

HYBRIDUR[®] 870**Polymer Dispersion****DESCRIPTION**

Hybridur 870 polymer dispersion is an NMP-free (<0.2% solvent), anionically stabilized urethaneacrylic hybrid polymer dispersion. It exhibits excellent wetting, adhesion, 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 870 dispersion is the most cost-effective alternative to standard polyurethane dispersions (PUD) available today. It provides enhanced performance properties when compared with conventional PUDs or blends of PUDs and acrylic emulsions in coatings for primer, topcoat and clear coat applications.

Hybridur 870 dispersion is easy to formulate and offers rapid dry times. 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.

Hybridur 870 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. Corrosion-resistant primer coatings for metal can also be formulated. Coatings based on Hybridur 870 dispersion have been found to perform similarly to those based on Hybridur 570 dispersion. Performance may be enhanced by heating and/or by cross-inking. Blending of Hybridur 870 with Hybridur 580 dispersion will improve hardness.

TYPICAL DISPERSION PROPERTIES

Property	Value	Unit
Solids (by Weight)	40	%
Solvent Content (by Weight)	< 0.2	%
Viscosity: Brookfield	< 150	mPa*s ¹
pH	7.5–9.0	
Density	1.03	g/mL
Acid Number (calculated)	16	
Particle Size	Colloidal (< 100 nm)	
Particle Charge	Anionic	
VOC	30	g/L

SHELF LIFE

At least 24 months from the date of manufacture in the original sealed container at ambient temperature. Hybridur 870 polymer dispersion is not freeze/thaw stable and the dispersion will break when exposed to freezing temperatures (2°C/36°F).

TYPICAL FILM PROPERTIES

Property	Value	Unit
Impact Resistance	> 160	in-lb
Tensile Strength ²	2,525	psi
Tensile Elongation at Break ²	279	%
MEK Double Rubs (film break-through)	> 200	
60° Gloss (White Topcoat)	75–85	

¹ 1 mPa*s = 1 cPs

² Measured on 6-mil thick, clear films that were prepared from a solventcontaining formulation that was drawdown on glass plates and allowed to dry for 30 minutes at room temperature followed by 30 minutes at 70°C.

PERFORMANCE

- Urethane-acrylic hybrid patented technology
- Solvent-free (< 0.2%)
- Significantly improved value versus PUDs and PUD/acrylic blends
- 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 870 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 870 dispersion films is very dependent on the degree of film integrity. Therefore, co-solvents are required to properly formulate the product. It generally is recommended to formulate Hybridur 870 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) blended with either Texanol or Exxate 1200. TPnB (tripropylene glycol n-Butyl ether) also can be used as a hydrophobic co-solvent. Suggested hydrophilic solvents are NMP (N-methylpyrrolidone) or Proglyde DMM (dipropylene glycol dimethyl ether). We have found that a level of 6% of the hydrophilic solvent (based on dispersion weight) and 7% of the hydrophobic co-solvent is adequate for film formation under ambient conditions. Each of these solvents provides certain contributions to the formula. The general trends observed are:

- NMP improves water resistance
- TPnB provides good water resistance but results in slower property development
- Exxate 1200 provides slightly better appearance and faster property development but does increase the odor of the formulation
- DPM should be avoided due to poor film Formation

Often, best results can be obtained when co-solvents and surfactants are pre-blended prior to the addition to the hybrid polymer dispersion.

FLOW, LEVELING AND FOAM CONTROL: For wetting and spreading, the addition of 0.05% (total formulation weight) of Byk-333 has been found to provide good appearance in topcoat formulations. Byk-024 at 0.1% (total formulation weight) has shown effectiveness for defoaming in topcoats. For topcoats in general, it is advised to avoid the use of additives that contain mineral oils or DPM solvent, as these will result in lower gloss. In primers, SURFYNOL® DF58 can be used for defoaming.

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 should be incorporated 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 predispersed pigments. For high-gloss coatings, a resin-freegrind of TiO₂ with Disperbyk-190 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 in a solution of co-solvent and surfactant before adding to 100 parts of the Hybridur 870 dispersion.

CORROSION INHIBITING PIGMENTS: Heucophos ZBZ has been found to provide good corrosion inhibition in Hybridur dispersion-based coatings. Other promising corrosion inhibiting pigments include: Heucophos ZPO, ZPA, ZMP, and ZPZ.

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 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 coatings that have dried may require a thorough wipe with a methanol-soaked towel.

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



FLASH RUST INHIBITOR: Ammonium benzoate (10% solution in water) can be used as a flash rust inhibitor at 1% of total formulation weight.

TRADEMARKS AND SUPPLIERS

SURFYNOL® DF58	Evonik
ACRYSOL® RM-2020NPR, RM-8W	Dow Chemical
ARCOSOLV® DPNB	Lyondell
BYK® -024, -333, -348; Disperbyk® -190	Byk-Chemie
DOWANOL® DPnB, TPM	Dow Chemical
EXXATE® 1200	Hallstar
FOAMASTER® VF	BASF
HEUCOPHOS® ZBZ, ZPO, ZPA, ZMP, ZPZ	Heucotech Ltd. (Heubach)
PROGLYDE® DMM	Dow Chemical
TAFIGEL® PUR 60	Münzing Chemie GmbH
TEXANOL® Ester Alcohol	Eastman Chemical
TINUVIN® 384, 292	BASF
TI-PURE® R-706, R-960	Chemours

STARTING POINT FORMULATION HYBRIDUR 870 WHITE PRIMER

ONE-COMPONENT POLYURETHANE-ACRYLIC HYBRID COATING FORMULATION – HY870MWP01

MATERIAL	POUNDS	GALLONS	SUPPLIER
Grind: Add the following into a clean container under mild agitation and mix until blended.			
Hybridur 870 dispersion	130.20	15.15	Evonik
Disperbyk-190 (Dispersant)	8.65	0.99	Byk-Chemie
FOAMASTER VF (Defoamer)	3.47	0.45	BASF
TI-PURE R-960 (TiO ₂ Pigment)	65.00	1.95	Chemours
HEUCOPHOS ZBZ (Anticorrosive)	113.59	3.58	Heucotech Ltd.
Increase speed to high and disperse to Hegman ≥ 7 grind. Temperature must not exceed 140°F. Letdown: Add the following to the grind; mix with medium agitation for a minimum of 15 minutes.			
Hybridur 870 dispersion	523.75	60.93	Evonik
TAFIGEL PUR 60 Thickener	0.84	0.09	Münzing Chemie GmbH
Ammonium Benzoate ¹ (Flash Rust Inhibitor)	37.57	4.49	Aldrich
ARCOSOLV DPNB (Solvent)	39.76	5.24	Lyondell
TEXANOL Ester Alcohol (Solvent)	52.03	6.57	Eastman
BYK-348 (Surfactant)	4.33	0.56	Byk-Chemie
Total	979.19	100.00	

¹ Added to the letdown as a 10% solution in water (included in weight).

FORMULATION CHARACTERISTICS

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

Weight Solids, %	46.5	VOC, lb/gal (g/l)	1.93 (231)
Volume Solids, %	36.4	Density, lb/gal (g/ml)	9.79 (1.17)
PVC, %	16.4		

* Properties reported are based on theoretical calculations.

TYPICAL COATING PERFORMANCE PROPERTIES

The following are typical properties only and are not intended to be specifications. Coating properties were tested over cold rolled steel with a zinc phosphate treatment (Bonderite 952) unless otherwise specified. Coatings were applied using a wire wound rod with a 0.110 inch wire diameter and were allowed to dry at 70°F and 50% relative humidity for 7 days. Dried film thickness was approximately 1.8 mils.

Gloss, 60° (ASTM D 523)	14	Impact Resistance (ASTM D 2794)	
Adhesion		Direct and Reverse, in-lb	> 160
Dry Tape (ASTM D 3359)	4A	Hardness	
Wet Tape (24 hr @ 70 °F)	4A	Persoz, s (ASTM D 4366)	83
Dry Scrape, kg (ASTM D 2197A)	> 10.5	Humidity Resistance (ASTM D 2247)	
Double Rubs (ASTM D 4752)		(100 °F / 100% RH, 1000 hours)	No Blisters
IPA	125		
MEK	> 200		

STARTING POINT FORMULATION HYBRIDUR 870 GLOSS WHITE PRIMER

ONE-COMPONENT POLYURETHANE-ACRYLIC HYBRID COATING PREPARED WITH A RESIN-FREE GRIND FORMULATION – HY870MWT01

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	Evonik
Disperbyk-190 (Dispersant)	25.73	2.93	Byk-Chemie
BYK-024 (Defoamer)	0.61	0.07	Byk-Chemie
Continue agitation while adding the pigment below.			
TI-PURE R-706 (TiO₂ Pigment)	214.31	6.42	Chemours
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)	19.07	2.29	
Blend: Add the following into a separate, clean container under mild agitation and mix until blended.			
Hybridur 870 dispersion	657.07	76.45	Evonik
Pre-blend the next 5 items before adding to the Hybridur 870 dispersion with strong agitation.			
PROGLYDE DMM (Solvent)	39.96	5.30	Dow Chemical
DOWANOL DPnB Glycol Ether (Solvent)	15.64	2.06	Dow Chemical
TEXANOL Ester Alcohol (Solvent)	14.03	1.77	Eastman
BYK-333 (Surfactant)	0.51	0.06	Byk-Chemie
BYK-024 (Defoamer)	0.40	0.05	Byk-Chemie
Final Blend: Slowly add the resin-free grind to the blend and mix with mild agitation until homogeneous.			
Total	1009.02	100.00	

FORMULATION CHARACTERISTICS

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

Weight Solids, %	48.5	VOC, lb/gal (g/l)	1.654 (184)
Volume Solids, %	36.9	Density, lb/gal (g/ml)	10.09 (1.21)
PVC, %	17.4		

* Properties reported are based on theoretical calculations.



TYPICAL COATING PERFORMANCE PROPERTIES

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

Gloss, 60° (ASTM D 523)	84	Hardness	
Adhesion		Persoz, s (ASTM D 4366)	78
Dry Tape (ASTM D 3359)	4A	Double Rubs (ASTM D 4752)	
Dry Scrape, kg (ASTM D 2197A)	> 10.5	IPA	50
Impact Resistance (ASTM D 2794)		MEK	> 200
Direct and Reverse, in-lb	> 160		

STARTING POINT FORMULATION HYBRIDUR 870 CLEAR COATING—AIR DRY

ONE-COMPONENT POLYURETHANE-ACRYLIC HYBRID COATING FORMULATION – HY870MCT01

MATERIAL	POUNDS	GALLONS	SUPPLIER
Pre-Mix: Mix a solution of the following.			
PROGLYDE DMM (Solvent)	46.62	6.19	Dow Chemical
DOWANOL DPnB (Solvent)	18.26	2.40	Dow Chemical
TEXANOL Ester Alcohol (Solvent)	16.39	2.07	Eastman
BYK-333 (Surfactant)	0.43	0.05	Byk-Chemie
BYK-024 (Defoamer)	0.85	0.10	Byk-Chemie
Resin Blend: Add the above Pre-Mix to the Hybridur 870 with strong agitation.			
Hybridur 870 dispersion	766.58	89.19	Evonik
Total	849.13	100.00	

FORMULATION CHARACTERISTICS

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

Weight Solids, %	36.3	VOC, lb/gal (g/l)	1.84 (220)
Volume Solids, %	34.2	Density, lb/gal (g/ml)	8.49 (1.02)
PVC, %	0		

* Properties reported are based on theoretical calculations.



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