

Eastman™ Adhesion Promoters Technical Tip

Compatibility of Eastman™ Waterborne Polyolefins and European Resins (TT-36C)

INTRODUCTION

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 an effective tool for improving paint adhesion to these substrates and are now supplemented by Eastman Advantis™ 510W, a new waterborne chlorine-free 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 to customers which resins are compatible or likely to be compatible with Eastman™ waterborne PO materials. Furthermore, 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.

DISCUSSION

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 the next generation waterborne, halogen-free polyolefin adhesion promoter. The physical properties of each are shown in Table 1.

Table 1: Typical Properties^a

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

^aEastman makes no representation that product in any particular shipment will conform exactly to the values listed.

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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 make 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 illustrates 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 on the final page of this technical tip.

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 (a) 2-butoxyethanol or (b) Eastman Texanol™ EA 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 Data

Resin	Coalescent Level	Adhesion Promoter Addition Level Percentage												
		Eastman™ CP 310W			Eastman™ CP 347W			Eastman™ CP 349W			Eastman Advantis™ 510W			
		10%	20%	30%	10%	20%	30%	10%	20%	30%	10%	20%	30%	
AS2605	20% ^a	SI	SI	SI	SI	SI	SI	SI	SI	SI	SI	I	I	I
AS2610	30% ^a	I	I	I	I	I	I	I	I	I	I	I	I	I
AS2615	20% ^a	C	C	C	C	C	C	C	C	C	C	SI*	VSI	C
CUR99	—	C	C	C	C	C	C	C	C	C	C	C	C	C
Lux101	—	C	C	C	C	C	C	C	C	C	C	C	C	C*
Lux352	—	C	C	C	C	C	C	C	C	C	C	C	C	C*
Lux399	—	C*	C*	C*	C*	C*	C*	C*	C*	C*	C*	C	C	C*
U325	—	C	C	C	C	C	C	C	C	C	C	C	C	C
U615	—	C	C	C	C	C	C	C	C	C	C	C	C	C
Bayhydrol A145	—	C	C	C	C	C	C	C	C	C	C	C	C	C
Bayhydrol PT241	—	C*	VSI*	SI	C	C	C	C	C	C	C	VSI	SI	SI
Bayhydrol VPLS 2139	—	I	I	I	SI	SI	SI	SI	SI	SI	SI	SI*	SG	SG
Bayhydrol VPLS 2290	—	C*	C	C	C*	C	C	C*	C	C	C	I	I	I
Bayhydrol VPLS2952	—	VSI	VSI	SI	C	C	C	C	C	C	C	VSI	VSI	VSI
Neocryl A615	—	C	C	SI	C	C	VSI	C	C	C	C	C	C	C
Neocryl A639	20% ^a	SI	SI	SI	SI	SI	SI	VSI	SI	SI	SI	VSI*	VSI*	VSI*

^a2-Butoxyethanol, ^bEastman Texanol™ ester alcohol

C = Compatible, I = Incompatible, SG = Solution gelled, SI = Slightly incompatible, VSI = Very slightly incompatible, * = Solution viscosity increase

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Table 2: Compatibility Data, cont.

Resin	Coalescent Level	Adhesion Promoter Addition Level Percentage											
		Eastman™ CP 310W			Eastman™ CP 347W			Eastman™ CP 349W			Eastman Advantis™ 510W		
		10%	20%	30%	10%	20%	30%	10%	20%	30%	10%	20%	30%
<i>Neocryl A662</i>	20% ^a	VSI	VSI	SI	C	C	C	C	C	C	I	I	I
<i>Neocryl XK12</i>	10% ^a	I	I	I	I	I	I	I	I	I	C	C	C
<i>Neocryl XK62</i>	10% ^a	C	C	C	C	C	C	C	C	C	C	C	C
<i>Incorez W830/140</i>	—	C	C	C	C	C	C	C	C	C	C	C	C
<i>Incorez W835/177</i>	—	C	C	C	C	C	C	C	C	C	C	C	C
<i>Incorez W830/397</i>	—	SI	SI	SI	SG	SG	SG	SG	SG	SG	SI*	SI*	SI*
<i>Incorez W830/446</i>	—	C	C	C	C	C	C	C	C	C	C	C	C
<i>Incorez W2310</i>	—	I	I	I	I	I	I	I	I	I	I	I	I
<i>Incorez W2450</i>	—	C	C	C*	C	C	C	C	C	C	C	C	C
<i>Incorez W2600</i>	—	VSI	VSI	VSI	VSI	VSI	VSI	VSI	VSI	VSI	C	C	C
<i>Joncryl 1555</i>	—	VSI*	SG	SG	C	SG	SG	C	SG	SG	C	C	C
<i>Joncryl 8211</i>	15% ^b	SG	SG	SG	SI*	SG	SG	SI*	SG	SG	C	VSI*	VSI*
<i>Joncryl 8320</i>	10% ^b	SG	SG	SG	VSI*	VSI*	VSI*	VSI*	VSI*	VSI*	C*	C*	VSI*
<i>Joncryl 8330</i>	10% ^a	C	VSI*	I	C	C	C	C	C	C	C	C	C
<i>Setal 6306 SS60</i>	—	SG	SG	SG	SG	SG	SG	SG	SG	SG	SG	SG	SG
<i>Setalux 6510 AQ42</i>	—	C	C	C	C	C	C	C	C	C	C	C	C
<i>Setalux 6511 AQ47</i>	—	C*	I	I	C	C	C	C	C	C	C	C	C
<i>Setalux 6520 AQ45</i>	10% ^a	VSI	SI	SI	VSI	SI	SI	VSI	VSI	SI	I	I	I
<i>Setalux 6758 AQ40</i>	—	C	C	C	C	C	C	C	C	C	C	C	C
<i>Setalux 6801 AQ24</i>	—	SG	SG	SG	C*	SG	SG	C*	SG	SG	SG	SG	SG
<i>Primal AC339</i>	10% ^a	SI	SI	SI	VSI	VSI	VSI	C	C	C	C	C	C
<i>Primal WL100</i>	10% ^a	VSI	VSI	VSI	C	C	C	C	C	C	C	C	C
<i>Primal WL91K</i>	10% ^a	VSI	VSI	VSI	C	C	C	C	C	C	C	C	C

^a2-Butoxyethanol, ^bEastman Texanol™ ester alcohol

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Adhesion Performance

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

Co-resins tested:

Incorez W835/177:

Co-solvent free polyurethane dispersion (PUD)

Neorez XK62:

Styrene-acrylic emulsion

The primer coats were spray applied onto *Sabic* PP108MF97 (PP/EPDM) substrate, then overcoated with a solventborne silver metallic basecoat and 2K acrylic/urethane clearcoat. 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 the adhesion to the substrate from poor to excellent.

Paint Application

Primer:

Pneumatic spray (5bar) to 4µm DFT
(Dry Film Thickness). 30 minutes flash-off

Basecoat:

Pneumatic spray (4bar) to 15µm DFT.
10 minutes flash-off

2K Clearcoat:

Pneumatic spray (4bar) to 35µm DFT.
10 minutes flash-off

Cure time:

20 minute @ 80°C

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

This study clearly indicates the versatility of Eastman™ waterborne polyolefin adhesion promoters for use in combination with European resin dispersions. It 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, please contact Eastman Technical Service.

Table 3: Adhesion Data

Film Former	<i>Neocryl</i> XK62 - Acrylic			<i>Incorez</i> W835/177 - PUD		
	None	Eastman Advantis™ 510W		None	Eastman Advantis™ 510W	
Adpro : Film former (on solids):	N/A	25:75	50:50	N/A	25:75	50:50
Cross-hatch adhesion After 24 hours	0%	100%	100%	0%	100%	100%

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Manufacturer and Resin Type

Product	Manufacturer	Type	% Solid
<i>AS2605</i>	Alberdingk Boley	Styrene acrylic	50
<i>AS2610</i>	Alberdingk Boley	Styrene acrylic	50
<i>AS2615</i>	Alberdingk Boley	Styrene acrylic	51
<i>CUR99</i>	Alberdingk Boley	PUD	30
<i>Lux101</i>	Alberdingk Boley	UV cure polyester PUD	40
<i>Lux352</i>	Alberdingk Boley	UV cure acrylic co-polymer	43
<i>Lux399</i>	Alberdingk Boley	UV cure polyester PUD acrylic co-polymer	45
<i>U325</i>	Alberdingk Boley	PUD	40
<i>U615</i>	Alberdingk Boley	PUD	39
<i>Bayhydrol A145</i>	Bayer	Acrylic polyol	45
<i>Bayhydrol PT241</i>	Bayer	Polyester PUD	41
<i>Bayhydrol VPLS 2139</i>	Bayer	Polyester/polyacrylate polyol	48
<i>Bayhydrol VPLS 2290</i>	Bayer	Polyester/polyacrylate dispersion	45
<i>Bayhydrol VPLS2952</i>	Bayer	PUD	40
<i>Neocryl A615</i>	DSM Neoresins	Acrylic dispersion	36
<i>Neocryl A639</i>	DSM Neoresins	Acrylic emulsion	45
<i>Neocryl A662</i>	DSM Neoresins	Acrylic emulsion	40
<i>Neocryl XK12</i>	DSM Neoresins	Acrylic emulsion	45
<i>Neocryl XK62</i>	DSM Neoresins	Styrene acrylic	42
<i>Incorez W830/140</i>	Industrial Copolymers Ltd	Polycarbonate PUD	32
<i>Incorez W835/177</i>	Industrial Copolymers Ltd	Polyester PUD	34
<i>Incorez W830/397</i>	Industrial Copolymers Ltd	Polyester PUD	33
<i>Incorez W830/446</i>	Industrial Copolymers Ltd	PUD	34
<i>Incorez W2310</i>	Industrial Copolymers Ltd	Urethane/acrylic hybrid	38
<i>Incorez W2450</i>	Industrial Copolymers Ltd	Urethane/acrylic hybrid	40
<i>Incorez W2600</i>	Industrial Copolymers Ltd	Urethane/acrylic hybrid	40
<i>Joncryl 1555</i>	Johnson Polymer	Acrylic emulsion	45
<i>Joncryl 8211</i>	Johnson Polymer	Acrylic emulsion	44
<i>Joncryl 8320</i>	Johnson Polymer	Acrylic emulsion	41
<i>Joncryl 8330</i>	Johnson Polymer	Acrylic emulsion	38
<i>Setalux 6306 SS60</i>	Nuplex Resins	Polyester polyol	60
<i>Setalux 6510 AQ42</i>	Nuplex Resins	Acrylic polyol	42
<i>Setalux 6511 AQ47</i>	Nuplex Resins	Acrylic polyol	47
<i>Setalux 6520 AQ45</i>	Nuplex Resins	Acrylic polyol	45
<i>Setalux 6758 AQ40</i>	Nuplex Resins	Acrylic dispersion	40
<i>Setalux 6801 AQ24</i>	Nuplex Resins	Acrylic co-polymer	24
<i>Primal AC339</i>	Rohm & Haas	Acrylic co-polymer	48
<i>Primal WL100</i>	Rohm & Haas	Acrylic co-polymer	50
<i>Primal WL91K</i>	Rohm & Haas	Acrylic co-polymer	40.5

Eastman™ Adhesion Promoters Technical

TT-36C

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