EASTMAN

Compatibility of **Eastman waterborne polyolefins** and **European resins**

Applying paint to polypropylene and other thermoplastic polyolefins (TPO) is difficult because most coatings exhibit poor adhesion to these types of plastics. Eastman chlorinated polyolefin (CPO) adhesion promoters are effective tools for improving paint adhesion to these substrates and are now supplemented by Eastman Advantis™ 510W, adhesion promoter. The addition of Eastman polyolefin dispersions to waterborne systems provides a means to promote adhesion and makes it possible to apply an adhesion-promoting primer.

The purpose of this technical tip is to indicate which resins are compatible or likely to be compatible with Eastman waterborne polyolefin materials. A short study was performed to demonstrate the improved adhesion of both an acrylic and polyurethane dispersion onto a TPO substrate by direct addition of the adhesion promoters prior to spray application.

The information in this technical tip will be of interest to customers involved in the production of coatings for low-surface-energy plastic substrates for automotive, teletronics, printing inks, or general industrial applications.

Physical properties

Eastman CP 310W, CP 347W, and CP 349W waterborne chlorinated polyolefin adhesion promoters, water dispersions of the same CPO resin, differ in the neutralizing amine in each and the presence of ethylene glycol in Eastman CP 349W. Eastman Advantis™ 510W is a next-generation, waterborne, halogen-free polyolefin adhesion promoter. The physical properties of each are shown in Table 1.

Table 1. Typical properties[a]

	Eastman CP 310W	Eastman CP 347W	Eastman CP 349W	Eastman Advantis 510W
Wt% solids	30	25	26	24
Wt% CPO	24	20	20	—
Solvent	—	—	5% ethylene glycol	—
pH @ 25°C	9–10	9–10	9–10	8
Stability				
Shelf, 1 yr	No change	No change	No change	No significant change
50°C, 4 wk	Slight settle	No change	No change	No significant change
Freeze/thaw	Good	Good	Good	Poor

[a]*Eastman makes no representation that product in any particular shipment will conform exactly to the values listed.*

Generally, the faster-evaporating ammonia in Eastman CP 310W makes it more useful in adhesion-promoting primers that are air-dried before application of the topcoat. The 2-amino-2-methyl-1-propanol in Eastman CP 347W and CP 349W makes them more compatible with other waterborne resins and therefore more useful as additives. However, there are exceptions to these generalizations, depending on the other components of the substrate/coating system.

Compatibility with European resins

Eastman adhesion promoter dispersions can be added directly to waterborne coating formulations to improve adhesion to polypropylene-based substrates. The utilization of adhesion promoters and resin blends depends initially on the compatibility of the waterborne PO (WBPO) with the water-based resin. The data in Table 2 illustrate the compatibility of Eastman adhesion promoters with various coating resins available in Europe. Details of the resin types and manufacturers used in this study are found in Table 4.

The adhesion promoters were added to the resin systems at 10%, 20%, and 30% levels (wt/wt on resin solids). In some instances, the addition of 2-butoxyethanol or Eastman Texanol™ ester alcohol was required to produce an acceptable coalesced film. The compatibility was assessed by visually checking the solution and the appearance of the dry film on glass. The results of the compatibility study are shown in Table 2.

Table 2. Compatibility study results

Resin	Coalescent level, %	Adhesion promoter addition level percentage											
		Eastman CP 310W			Eastman CP 347W			Eastman CP 349W			Advantis 510W		
		10%	20%	30%	10%	20%	30%	10%	20%	30%	10%	20%	30%
AS 2605	20	SI	SI	SI	SI	SI	SI	SI	SI	SI	I	I	I
AS 2610	30	I	I	I	I	I	I	I	I	I	I	I	I
AS 2615	20	C	C	C	C	C	C	C	C	C	SI*	VSI	C
CUR 99	—	C	C	C	C	C	C	C	C	C	C	C	C
LUX 101	—	C	C	C	C	C	C	C	C	C	C	C	C*
LUX 352	—	C	C	C	C	C	C	C	C	C	C	C	C
LUX 399	—	C*	C*	C*	C*	C*	C*	C*	C*	C*	C	C	C*
U 325	—	C	C	C	C	C	C	C	C	C	C	C	C
U 615	—	C	C	C	C	C	C	C	C	C	C	C	C
Bayhydrol® A 145	—	C	C	C	C	C	C	C	C	C	C	C	C
Bayhydrol PT 241	—	C*	VSI*	SI	C	C	C	C	C	C	VSI	SI	SI
Bayhydrol VPLS 2139	—	I	I	I	SI	SI	SI	SI	SI	SI	SI*	SG	SG
Bayhydrol VPLS 2290	—	C*	C	C	C	C*	C	C*	C	C	I	I	I
Bayhydrol VPLS 2952	—	VSI	VSI	SI	C	C	C	C	C	C	VSI	VSI	VSI
NeoCryl® A615	—	C	C	SI	C	C	VSI	C	C	C	C	C	C
NeoCryl A639	20	SI	SI	SI	SI	SI	SI	VSI	SI	SI	VSI*	VSI*	VSI*
NeoCryl A662	20	VSI	VSI	SI	C	C	C	C	C	C	I	I	I
NeoCryl XK12	10	I	I	I	I	I	I	I	I	I	C	C	C
NeoCryl XK62	10	C	C	C	C	C	C	C	C	C	C	C	C
Incorez W830/140	—	C	C	C	C	C	C	C	C	C	C	C	C
Incorez W835/446	—	C	C	C	C	C	C	C	C	C	C	C	C
Incorez W2310	—	I	I	I	I	I	I	I	I	I	I	I	I
Incorez W2450	—	C	C	C*	C	C	C	C	C	C	C	C	C
Incorez W2600	—	VSI	VSI	VSI	VSI	VSI	VSI	VSI	VSI	VSI	C	C	C
Joncryl® 1555	—	VSI*	SG	SG	C	SG	SG	C	SG	SG	C	C	C
Joncryl 8211	15	SG	SG	SG	SG	SI*	SG	SI*	SG	SG	C	VSI*	VSI*
Joncryl 8320	10	C	VSI*	I	C	C	C	C	C	C	C	C	C
Setal® 6306 SS60	—	SG	SG	SG	SG	SG	SG	SG	SG	SG	SG	SG	SG
Setalux® 6510 AQ42	—	C	C	C	C	C	C	C	C	C	C	C	C
Setalux 6511 AQ47	—	C*	I	I	C	C	C	C	C	C	C	C	C
Setalux 6520 AQ45	10	VSI	SI	SI	VSI	SI	SI	C	C	C	C	C	C
Setalux 6801 AQ24	—	SG	SG	SG	C*	SG	SG	C*	SG	SG	SG	SG	SG
Primal™ AC-339	10	SI	SI	SI	VSI	VSI	VSI	C	C	C	C	C	C
Primal WL-100	10	VSI	VSI	VSI	C	C	C	C	C	C	C	C	C
Primal WL-91K	10	VSI	VSI	VSI	C	C	C	C	C	C	C	C	C

Legend
C = Compatible **INC** = Incompatible **SG** = Solution gelled **SI** = Slightly incompatible **VSI** = Very slightly incompatible

**Solution viscosity increase*

Adhesion performance

To indicate the adhesion performance of coatings applied to polypropylene, a series of clear (nonpigmented) primers was prepared using Eastman Advantis™ 510W blended with a polyurethane dispersion and a styrene-acrylic emulsion.

The co-resins tested were:
- **Incorez W835/177:** *A cosolvent-free polyurethane dispersion (PUD)*
- **NeoCryl® XK62:** *A styrene-acrylic emulsion*

The primer coats were spray applied onto SABIC PP108MF97 (PP/EPDM) substrate then overcoated with a solventborne silver metallic base coat and 2K acrylic/urethane clear coat. A cross-hatch adhesion test was performed after 24 hours. Applying and removing tape over the scribed cross-hatch test area measured the amount of coating left on substrate (0% = worst adhesion, 100% = best adhesion). The results shown in Table 3 indicate that the addition of Advantis™ 510W to both the acrylic and PUD improved adhesion to the substrate from poor to excellent.

Paint application

Primer
Pneumatic spray (5 bar) to 4 µm DFT (dry film thickness); 30 min flash-off

Base coat
Pneumatic spray (4 bar) to 15 µm DFT; 10 min flash-off

2K clear coat
Pneumatic spray (4 bar) to 35 µm DFT
10 min flash-off

Cure time
20 min @ 80°C

Table 3. Adhesion data

Film former	NeoCryl XK62—Acrylic			Incorez W835/177—PUD		
Adhesion promoter	None	Eastman Advantis 510W		None	Eastman Advantis 510	
Film former (on solids)	NA	25:75	50:50	NA	25:75	50:50
Cross-hatch adhesion after 24 hours	0%	100%	100%	0%	100%	100%

Use in adhesion-promoting primers

Eastman adhesion promoter dispersions are used as the base resin in adhesion-promoting primers. Information on optimization for this application is available in Eastman publication GN-411, *Formulating with Eastman waterborne CPO adhesion promoters*.

Conclusion

The data in this technical tip indicate the versatility of Eastman waterborne polyolefin adhesion promoters for use in combination with European resin dispersions. This technical tip further illustrates how the addition of a WBPO to examples of such dispersions resulted in improved adhesion on a polyolefin-based substrate.

Additionally, Advantis 510W provides the advantage of being halogen-free, benefiting the user by reducing environmental issues with regards to waste paint disposal and recycling of coated parts. For additional information or for help in determining which Eastman waterborne polyolefin adhesion promoter best suits your application, contact Eastman Technical Service.

Table 4. List of manufacturers and resin type

Product	Manufacturer	Type	% Solid
AS 2605	Alberdingk Boley	Styrene acrylic	50
AS 2610	Alberdingk Boley	Styrene acrylic	50
AS 2615	Alberdingk Boley	Styrene acrylic	51
CUR 99	Alberdingk Boley	PUD	30
LUX 101	Alberdingk Boley	UV-cure polyester PUD	40
LUX 352	Alberdingk Boley	UV-cure polyester PUD acrylic copolymer	43
LUX 399	Alberdingk Boley	UV-cure polyester PUD acrylic copolymer	45
U 325	Alberdingk Boley	PUD	40
U 615	Alberdingk Boley	PUD	39
Bayhydrol A 145	Covestro	Acrylic polyol	45
Bayhydrol PT 241	Covestro	Polyester PUD	41
Bayhydrol VPLS 2139	Covestro	Polyester/polyacrylate polyol	48
Bayhydrol VPLS 2290	Covestro	Polyester/polyacrylate dispersion	45
Bayhydrol VPLS 2952	Covestro	PUD	40
NeoCryl A615	DSM	Acrylic dispersion	36
NeoCryl A639	DSM	Acrylic emulsion	45
NeoCryl A662	DSM	Acrylic emulsion	40
NeoCryl XK12	DSM	Acrylic emulsion	45
NeoCryl XK62	DSM	Styrene acrylic	42
Incorez W830/140	Incorez	Polycarbonate PUD	32
Incorez W835/177	Incorez	Polyester PUD	34
Incorez W830/397	Incorez	Urethane/acrylic hybrid	33
Incorez W2310	Incorez	Urethane/acrylic hybrid	38
Incorez W2450	Incorez	Urethane/acrylic hybrid	40
Incorez W2600	Incorez	Urethane/acrylic hybrid	40
Joncryl 1555	BASF	Acrylic emulsion	45
Joncryl 8211	BASF	Acrylic emulsion	44
Joncryl 8320	BASF	Acrylic emulsion	41
Joncryl 8330	BASF	Acrylic emulsion	38
Setal 6306 SS60	Allnex	Polyester polyol	60
Setalux 6510 AQ42	Allnex	Acrylic polyol	42
Setalux 6511 AQ47	Allnex	Acrylic polyol	47
Setalux 6520 AQ45	Allnex	Acrylic polyol	45
Setalux 6758 AQ40	Allnex	Acrylic dispersion	40
Setalux 6801 AQ24	Allnex	Acrylic copolymer	24
Primal AC-339	Dow Chemical	Acrylic copolymer	48
Primal WL-100	Dow Chemical	Acrylic copolymer	50
Primal WL-91K	Dow Chemical	Acrylic copolymer	40.5

EASTMAN

The results of **insight**™

Eastman Corporate Headquarters
P.O. Box 431
Kingsport, TN 37662-5280 U.S.A.

U.S.A. and Canada, 800-EASTMAN (800-327-8626)
Other Locations, +(1) 423-229-2000

www.eastman.com/locations

ADD-COAT-9327 8/19