Epoxy Curing Agents and Modifiers

HYBRIDUR® 878 Polymer Dispersion

DESCRIPTION

Hybridur 878 polymer dispersion is an NMP-free (<0.1% solvent), anionically-stabilized aliphatic urethane-acrylic hybrid polymer dispersion. It exhibits excellent wetting, adhesion, and barrier and film properties when used in air-dried, baked or cross-linked high-performance coatings on a wide variety of metal, wood, plastic and previously painted substrates.

Hybridur 878 polymer dispersion is a cost-effective alternative to standard aliphatic polyurethane dispersions (PUD) available today. The product provides enhanced performance properties when compared with conventional hybrids and blends of PUDs and acrylic emulsions in coatings for topcoat and clear coat applications.

Hybridur 878 dispersion is easy to formulate and offers rapid dry times and high hardness. Coatings based on this product provide the same ease of use and VOC compliance of those based on typical waterborne dispersions, but with the added benefits of outstanding durability and UV resistance in both air-dried and baked systems. Their solvent-free nature allows formulating latitude when choosing coalescing solvents.

Hybridur 878 dispersion can be used for both clear and pigmented (gloss) coating applications in both interior and exterior exposures on metal, wood, concrete and plastic substrates. Because of its high hardness, it is especially suitable for use on floors and furniture. Coatings based on Hybridur 878 dispersion have been found to perform similarly to those based on Hybridur 580 dispersion. Performance may be enhanced by heating and/or by cross-linking. Blending of Hybridur 878 dispersion with other Hybridur polymer dispersions is possible to tailor performance properties such as elongation, adhesion and chemical resistance.

TABLE 1: TYPICAL DISPERSION PROPERTIES

Solids (% by Weight)	40
Solvent Content (% by Weight)	< 0.1
Viscosity: Brookfield mPa*s [1]	< 150
pH	7.5–9.0
Density (g/mL)	1.0
Acid Number (calculated)	14.5
Particle Size	Colloidal (75 - 85 nm)
Particle Charge	Anionic
VOC (g/L)	~ 24; 0.20

TABLE 2: TYPICAL FILM PROPERTIES

Impact Resistance (in-lb)	> 160
Tensile Strength (psi) [2]	4400
Elongation, % [2]	> 32
MEK Double Rubs (film break-through)	> 200
60 ° Gloss (White Topcoat)	70 - 80

[1] Measured on 6-mil thick clear films that were prepared from a solvent-containing formulation that was drawn down on glass plates and allowed to dry for 7 days at room temperature.

[2] Measured on clear and pigmented white coatings on steel panels using the conical mandrel bend test (ASTM D 522).

ADVANTAGES

- Aliphatic urethane-acrylic hybrid patented technology
- Solvent-free (<0.1%)
- Significantly improved value versus PUDs and PUD/acrylic blends
- Produces films with excellent mechanical properties, adhesion to a variety of substrates and good chemical resistance
- Rapid dry
- One-component (1K) systems
- Excellent gloss and clarity
- Superior weatherability

FORMULATING HYBRIDUR 878 POLYMER DISPERSIONS

GENERAL STARTING FORMULATIONS: Included with this data sheet are general clearcoat, topcoat and primer formulations. They have not been optimized for specific applications and, therefore, should be considered as starting points for more specific and defined formulation efforts. Initial formulation guidelines are provided below. For additional information contact your Evonik sales representative.

FILM FORMATION–CO-SOLVENTS: The performance of Hybridur 878 dispersion films is very dependent on the degree of film integrity. Therefore, co-solvents are required to formulate the product properly. It generally is recommended to formulate Hybridur 878 dispersion with a co-solvent package consisting of at least one hydrophilic solvent and one hydrophobic solvent. Suggested hydrophobic solvents are DPnB (dipropylene glycol n-butyl ether) or DPnB blended with Texanol solvent. TPnB (tripropylene glycol n-butyl ether) also can be used as a hydrophobic co-solvent. Suggested hydrophilic solvents are TPM (tripropylene glycol monomethyl ether), NMP (N methylpyrrolidone) or Proglyde DMM solvent (dipropylene glycol dimethyl ether). For optimum film formation and performance, the total solvent level (based on dispersion weight) should be about 15% or higher, and approximately equal amounts of hydrophilic and hydrophobic co-solvents should be used. Often, the best results can be obtained when co-solvents and surfactants are pre-blended prior to their addition to Hybridur 878 dispersion.

FLOW, LEVELING AND FOAM CONTROL: For optimum wetting and spreading, the addition of surfactants is required. Approximately 0.3% to 0.4% (total formulation weight) of Byk-346 has been found to provide good appearance in topcoat formulations. Surfynol® 440 surfactant is also suggested as a wetting agent. Surfynol DF-58 defoamer is an effective at approximately 0.05% to 0.2% (total formulation weight).

VISCOSITY CONTROL: Viscosity modifiers should be kept to a minimum. However, where they must be employed, associative thickeners such as Acrysol RM-2020NPR/ RM-8W thickeners are suggested at a 10:1 ratio. The addition of less than 1 pph should be sufficient. Full viscosity development may take 12 hours.

PIGMENTATION: Hybridur dispersions will accept pre-dispersed pigments. For high-gloss coatings, a resin-free-grind of TiO2 with Disperbyk-190 or Surfynol CT-171 surfactants is recommended.

UV RESISTANCE: Based on previous work with other Hybridur dispersions, a UV stabilizer may be added to improve protection of the coating and substrate. Dissolve a blend of 1.0 pph Tinuvin 384 and 0.5 pph Tinuvin 292 stabilizers in a solution of co-solvent and surfactant before adding to 100 parts of the Hybridur 878 dispersion.

CROSS-LINKING: Hybridur dispersions can be cross-linked with polyaziridines, carbodiimides, epoxies, epoxy-silanes and metal ion cross-linkers at ambient or baked conditions depending upon the cross-linker selected. A 5 to 15-minute flash time prior to heating is recommended.

CLEAN-UP: Processing and application equipment used for Hybridur dispersion based coatings should be cleaned immediately after use—before the coating dries. For best results, rinse and flush thoroughly with water using mechanical agitation such as brushing or wiping if possible. This may be followed by a thorough rinse and flush with acetone or methanol. Hybridur dispersant based coatings that have dried may require a thorough wipe with a methanol-soaked towel.

HEATING: In general, heating can enhance the performance of Hybridur dispersion films. Twenty minutes at 100 125°C or 5 minutes at 150°C is suggested.

TRADEMARKS AND SUPPLIERS

Surfynol® 440	Evonik
Surfynol CT-171	Evonik
Surfynol DF-58	Evonik
ACRYSOL® RM-2020NPR, RM-8W	Dow Chemical
ARCOSOLV® DPNB, TPM	Alchem
BYK®-346; Disperbyk®-190	Byk-Chemie
PROGLYDE® DMM	Dow Chemical
TEXANOL® Ester Alcohol	Eastman Chemical
TINUVIN® 384, 292	BASF
TI-PURE® R-706	Chemouis

STARTING POINT FORMULATION HYBRIDUR® 878 DISPERSION GLOSS WHITE COATING

One-Component Polyurethane-Acrylic Hybrid Coating Prepared with a Resin-Free Grind
Formulation – HY878WT01

MATERIAL	POUNDS	GALLONS	SUPPLIER
Resin-Free Grind: Add the following into a clean container under mild agitation and mix until dissolved.			
Water (Deionized)	21.69	2.60	
Disperbyk-190 (Dispersant)	25.73	2.93	Byk-Chemie
Surfynol DF-58 (Defoamer)	0.85	0.10	Evonik
Continue agitation while adding the pigment below.			
TI-PURE R-706 (TiO_2 Pigment)	211.96	6.37	DuPont
Increase speed to high and disperse to Hegman ≥ 7 grind. Temperature must not exceed 140 °F. Reduce speed and add the following with medium agitation until blended.			
Water (Deionized)	7.38	0.88	
Blend: Add the following into a separate, clean container under mild agitation and mix until blended.			
Hybridur 878 Dispersion	645.84	74.25	Evonik
Pre-blend the next 5 items before adding to the Hybridur 878 dispersion with strong agitation.			
ARCOSOLVE DPNB Glycol Ether (Solvent)	48.45	6.38	Alchem
ARCOSOLVE TPM Glycol Ether (Solvent)	48.45	6.06	Alchem
BYK-346 (Surfactant)	3.25	0.39	Byk-Chemie
Surfynol DF-58 (Defoamer)	0.85	0.10	Evonik
Final Blend: Add the resin-free grind to the blend slowly and mix with mild agitation until homogeneous..			
Total	1013.95	100.00	

Formulation Characteristics

The following are typical properties* only and are not intended to be specifications.

Weight Solids, %	47.9	VOC, lb/gal (g/l)	2.13 (255)
Volume Solids, %	35.8	Density, lb/gal (g/ml)	10.14 (1.22)
PVC, %	17.8		

* Properties reported are based on theoretical calculations.

Typical Coating Performance Properties

The following are typical properties only. They are not intended to be specifications. The coating properties were tested over cold rolled steel with a zinc phosphate treatment (Bonderite 952) unless otherwise specified. The coatings were applied using a wire wound rod with a 0.110 inch wire diameter. They were allowed to dry at 70°F / 50% relative humidity for 7 days. The dried film thickness was approximately 2.5 mils.

Gloss, 60° (ASTM D 523)	74	Chemical Spot Tests, 1 hour covered exposure (ASTM D 1308) *	
Impact Resistance (ASTM D 2794)			
Direct and Reverse, in-lb	> 160	Household Bleach	10
Flexibility, %		Vinegar	10
Conical Mandrel Bend (ASTM D 522)	> 32	Olive Oil	10
Hardness		Fantastic Cleaner	9
Persoz, s (ASTM D 4366)	200	10% Ammonia	10
Pencil (ASTM D 3363; scratch / gouge)	F / 3H	Isopropanol	7
Double Rubs (ASTM D 4752)		50% Ethanol/water	8
IPA	90		
MEK	> 200		

* Rating Key: 10 = no effect; 5 = moderate swelling, softening and whitening; 0 = completely dissolved.

STARTING POINT FORMULATION HYBRIDUR 878 DISPERSION CLEAR COATING–AIR DRIED

One-Component Polyurethane-Acrylic Hybrid Coating
Formulation – HY878CT01

MATERIAL	POUNDS	GALLONS	SUPPLIER
Pre-Mix: Mix a solution of the following:			
ARCOSOLVE DPnB (Solvent)	48.63	6.40	Alchem
ARCOSOLVE TPM (Solvent)	48.63	6.08	Alchem
BYK-346 (Surfactant)	3.26	0.39	Byk-Chemie
Surfynol DF-58 (Defoamer)	1.71	0.21	Evonik
Resin Blend: Add the above Pre-Mix to the Hybridur 878 / water mixture with strong agitation.			
Hybridur 878 Dispersion	648.19	74.51	Evonik
Water (Deionized)	103.54	12.41	
Total	853.96	0.39	Byk-Chemie

Formulation Characteristics

The following are typical properties* only and are not intended to be specifications.

Weight Solids, %	30.95	VOC, lb/gal (g/l)	2.51 (301)
Volume Solids, %	28.5	Density, lb/gal (g/ml)	8.54 (1.02)
PVC, %	0		

* Properties reported are based on theoretical calculations.

Typical Coating Performance Properties

The following are typical properties only. They are not intended to be specifications. The coating properties were tested over cold rolled steel with a zinc phosphate treatment (Bonderite 952) unless otherwise specified. The coatings were applied using a wire wound rod with a 0.110 inch wire diameter. They were allowed to dry at 70°F / 50% relative humidity for 7 days. The dried film thickness was approximately 2.5 mils.

Gloss, 60 ° (ASTM D 523)	92	Double Rubs (ASTM D 4752)	
Adhesion		IPA	105
Dry Tape (ASTM D 3359)	5B	MEK	> 200
Impact Resistance (ASTM D 2794)		Chemical Spot Tests, 1 hour covered exposure (ASTM D 1308) *	
Direct and Reverse, in-lb	> 160		
Flexibility, %		Household Bleach	10
Conical Mandrel Bend (ASTM D 522)	> 32	Vinegar	10
Hardness		Olive Oil	10
Persoz, s (ASTM D 4366)	231	Fantastic Cleaner	8
Pencil (ASTM D 3363; scratch / gouge)	HB / 3H	10% Ammonia	7
Abrasion, mg loss (ASTM D 1044)		Isopropanol	7
(Taber, 1000 g, 1000 cycles, CS-17)	77	50% Ethanol/water	7

* Rating Key: 10 = no effect; 5 = moderate swelling, softening and whitening; 0 = completely dissolved.

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