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EASTMAN ADHESION PROMOTER TECHNICAL TIP

# Compatibility study of Eastman Advantis™ 510W adhesion promoter for automotive coatings

Eastman Advantis 510W is a waterborne, chlorine-free adhesion promoter that helps coatings stick to automotive plastic substrates such as thermoplastic polyolefins (TPO) and polypropylene (PP). It can be used to substitute for chlorinated polyolefins (CPO). Advantis 510W can be used as a stand-alone primer to help automotive base coats stick. However, because of the move to fewer coating steps in the automotive painting process, many customers use Advantis 510W as a stir-in additive to waterborne base coats. Because these formulations are complicated systems with different additives, binders, surfactants and solvents, work was done to better understand the compatibility of Advantis 510W with some of these materials.

We measured the compatibility of Advantis 510W with additives commonly used in waterborne base coats, such as amines, surfactants and solvents. Drops of the additives were put into Advantis 510W until a noticeable change in appearance or viscosity occurred. In some cases, when no change was seen, we added material until we reached a maximum level specific to each additive. This level is much higher than typical levels used in water-based coatings. Changes were noted both initially and after 24 hours.

## Discussion

Eastman Advantis 510W is compatible with most additives and solvents at the maximum weight percent added. A few aren't compatible at a measured weight percent. All weight percent data are based on the total weight of the Advantis 510W. Each material was added gradually to the Advantis 510W with stirring (using a magnetic stirrer at 500 rpm) in a 200-mL beaker. The weight percent added was the maximum level when there was no noticeable change in either appearance or viscosity. In some cases, the process was stopped because there was a visible change in viscosity or appearance. Visual changes were noted, and both viscosity increases and material solubility in the Advantis 510W were rated. Latter studies were performed on any additives that were initially soluble in the Advantis 510W but gelled after 24 hours to determine the more precise amount added before any changes took place. The data are shown in Table 1.

**Table 1.** Eastman Advantis™ 510W compatibility study

| | Wt% added[1] | Initial appearance and characteristics | Initial viscosity rating (1–4)[2] | Initial solubility | 24-hour appearance and characteristics | 24-hour viscosity rating (1–4)[2] | 24-hour solubility |
|---|---|---|---|---|---|---|---|
| **Amines** | | | | | | | |
| DMEA | 13 | Congealed on surface | Insoluble | Insoluble | No change | Insoluble | Insoluble |
| AMP | 35 | No visible change | 1 | Soluble | No change | 1 | Soluble |
| Ammonia | 35 | No visible change | 1 | Soluble | No change | 1 | Soluble |
| Eastman Advantex™ amine additive | 32 | No visible change | 1 | Soluble | No change | 1 | Soluble |
| **Surfactants** | | | | | | | |
| Tergitol 15-S-9 | 9 | Thickened | 4 | Soluble | No change | 4 | Soluble |
| Tergitol 15-S-15 (solid) | 6 | Thickened; required generous mixing | 2 | Soluble | No change | 2 | Soluble |
| Tergitol 15-S-3 | 3 | Thickened | 4 | Soluble | No change | 4 | Soluble |
| **Solvents** | | | | | | | |
| Aromatics | | | | | | | |
| Xylene | 1.5 | Thickened | 4 | Soluble | No change | 4 | Soluble |
| Aromatic 100 | 2.5 | Thickened | 4 | Soluble | No change | 4 | Soluble |
| **Alcohols** | | | | | | | |
| Butanol | 15 | Thickened and cloudy | 2 | Soluble | Separated | Insoluble | Insoluble |
| Isobutanol | 14 | Thickened | 2 | Soluble | Separated | Insoluble | Insoluble |
| Propanol[3] | 5 | No visible change | 1 | Soluble | No change | 1 | Soluble |
| | 10 | No visible change | 1 | Soluble | No change | 1 | Soluble |
| | 15 | No visible change | 1 | Soluble | No change | 1 | Soluble |
| | 20 | No visible change | 1 | Soluble | No change | 1 | Soluble |
| | 25 | No visible change | 1 | Soluble | Thickened | 2 | Soluble |
| | 30 | Cloudy | 1 | Soluble | Thickened | 3 | Soluble |
| | 35 | Milky white | 1 | Soluble | Thickened | 4 | Soluble |
| Isopropanol | 35 | Milky white | 2 | Soluble | Thickened | 3 | Soluble |
| **Coalescents** | | | | | | | |
| Eastman Texanol™ ester alcohol[3] | 1 | No visible change | 1 | Soluble | Cloudy | 1 | Soluble |
| | 2 | No visible change | 1 | Soluble | Thickened and cloudy | 2 | Soluble |
| | 3 | No visible change | 1 | Soluble | Thickened and cloudy | 3 | Soluble |
| | 4 | No visible change | 1 | Soluble | Thickened and milky white | 4 | Soluble |
| | 5 | No visible change | 1 | Soluble | Thickened and milky white | 4 | Soluble |
| Eastman Optifilm™ enhancer 300 | 45 | Milky white | 1 | Soluble | Separated | Insoluble | Insoluble |
| Eastman Optifilm™ enhancer 400 | 45 | Milky white | 1 | Soluble | Separated | Insoluble | Insoluble |

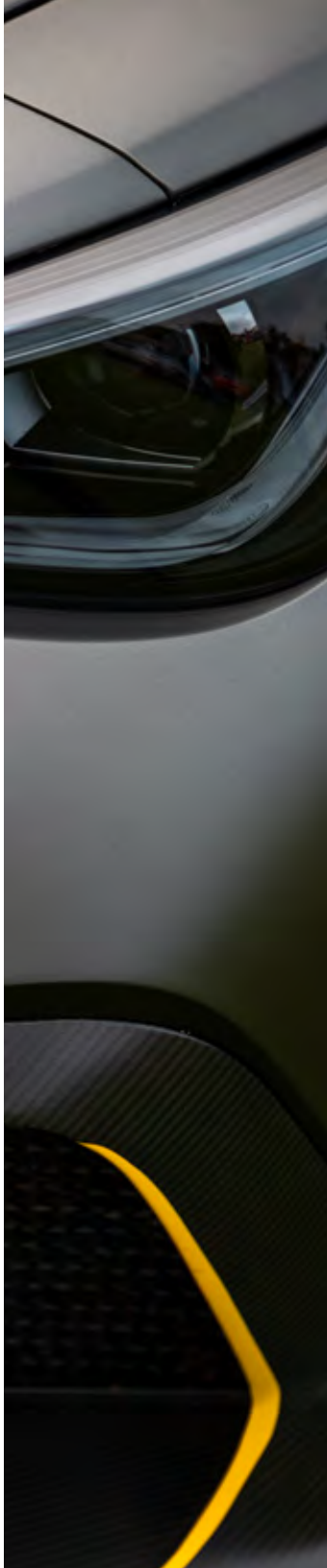


**Table 1.** Eastman Advantis™ 510W compatibility study *(continued)*

| | Wt% added[1] | Initial appearance and characteristics | Initial viscosity rating (1–4)[2] | Initial solubility | 24-hour appearance and characteristics | 24-hour viscosity rating (1–4)[2] | 24-hour solubility |
|---|---|---|---|---|---|---|---|
| **Glycol ethers** | | | | | | | |
| EB | 11 | Precipitate noticed | Insoluble | Insoluble | Separated; gelled on top | Insoluble | Insoluble |
| DB | 35 | Milky white and thickened | 2 | Soluble | Separated | Insoluble | Insoluble |
| Propylene glycol *n*-butyl ether (PnB) | 23 | Thickened | 2 | Soluble | Separated | Insoluble | Insoluble |
| Dipropylene glycol methyl ether (DPM)[3] | 5 | No visible change | 1 | Soluble | No change | 1 | Soluble |
| | 10 | No visible change | 1 | Soluble | No change | 1 | Soluble |
| | 15 | No visible change | 1 | Soluble | No change | 1 | Soluble |
| | 20 | No visible change | 1 | Soluble | No change | 1 | Soluble |
| | 25 | Cloudy | 1 | Soluble | Thickened | 2 | Soluble |
| | 30 | Cloudy | 1 | Soluble | Thickened | 2 | Soluble |
| | 35 | Cloudy | 1 | Soluble | Thickened | 2 | Soluble |
| | 40 | Milky white | 1 | Soluble | Thickened | 3 | Soluble |
| | 45 | Milky white and thickened | 2 | Soluble | Thickened | 4 | Soluble |
| **Esters** | | | | | | | |
| EB acetate | 45 | Milky white and thickened | 2 | Soluble | Separated | Insoluble | Insoluble |
| *n*-Butyl acetate | 3.5 | Thickened | 4 | Soluble | No change | 4 | Soluble |
| **Chlorinated adhesion promoters** | | | | | | | |
| CP 347W | 46 | No visible change | 1 | Soluble | No change | 1 | Soluble |
| CP 349W | 47 | No visible change | 1 | Soluble | No change | 1 | Soluble |
| CP 310W | 48 | No visible change | 1 | Soluble | No change | 1 | Soluble |

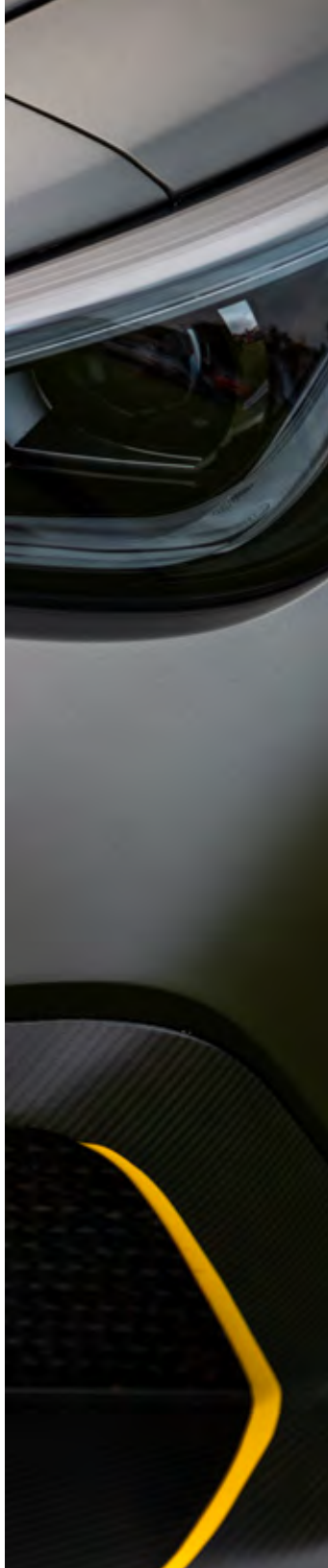


**Table 1.** Eastman Advantis™ 510W compatibility study *(continued)*

| | Wt% added[1] | Initial appearance and characteristics | Initial viscosity rating (1–4)[2] | Initial solubility | 24-hour appearance and characteristics | 24-hour viscosity rating (1–4)[2] | 24-hour solubility |
|---|---|---|---|---|---|---|---|
| **Dispersants** | | | | | | | |
| DISPERBYK 2010 | 15 | No visible change | 1 | Soluble | No change | 1 | Soluble |
| DISPERBYK 2013 | 6 | Thickened; required generous mixing time | 3 | Soluble | No change | 3 | Soluble |
| DISPERBYK 2015[3] | 2.5 | No visible change | 1 | Soluble | No change | 1 | Soluble |
| | 5 | No visible change | 1 | Soluble | No change | 1 | Soluble |
| | 7.5 | No visible change | 1 | Soluble | No change | 1 | Soluble |
| | 10 | No visible change | 1 | Soluble | Thickened | 2 | Soluble |
| | 12.5 | Cloudy and thickened | 2 | Soluble | Thickened | 3 | Soluble |
| | 15 | Cloudy and thickened | 2 | Soluble | Thickened | 4 | Soluble |
| DISPERBYK 180 | 2 | Congealed precipitate formed | Insoluble | Insoluble | No change | Insoluble | Insoluble |
| DISPERBYK 190[3] | 2.5 | No visible change | 1 | Soluble | No change | 1 | Soluble |
| | 5 | No visible change | 1 | Soluble | No change | 1 | Soluble |
| | 7.5 | No visible change | 1 | Soluble | No change | 1 | Soluble |
| | 10 | No visible change | 1 | Soluble | Thickened | 2 | Soluble |
| | 12.5 | Cloudy and thickened | 2 | Soluble | Thickened | 3 | Soluble |
| | 15 | Cloudy and thickened | 2 | Soluble | Thickened | 4 | Soluble |
| DISPERBYK 194N | 1 | Congealed precipitate formed | Insoluble | Insoluble | No change | Insoluble | Insoluble |

*[1]Based on total weight of Eastman Advantis 510W adhesion promoter* *[2]Viscosity rated visually from 1–4. 1 = no viscosity change; 2 = slight increase in viscosity; 3 = moderate increase in viscosity; 4 = large increase in viscosity*
*[3]No visible change*

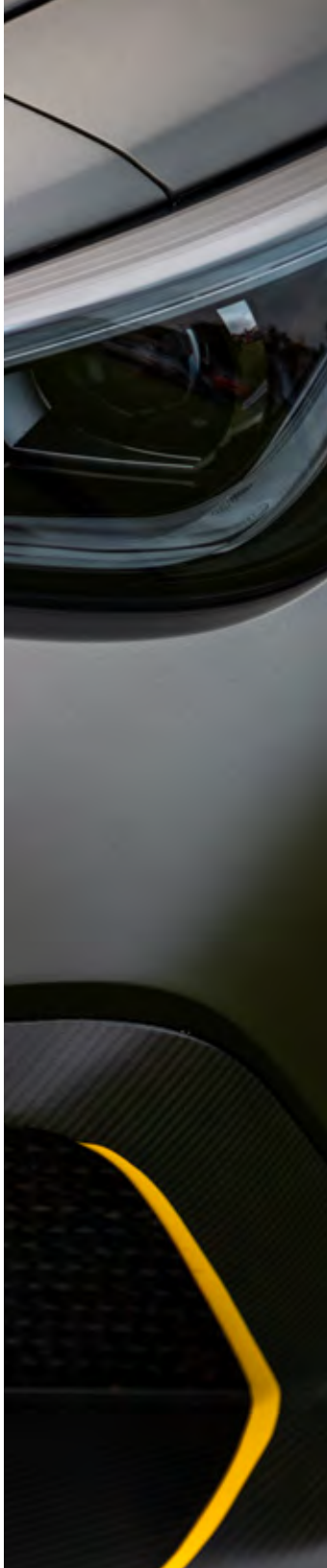
## Conclusion

### Amines

Dimethylethanolamine (DMEA) became incompatible with Advantis 510W after a 13% addition. Advantis 510W seemed to better tolerate AMP-95, Eastman Advantex and ammonia, accepting up to 35% with no increase in viscosity and being soluble in the Advantis 510W. If amines are in the waterborne base coat, then additional DMEA is not compatible with Advantis 510W.

### Surfactants

The addition of Tergitol 15-S-3, 15-S-9, and 15-S-15 all thickened the Advantis 510W. There didn't seem to be a relationship between the viscosity rating and the level of ethoxylate (EO) groups for the Tergitol. All three surfactants demonstrated good solubility.



### Solvents

The addition of aromatic solvents xylene and Aromatic 100 resulted resulted in a high viscosity increase at levels as low as 1.5%. Advantis 510W developed an increased viscosity at a 15% addition of the butanols, compared to a 35% addition of the propanols. When comparing the normal and iso versions of the alcohols, the branched versions were compatible and seemed not to gel as much after 24 hours. Advantis 510W was incompatible with EB, DB and PnB, but DPM showed signs of thickening at 25 wt% after 24 hours. Advantis 510W seemed to be sensitive to glycol ether solvents. When comparing coalescing aids, Texanol was solely compatible. We began to see signs of thickening at 2 wt%. All other coalescing aids caused separation after 24 hours. *n*-Butyl acetate caused thickening at 3.5%, while EB acetate was added up to 45% before any effects were noted. It separated after 24 hours.

### BYK dispersants

BYK dispersants were added up to a maximum of 15%. DISPERBYK 2010 was compatible with Advantis 510W and caused no visible change. DISPERBYK 2015 and 190 started showing signs of thickening at 10 wt% after 24 hours. DISPERBYK 180 and 194N, at levels less than 3%, formed a congealed precipitate with Advantis 510W, and DISPERBYK 2013 thickened the Advantis 510W by 6%.

For more information, contact an Eastman representative.

## References

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

EASTMAN

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