

EASTMAN

Optimum colorimetric properties for coatings and inks

Eastman Solus™
performance additive



Pigments are expensive, and not achieving the optimal color strength can impact formulation costs and performance. Color strength, in turn, typically requires very good pigment dispersion. Successful pigment dispersion depends on many factors; one is to have a resin base or media that effectively wets pigments.

Because of their excellent pigment-wetting characteristics, Eastman Solus™ performance additives are regularly used as pigment dispersion media.

Application overview

To achieve the optimum colorimetric properties in coatings and inks, pigments need to be ground or dispersed. Pigments are often ground; loaded at high concentrations in the form of liquids, pastes, or pigment chips; and then mixed into coatings systems.

When pigments are not stabilized, flooding and floating can occur.

- Flooding is the tendency of pigments to rise to the surface during drying and curing. This produces a surface color that is different from the rest of the material.
- Floating occurs when pigments separate from each other and concentrate in certain areas, resulting in uneven color distribution.

Solus™ minimizes flooding and floating to produce beautiful coatings with uniform color consistency.

Difficult-to-disperse pigments such as carbon black, phthalocyanine blues and greens, transparent iron oxide, and perylene reds can be dispersed in Solus™ to provide easy-to-use pigment chips.

High-quality black pigments are used to create automotive and plastic coatings with enhanced levels of black often with a blue rather than brown undertone to create a visually attractive black color. These small particle-sized powders are renowned for being difficult to disperse. Formulating with Solus™ alongside specially selected dispersing agents can enable the formulator to achieve excellent mass-tone jetness and blue undertone.

The white pigment — titanium dioxide — usually disperses very well under high-speed dispersion without any dispersing agent. By adding Solus™ to the grind phase, improved pigment dispersion occurs and a purer, whiter color value can be produced.

To further improve pigment dispersion, especially designer pigment, dispersants and wetting aids may be used in conjunction with Solus™. These additives can be highly specific and may not be needed in all dispersions.

Designers want to accentuate the character of their finished products to create stylish and exclusive designs. To achieve this, metallic and



pearlescent flakes — often described as effect pigments — are a very important part of the coating, producing brilliant colors and iridescent effects that bring the curves, styling lines and projections of coated articles to life. The ability to control the orientation of these flakes with minimal defects is critical in producing high-quality finishes. Solus™ acts as a viscosity control agent that “locks” the metallic and pearlescent flakes in the proper orientation, creating an optimized visual effect. And better flake alignment means formulators require fewer flakes to achieve the same — or better — desired aesthetic impact.

In combination with excellent pigment dispersion properties, Solus™ provides numerous benefits that further enhance coating formulations:

- Flexibility to be used as additives, modifiers or co-resins; when used as co-resins, they provide a high-gloss surface due to their resin-like qualities
- Can be cross-linked, particularly with isocyanates and amino resins (especially with the higher-hydroxyl grades of Solus™)
- Improved flow, leveling and defect control
- High resistance to UV light, salt and oxygen that produces superior weatherability, durability and outstanding yellowing resistance over time
- Consistent gloss control with silica matting agents, reducing gloss variation over the coating surface
- Solubility of high-hydroxyl grades in alcohol-water mixtures makes them useful in coatings that require some water solubility
- Excellent hardness development, scratch resistance and reduced blocking due to high T_g
- Reduced drying time (faster dry-to-touch) due to their high T_g and fast solvent release
- Nonflammable and safer to use when compared to nitrocellulose; perfect for improved plant and factory safety and producing articles that comply with nitrocellulose restrictions
- Excellent grease resistance due to good barrier properties

In addition, Solus™ products are based on cellulose, one of the most abundant natural, renewable resources. Many of the grades meet requirements for use in certain food contact applications under regulations of the U.S. Food and Drug Administration (CFR Title 21), European Commission (Regulation 10/2011) and the Swiss Ordinance on Materials and Articles (SR 817.023.21).

Contact your Eastman representative or authorized Eastman distributor for specific regulatory compliance documentation.



Product-in-use details

In the production of paints and inks, various milling and mixing equipment is used to produce pigment dispersions. The types of equipment that can be used to produce pigment dispersions in Solus™ are listed in Table 1.

Table 1. Milling equipment

Viscosity requirement (shear rate)	Physical form of dispersion	Mill type
Low	Fluid	Kady mill, ^a attritor, sand mill, shot mill, ball/pebble mill
Intermediate	Paste	High-speed disperser, three-roll mill
High	Chip	Banbury ^b (sigma blade), two-roll mill

^aKinetic Dispersion Corporation

^bHF Mixing Group

Solus™ can be used to prepare pigment pastes, fluids and chips that are subsequently used in many coating and ink formulations.

Pigment chips for coatings and inks

Pigment chips are dust-free, predispersed, highly concentrated organic and inorganic pigment preparations, usually contained in a resin matrix. They contain no solvents and are dry chip products. The use of pigment chips is universal. They offer the formulator a great deal of flexibility because the time-consuming, dusty and expensive step of dispersing the pigment has already been carried out. The pigment particles in pigment chips are well separated, resulting in high color development, transparency and gloss. Often, the chroma and hue produced from pigment chips are much better than that achieved from the same dry pigment processed using conventional dispersion procedures. The paint formulator simply dissolves the pigment chips into their formulation by mixing to form the colored coating. They are used in many coatings that are applied to substrates like metal, wood, plastic, and paper and board in industries such as the automotive, furniture and ink markets.

Eastman Solus™ is an excellent choice to produce highly dispersed pigment chips. Starting point formulations are available on request.

Fluid ink dispersions

Flexographic and gravure inks are applied in thin films from low-viscosity solutions. A high level of finely ground pigment is essential for desirable appearance properties. Finely ground particles are also important to minimize damage to the printing cylinders. Alcohol-soluble Solus™ grades can be formulated into high-solids pigment dispersions with greater than 50 wt% pigment or as wet-press cakes. Fluid ink dispersions can be formulated by using 20% by weight of pigments such as Sunfast® Blue 249-3450 and Raven® 1020 black pigment with 5% to 8% by weight of Solus™. To make the best fluid dispersions with Solus™, contact your Eastman representative for specific guidelines that we would be happy to provide.

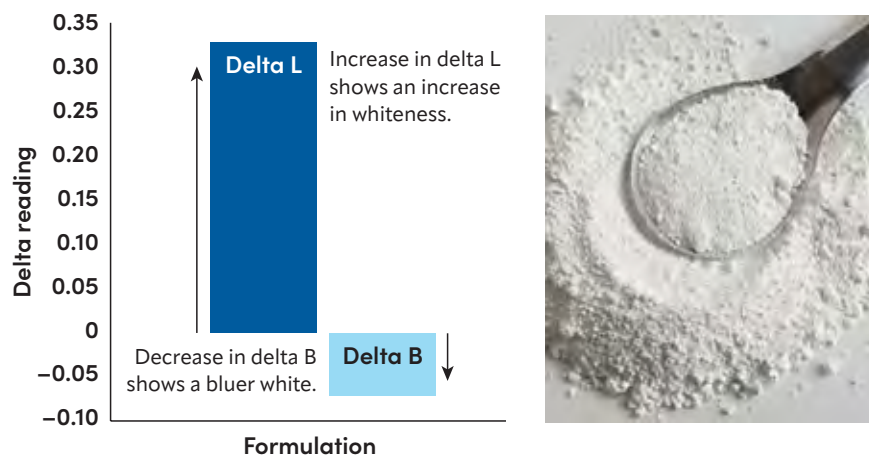
Enhancing the whiteness of titanium dioxide dispersions in coatings

Titanium dioxide usually disperses without any dispersing agent. However, by adding Solus™ to the grind phase, improvement in pigment dispersion can be achieved. To demonstrate this, a white coil-coating formulation was prepared using Solus™ in the grind stage. The coating was then applied to an aluminum substrate with a dry film thickness of 20 microns. The coating was cured in a Werner Mathis oven at 250°C for 1.5 min, which gave a peak metal temperature of 232°C for 10 seconds.

The results show that Solus™ is effective in enhancing pigment dispersion by producing an increase in whiteness and a bluer, less yellow tone. Aesthetically, a bluer white produces a coating that looks cleaner and more brilliant. Starting point formulations for enhanced titanium dioxide dispersion in coil-coating formulations are available on request.

The chart in Figure 1 demonstrates that Solus™ is beneficial in increasing the lightness value. A higher lightness value produces an increase in whiteness and an overall improvement in appearance. Solus™ is also beneficial at decreasing the delta B, resulting in less yellow and a bluer white.

Figure 1. Impact of Solus™ on pigment dispersion



Enhancing the dispersibility of carbon black in coatings

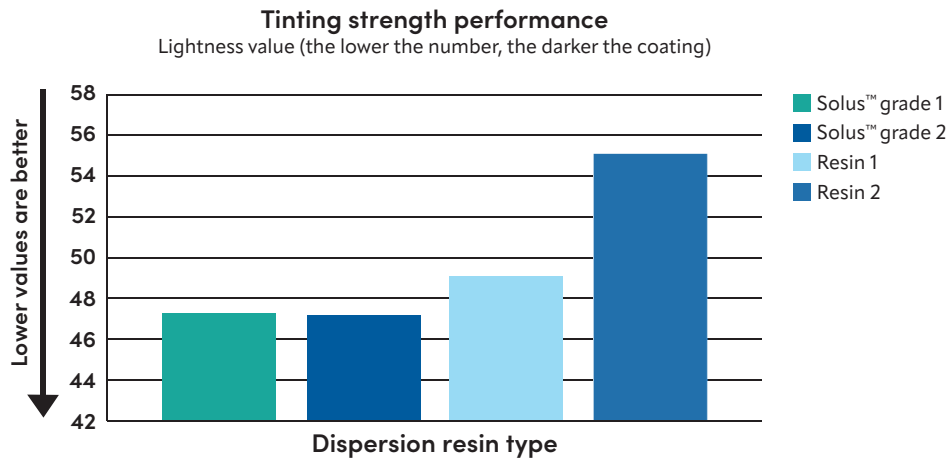
For high-quality, visually attractive black inks and coatings for automotive and plastic applications, excellent color strength, mass tone jetness and blue undertone are often required. To achieve the best dispersion of carbon black pigment, you need the proper dispersing resin and specially selected dispersing agents. To demonstrate the carbon black pigment dispersion properties of Solus™, concentrated dispersions were prepared and compared against two common commercial pigment dispersion resins, and the color strength was measured via a tint strength test. A good pigment dispersion resin will effectively disperse carbon black pigment and show excellent tint strength.



Black coating formulation comparing dispersion resins with carbon black pigment

Carbon black dispersions based on Eastman Solus™ produce lower lightness values compared to that of two commercial dispersing resins. A lower lightness value produces an increase in blackness. A blacker or darker coating means that they are effectively dispersing carbon black pigment to produce a pigment paste that provides an improvement in tint strength. This improvement should enable a manufacturer to reduce formulation costs because less carbon black pigment dispersion should be required to achieve a specific shade.

Figure 2. Comparing dispersion resins with carbon black



Summary

The pigment and filler particles in coatings and inks need to be fully dispersed to ensure the best-performing coatings and the most attractive color and effects. Over many years, Eastman Solus™ performance additives have demonstrated that — either solely or in combination with other dispersing and wetting additives — these products can create the best coatings with optimum colorimetric properties. They help maximize color strength, optimize pigment particle spacing, and provide the necessary particle stabilization to ensure color consistency during storage and application of the coating.

For help selecting the best Solus™ product for your specific need, contact your Eastman technical service representative or your authorized Eastman distributor.

For nearly a century, Eastman has been the world leader in manufacturing specialty cellulose esters and has developed deep application expertise. Eastman Solus™ can help formulators achieve high performance, enduring beauty, sustainability and regulatory compliance. Because of the breadth of possibilities, this naturally derived cellulosic is ideal for many applications. It offers the consistency and quality that formulators require and brand owners rely on. Eastman Solus™ — the natural choice.



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