquamine 401 curing agent can be thinned with water to retain zero VOC in the finished formulation.

Anquamine 419 curing agent is recommended for optimum humidity and corrosion resistance. Anquamine 419 curing agent can be thinned with a mixture of water and propyleneglycol monomethyl ether.

Anquawhite 100 curing agent is recommended when low color, stain resistant (good acid and food stain resistance) are required. It provides long pot life, and offers high yellowing resistance.

Both Anquamine 401 and 419 curing agents can be modified with acetic acid to improve water solubility and to extend pot life. Typical use levels are 0.5-2.0% glacial acetic acid based on curing agent weight. Acetic acid levels should be kept to a minimum to avoid negative impact on water resistance.

STORAGE AND STABILITY

Ancarez AR555 resin should be stored between 35 and 105°F (2 and 41°C) for best package stability. Freeze-thaw stability can be enhanced through the addition of glycol ether solvents such as propyleneglycol monomethyl ether or ethyleneglycol monopropyl ether.

STOICHIOMETRY

When the EEW of Ancarez AR555 is assumed 1300, the best overall results have been obtained in the range of 0.8:1 to 1.2:1 (epoxy:amine). The best corrosion resistance has been observed at 1:1 stoichiometry or with a slight excess of curing agent.

PIGMENTS/PIGMENT DISPERSION

Ancarez AR555 resin can be readily pigmented through the use of pigment dispersants. Best results have been obtained by preparing a resin-free grind in water utilizing Disperbyk 190 (2.5-3.5% based on pigment weight) and Surfynol® 420 surfactants (0.1-0.2% based on pigment weight). Ancarez AR555 resin is then added during the let down.

When formulating gloss white enamels, good results have been obtained using a variety of titanium dioxides including: Ti-Pure R-706, Tioxide TR-92, Tronox CR-826, Tronox CR-828, Kronos 2102, Kronos 2310 and Tiona RCL-535. Tronox CR-826 in particular, exhibits good yellowing resistance. Ti-Pure R-960 should be avoided due to reduced gloss in enamels made with this product. Typical PVCs are 15-20%. Gloss can be reduced through the addition of 0.25-0.75 pounds per gallon of low oil absorption talc such as Mineral Technology's P 40-27 or LVT 400.

When formulating primers, PVC should be targeted at and no higher than 32% for optimum corrosion and humidity resistance. Extender pigments such as barytes, talc, wollastonite and ceramic microspheres should be selected for low oil absorption and good packing characteristics. Calcium carbonate and zinc oxide should be avoided due to possible interactions with the curing agent. Anticorrosive pigments such as Halox SW 111 or SZP 391 have been effective at boosting corrosion resistance. Typical use levels are 0.5-1.0 lb/gal.

Tinted coatings exhibit excellent compatibility and color stability throughout the pot life. Colorant dispersions can be added to the curing agent or the epoxy side, or to the mixed paint without exhibiting pigment flooding, floating or color drift during pot life. Systems found to be effective include: Creanova M 888, M 803, COVON and Elementis WD, UL.

RHEOLOGY MODIFIERS

Rheology modifiers should be pre-diluted in water prior to addition to Ancarez AR555 resin. Diluted rheology modifiers should be added slowly with good mixing to avoid agglomeration.

Associative thickeners such as Rheolate 310, Drewthix 6050 and Acrysol RM 8W are effective at increasing sag resistance and storage stability while maintaining good flow and leveling. Associative thickeners can be added to either the epoxy or the curing agent side of the formulation. When adding to Ancarez AR555 resin, the thickener should be pre-diluted in water and added slowly with good mixing. Typical use levels are 0.5-1.5% based on total formulation weight.

FOAM CONTROL

Surfynol DF 75, an organic based, 100% active silicone free defoamer, has proven effective as both a grind defoamer and an application defoamer. It should be incorporated into the formulation with high shear. A typical use level is 0.25-0.5% based on total formulation weight. Surface cratering associated with Surfynol DF 75 defoamer can be avoided through the addition of Surfynol 420 surfactant at 0.1-0.2% based on total formulation weight.

FLASH RUST PREVENTION

Flash rusting may occur under conditions of high humidity. Flash rust can be eliminated by the addition of a 10% aqueous solution of sodium nitrite ($NaNO_2$), or equivalent, to the Part B (curing agent) side in the amount of 2 pounds of solution per 100 gallons of paint.

MIXING AND APPLICATION

Thoroughly mix the A and B side components for 1-2 minutes until a uniform consistency is achieved. For high-gloss finishes, no induction time is needed. However, for maximum humidity and corrosion resistance, allow the mixed paint to induct for 15-30 minutes.

For conventional spray, the mixed paint can be reduced to application viscosity with water.

A maximum wet film thickness of 8 mils is recommended to allow for water evaporation from the paint film.

Good air flow across freshly painted areas will assist in water evaporation and improve dry speed.

Typical pot life is 3-6 hours. In gloss enamels, end of pot life is signaled by a visible loss of gloss in the dried film. Paint remains fluid beyond the pot life but loses coalescence and should be discarded. Do not mix expired paint with fresh paint.

To help avoid shocking the system, formulated A and B components should be free flowing liquids of similar viscosity.

CLEAN UP

Application tools can be cleaned with warm soap and water.

STARTING POINT FORMULATIONS

ANCAREZ AR555 EPOXY RESIN/ANQUAMINE 419 CURING AGENT — 4:1 ANTICORROSIVE METAL PRIMER

Part A	Pounds	Gallons
Water	123.56	14.80
Disperbyk 190	13.51	1.48
Surfynol DF 75 Defoamer	4.13	0.52
Surfynol 420	4.99	0.64
Mix at Slow Speed, then add:		
Red Iron Oxide	72.40	1.68
Zeeospheres G 400	62.74	3.42
Sparwite Barytes	62.74	1.71
Wollastocoat 10ES	62.74	2.59
Halox SW 111	96.53	4.00
Mica 325	9.65	0.41
High speed disperse to Hegman 6+ Reduce speed then add:		
Ancarez AR555 Epoxy Resin	415.08	45.62
Rheolate 310 (15% solution in water)	32.18	3.82
	955.00	**80.0**
Part B		
Anquamine 419 Curing Agent	113.43	12.52
Propylene glycol methyl ether	32.82	3.75
De-ionized Water	31.08	3.72
	117.33	**20.0**

FORMULATION ATTRIBUTES

VOC (g/l)	137
Weight Solids (%)	60.53%
Volume Solids (%)	46.74%
PVC (%)	30
Resin Stoichiometry	0.8 : 1 (Epoxy : Amine)
Part A Viscosity	63 KU
Part B Viscosity	80 KU
Mix Viscosity	65 KU
Pot life	>6 h

ANCAREZ AR555 EPOXY RESIN/ANQUAMINE 401 CURING AGENT — ULTRA-LOW-VOC 4:1 CLEAR CONCRETE PRIMER

Part A	Pounds	Gallons
Ancarez AR555 Epoxy Resin	655.76	72.06
Add at slow speed a premix of:		
Rheolate 310	15.48	1.75
De-ionized Water	51.53	6.19
	722.8	**80.0**
Part B		
Anquamine 401 Curing Agent	113.43	12.52
De-ionized Water	32.82	3.75
Surfynol DF-75 Defoamer	31.08	3.72
Surfynol 420	31.08	3.72
Glacial Acetic Acid	31.08	3.72
Mix at medium speed		
	175.5	**20.0**

FORMULATION ATTRIBUTES

VOC (g/l)	Trace
Mix Viscosity (cP)	850
Weight Solids (%)	50.3
Volume Solids (%)	41.8
Resin Stoichiometry	0.90 : 1 (Epoxy : Amine)
Part A Viscosity	63 KU
Part B Viscosity	60 KU
Mix Viscosity	77 KU
Pot life	>3 h

ANCAREZ AR555 EPOXY RESIN/ANQUAMINE 401 CURING AGENT — ULTRA-LOW-VOC 2:1 HIGH-GLOSS ENAMEL

Part A	Pounds	Gallons
Ancarez AR555 Epoxy Resin	546.50	60.05
Add at slow speed a premix of:		
Rheolate 310	12.90	1.46
De-ionized Water	42.94	5.15
	602.3	**66.7**
Part B		
De-ionized Water	62.15	7.46
Surfynol DF-75 Defoamer	4.01	0.51
Anquamine 401 Curing Agent	64.29	7.06
Glacial Acetic Acid	0.86	0.10
Mix until curing agent is incorporated, then add:		
TiPure R-706 Titanium Dioxide	230.03	6.90
Grind to Hegman 7+, then add:		
De-ionized Water	47.43	5.70
Anquamine 401 Curing Agent	26.35	2.89
Surfynol 420	2.75	0.35
Mix for 15 min. at slow speed, then add at slow speed a premix of:		
De-ionized water	15.35	1.84
Rheolate 310	4.61	0.52
	457.8	**33.3**

FORMULATION ATTRIBUTES

VOC (g/l)	Trace
Mix Viscosity (cP)	1100
Weight Solids (%)	57.2
Volume Solids (%)	41.9
PVC (%)	16.5
Resin Stoichiometry	0.93 : 1 (Epoxy : Amine)
Part A Viscosity	64 KU
Part B Viscosity	81 KU
Mix Viscosity	83 KU
Pot life	>3 h

MAINCOTE AE-58/ANCAREZ AR555 — ACRYLIC-EPOXY CLEARCOAT

Acrylic Component A	Parts by Weight
Add the following in the order listed and mix thoroughly:	
Methyl Carbitol	5.7
Maincote AE-58	72.0
NH4OH (28% NH3)	0.5
Ektasolve EEH	7.0
Patcote 550	0.3
Acrysol RM-1020	1.2
Acrysol RM-8	0.2
Sodium Nitrite (15% aqueous solution)	1.3
Total Acrylic Component A	**88.2**
Acrylic Component B	
Ancarez AR555 (Evonik)	11.8
TOTAL ACRYLIC / EPOXY TOPCOAT	**100.0**

MAINCOTE AE-58/ANCAREZ AR555 — ACRYLIC-EPOXY TOPCOAT

Acrylic Component A	Pounds	Gallons
Grind the following materials using a high speed dissolve for 20 minutes:		
Methyl Carbitol	39.34	4.56
Tamol 165 (Rohm and Haas)	13.99	1.59
NH_4OH (28% NH_3)	1.01	0.12
Triton CF-10 (Union Carbide)	1.62	0.19
Patcote 519 (Hydrite)	0.41	0.06
TiPure R-900 (DuPont)	196.39	5.74
Add the following and continue to grind for 2-3 minutes at lower speed:		
Water	20.18	2.42
Total Grind	**272.94**	**14.69**
Letdown Preparation		
Add the following in the order listed and mix thoroughly:		
Maincote AE-58 (Rohm and Haas)	499.85	58.05
Water	59.31	7.10
NH_4OH (28% NH_3)	2.43	0.29
Grind (from above)	272.94	14.60
Ektasolve EEH (Eastman Chemical)	48.87	6.59
Patcote 531 (Hydrite)	2.03	0.28
Water	14.40	1.73
Acrysol RM-1020 (Rohm and Haas)	8.11	0.91
Acrysol RM-8(Rohm and Haas)	1.22	0.14
Sodium Nitrite (15% aqueous solution)	8.92	1.07
Total Acrylic Component A	**918.08**	**90.86**
Epoxy Component B		
Ancarez AR555	83.14	9.14
Total Acrylic-Epoxy Topcoat	**1000.91**	**100.00**

MAINCOTE AE-58/ANCAREZ AR555 — ACRYLIC-EPOXY TOPCOAT — COATING TEST RESULTS

		Clear	Topcoat
Test	1/2 h induction — 21-Day Cure		
Substrate	Cold Rolled Steel, Zinc Phosphate, B952		
Primer	None		
Color		Clear	White
	Pot Life/Gel Time (h)	>12	>12
	Thickness (mil)	2.0	2.0
Drying Time (h)	Set-to-Touch	0.25	0.25
	Tack-Free	0.50	0.50
	Dry-Hard	1.00	0.80
	Dry-Through	3.75	3.00
Film Appearance	Gloss (20°)	67.3	33.8
	Gloss (60°)	96.6	77.3
	Gloss (85°)	96.2	93.2
Adhesion	Dry Scrape (kg)	>10.5 kg	>10.5 kg
	Wet Scrape (kg) (24 h/21°C)	3 kg	2 kg
Immersion	Water Immersion (24 h/21°C)	Pass	Pass
	MEK Immersion (r/21°C)	Fail	Soft-Edge Lift
Solvent Resistance	MEK Double Rubs	Pass 200 Slight mar	Pass 200 Slight mar
Spot Tests	5% sol. Hydrochloric Acid	No Effect	No Effect
4-h Exposure	5% sol. Sodium Hydroxide	No Effect	No Effect
4-h Recovery	5% sol. Sulfuric Acid	No Effect	No Effect
	5% sol. Nitric Acid	No Effect	No Effect
	Chlorox	No Effect	No Effect
	Mustard	No Effect	No Effect
	Ketchup	No Effect	No Effect
Impact	Gardner Impact (in/lb) Direct	12	96
	Gardner Impact (in/lb) Reverse	4	60
Flexibility	Mandrel Bend	1/8″	1/8″
Hardness	Pencil	HB	2H
	Persoz	179	165

ANCAREZ® AR555 Waterborne Epoxy Resin

RESIN, PIGMENT AND ADDITIVE SUPPLIERS

Product	Supplier
Acrysol RM-8	Rohm & Haas
Ancarez™ AR555	Evonik
Anquamine® 401	Evonik
Anquamine 419	Evonik
Colortrend 800-series Colorants	Creanova
Disperbyk 190	BYK Chemie
Drewthix 6050	Ashland
Elementis WD, UL	Elementis
Glacial Acetic Acid	Hoechst Celanese
Halox SW 111	Halox Pigments
Mica 325	KMG
P 40-27 Talc	Baretts Minerals Inc.
Red Iron Oxide	Elementis Pigments
Rheolate 310	Rheox
Sparwite Barytes	Mountain Minerals
Surfynol® Surfactants	Evonik
TiPure R-706 Titanium Dioxide	DuPont
TR-92 Titanium Dioxide	Tioxide America
Wollastocoat 10ES	NYCO
Zeeospheres 400	3M Company

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