

EASTMAN

Helping enhance the production
and appearance of can coatings

Eastman Solus™
performance additive



Application overview

Consumers want assurance that metal packaging is not compromised, whether it is used to store food or nonfood materials. The metal used in such packaging is usually protected by suitable coatings on its inside and outside surfaces. Coatings that protect external metal packaging surfaces enhance resistance to corrosion and mechanical abrasion, whereas protection of internal packaging surfaces ensures limited interaction between the metal and the contents, which are often food related. In addition to protective qualities, external metal packaging coatings are expected to be aesthetically pleasing, smooth, and defect free. External coatings with a distinct glossy image are important to both manufacturers and consumers.

The performance of can coatings is also important to manufacturers and formulators. Manufacturers seek improved line efficiency with less downtime and production waste, which requires a coated surface that does not cause problems during the can-making and canning processes. Formulators seek multifunctional additives that will enhance the application, appearance and protection qualities of can coatings.

Eastman Solus™ performance additives help address all these coating issues.

The molecular composition of Solus makes it particularly effective for metal packaging coatings. Consumers, can makers and brand owners expect coatings with excellent properties that enable production and appearance benefits. It is theorized that both Solus 1100 and Solus 1000 move through the coating to the surface. During this migration, it is hypothesized that they equalize surface tension and ensure excellent flow and leveling that make application easy. They also produce tack-free coatings, which means no blocking during application and handling. This results in reduced defects, excellent clarity, high gloss and distinctiveness of image (DOI), all of which contribute to stronger and more durable coatings with better appearance.

Eastman offers many products approved for food contact use, including Solus 1100 and Solus 1000. These products are manufactured, stored, handled and transported by Eastman under conditions adhering to current Good Manufacturing Practices for food contact applications. They meet the requirements of the U.S. Food and Drug Administration (CFR Title 21), the European Commission (Regulation 10/2011), and the Swiss Ordinance on Materials and Articles (SR 817.023.21).

Product-in-use details

Solus 1100 and Solus 1000 were evaluated and showed significant improvements in blocking resistance, flow, leveling, gloss, DOI and clarity compared to a leading polyacrylate flow and leveling agent. Both clear and white formulations were tested. Though the tests focused on exterior coatings, the findings should also translate to interior coatings.

Table 1. External clear coating formulation

Description	Ingredient	No additive	1% Solus 1100	1% Polyacrylate	1% Solus 1000
Saturated polyester resin	Novasynth™ S1535-65 ^a	64.73	64.73	64.73	64.73
Melamine resin	Maprenal™ MF612 ^b	15.03	15.03	15.03	15.03
Solvent	Solvesso™ 150 ^c	12.14	12.14	12.14	12.14
Dibasic ester solvent	Loxanol™ CA 5308 ^d	8.10	7.10	7.10	7.10
Flow aid	Solus 1100 ^e	0	1	0	0
Flow aid	Solus 1000 ^e	0	0	0	1
Flow aid	Polyacrylate based	0	0	1	0
Total		100	100	100	100

Specific gravity of formulation is 1.01 kg/L.

^aNovaresine ^bPrefere Resins ^cExxonMobil Chemical ^dBASF ^eEastman

Table 2. Exterior white coating formulation

Description	Ingredient	No additive	1% Solus 1100	1% Polyacrylate	1% Solus 1000
Saturated polyester resin	Novasynth™ S1535-65 ^a	39.04	39.04	39.04	39.04
Melamine resin	Maprenal™ MF612 ^b	8.33	8.33	8.33	8.33
Titanium dioxide pigment	Ti-Pure™ R-900 ^c	11.30	11.30	11.30	11.30
Aromatic 150 solvent	Solvesso™ 150 ^d	33.09	33.09	33.09	33.09
Rheology modifier	Aerosil™ 200 ^e	0.14	0.14	0.14	0.14
Dibasic ester solvent	Loxanol™ CA 5308 ^d	8.10	7.10	7.10	7.10
Flow aid	Solus 1100 ^e	0	1	0	0
Flow aid	Solus 1000 ^e	0	0	0	1
Flow aid	Polyacrylate based	0	0	1	0
Total		100	100	100	100

Specific gravity of formulation with no additive, 1% Solus 1100, and 1% polyacrylate is 0.94 kg/L.

Specific gravity of formulation with Solus 1000 is 0.93 kg/L.

^aNovaresine ^bPrefere Resins ^cChemours ^dExxonMobil Chemical ^eEvonik ^fBASF ^gEastman

The starting point formulations developed by Eastman's technical service laboratories can be used as presented or modified with other resins. If significant changes are made, resin compatibility, viscosity, application performance and subsequent film performance should be thoroughly investigated.

Test results

The blocking, flow, leveling and surface defects were rated in accordance with the ratings in Tables 3, 4 and 5. ASTM test method D3003-01 (2006) was followed for the blocking tests. The panels were subjected to a pressure of 110 psi for 16 hours at 43°C before being pulled apart and assessed for blocking resistance using the ratings in Table 3.

In production-scale coating lines, cellulose esters have demonstrated effectiveness in improving flow and leveling under low- and high-shear conditions. Figures 1 and 2 show that the addition of Solus 1100 or Solus 1000 eliminates blocking, reduces surface defects and enhances flow and leveling in both clear and white can coating formulations.

Figure 1. Block, flow and leveling and surface defects

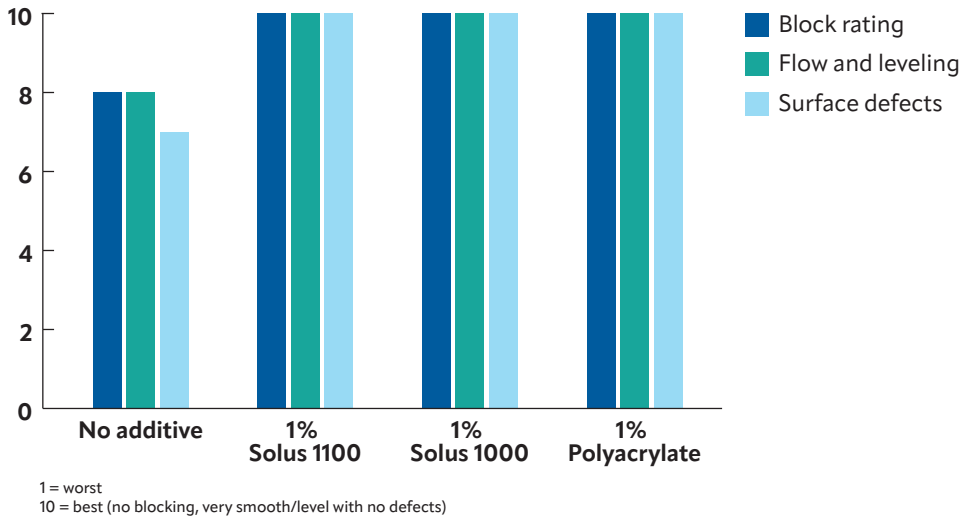


Figure 2. Block, flow and leveling and surface appearance of white can coatings with and without additives

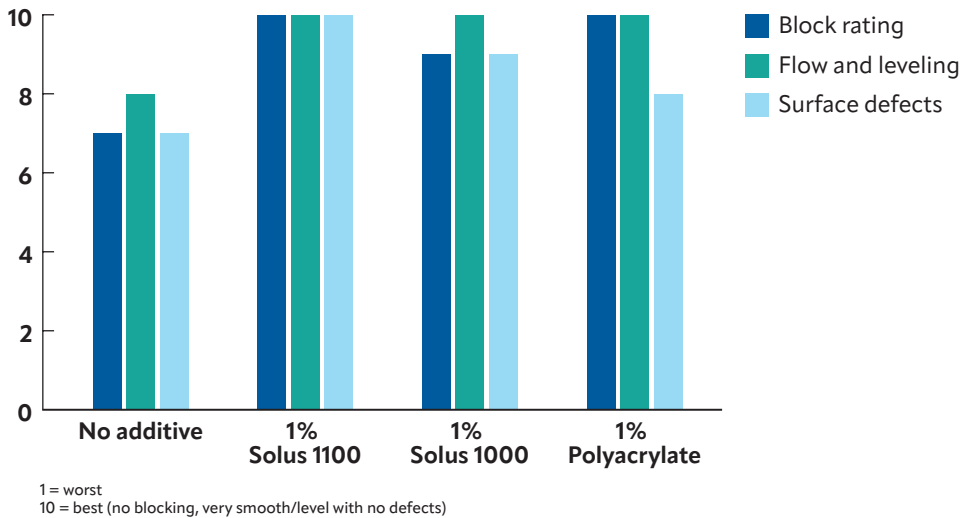


Table 3. Key to block resistance ratings

Rating	Tackiness or blocking
10	Panels fall apart; no tackiness
8	Panels pull apart easily; slight tackiness
6	Panels pull apart with effort; no prying is required to aid separation; slight tack
4	Panels pull apart using reasonable force; prying is required to aid separation; very tacky
2	Panels require prying apart with a spatula or similar instrument
0	Panels block together so they cannot be separated with a spatula or similar instrument without using extreme force

Table 4. Key to flow and leveling ratings

Rating	Flow and leveling
10	Perfect, smooth surface
8	Very smooth
6	Smooth with slight imperfections
4	Smooth with numerous imperfections
2	Poor, uneven surface
0	Very poor, uneven surface; lots of imperfections

Table 5. Key to surface defect ratings

Rating	Surface defects
10	Perfect, smooth surface; no defects
8	Defects barely visible
6	A few defects
4	Defects on 50% of the panel
2	Poor with numerous surface defects
0	Very poor with lots of surface defects

Gloss

Figures 3 and 4 clearly demonstrate that addition of Solus 1100 and Solus 1000 improves the gloss value at 60° in clear and white can coating formulations. The system containing a leading polyacrylate flow and leveling agent produces a sharp reduction in gloss.

Figure 3. 60° gloss values of clear can coatings with and without additives

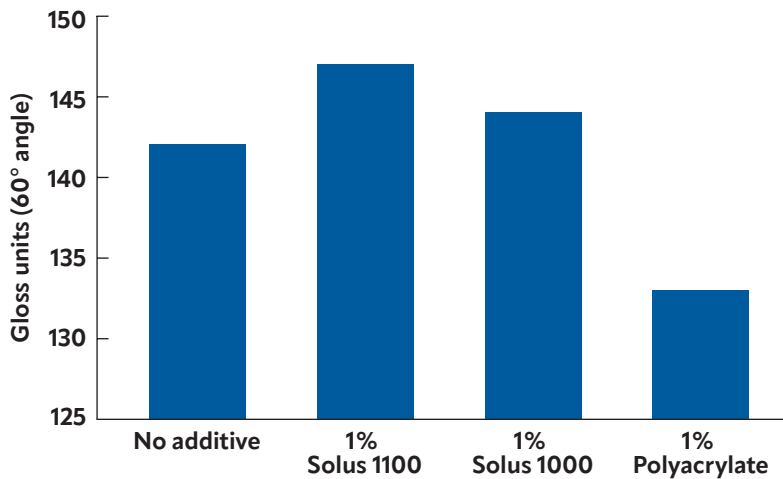
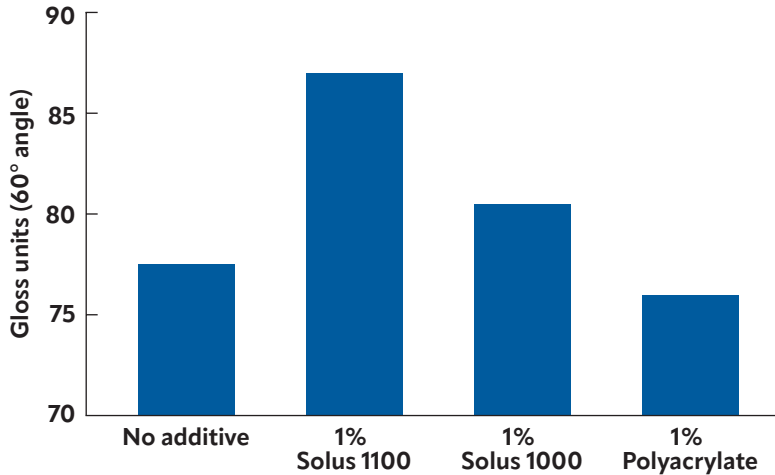


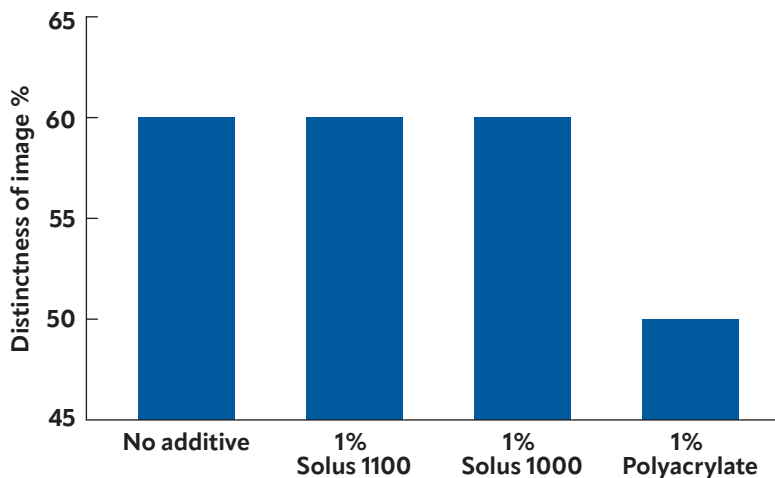
Figure 4. 60° gloss values of white can coatings with and without additives



Distinctiveness of image (DOI)

DOI is determined by measuring the gloss close to the reflection angle. The values obtained are relative numbers from 0 to 100. The higher the DOI value, the sharper a reflected image appears in the coated surface. A high DOI value indicates that the reflection of a high-contrast ratio object would be sharp and clear. As seen in Figure 5, the addition of Solus 1100 and Solus 1000 to a clear can coating formulation does not impact the DOI. A clear coating is produced with no haze and high reflection. The system containing a leading polyacrylate flow/leveling agent produces a sharp reduction in DOI, and a haze can be visually observed. This haze reduces the clarity of the coating and the sharpness of a reflected object.

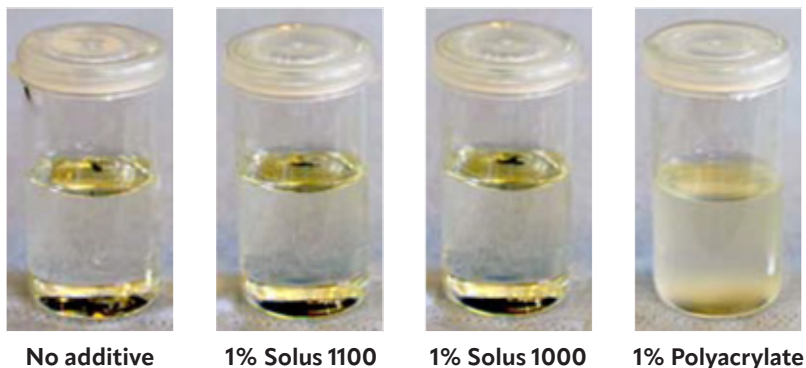
Figure 5. DOI in clear can coatings with and without additives



Clarity

The addition of Solus 1100 and Solus 1000 does not impact the clarity of a clear can coating formulation. A haze in the clear coating system containing a leading polyacrylate flow and leveling agent can be seen in the photograph in Figure 6.

Figure 6. Clear can lacquers after shaking on Griffin flask shaker and standing for 24 hours



Summary

In an external metal packaging coating, Eastman additives enhance production and appearance by:

- Producing a tack-free coating that eliminates blocking
- Improving flow and leveling so that a smooth, glossy surface is achieved
- Reducing the amount of surface defects
- Maintaining DOI
- Providing excellent clarity

In an external white metal packaging coating, Eastman additives enhance production and appearance by:

- Producing a tack-free coating that eliminates blocking
- Improving flow and leveling so that a smooth, glossy surface is achieved
- Reducing the amount of surface defects

Though the test results focused on exterior coatings, the findings should also translate to interior coatings.

For help selecting the best cellulose ester for your needs, contact your Eastman representative or authorized Eastman distributor.

As the world's leading supplier of specialty cellulose esters for more than 85 years, Eastman has a long history of reliably supplying customers with consistently high-quality products manufactured using advanced processes and controls. With a diverse portfolio of more than 50 cellulose esters — including Solus grades — for a variety of applications and years of formulating experience, our technical experts can help customers select the best cellulose ester or blend to achieve the specific performance desired for their unique application. Over the years, we've introduced innovative products that help meet customer needs and market demands — most recently Eastman Solus™ performance additive for high-solids coatings and Eastman membrane material products for membrane filtration. Eastman works with regulatory agencies and industry associations on behalf of our customers to advocate for policies that allow industries to thrive, enabling sustainable innovation. At Eastman, our goal is to enhance the quality of life in a material way.

EASTMAN

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