

Using Pearlescent Pigments

A better understanding of how pearlescent pigments differ from other conventional pigments can help the end-user achieve the desired effect and sidestep common problems in their formulations, mixing, and processing. Pearlescent pigments are somewhat more complex to use than other conventional colorants.

The most widely used pearlescent pigments consist of mica platelets clad with titanium dioxide or iron oxide to give silver white and coloured effects. Pearlescent pigments typically are colourless as the colour they develop is from interference of light rays reflecting at specular angles from the top to bottom surfaces of the many metal oxide layers – in addition the use of dyes may be incorporated within the pearlescent pigment structure to develop more colours or effects. Pearlescent pigments lose colour intensity as viewing angle shifts to non-specular angles. In addition to the reflected primary colour a complementary second colour (or transmission colour) is transmitted through the pigment platelet.

Interference pearlescent pigments on a white base the weaker transmission colour is reflected back through the coating and supplements the stronger reflection colour. Against a dark background, the transmission colour is absorbed and only the interference pearlescent pigment's reflection colour is seen.

Light reflected from pearlescent platelets that are essentially parallel to each other at different levels in the coating creates a sense of depth and lustre. The best pearl lustre, brightness, and colour intensity occurs with platelets that are 10 to 40 µm in size while larger platelets of 50 to 150 µm confer sparkle and glitter.

Pearlescent Pigments in Plastic

Pearlescent pigments can be used in nearly all thermoplastics and most processes. Their effects are most intense in transparent resins like PS, PP, PE, PVC, acrylic, styrene-block copolymers, and silicone.

It is also possible to attain pearlescence and lustre in polymers having little or no transparency as with nylon 6, ABS, and HIPS but only with higher pigment loadings. Pearlescent pigments combined with dark absorption pigments in opaque polymers can yield a strong reflection colour and produce pearlescent effects of great richness and depth.

Highly filled plastics are not good candidates for pearlescent pigments because opaque fillers scatter light, eliminating the pearlescent effect. Most users limit fillers to less than 1% in systems containing pearl pigments.

Pearlescent pigments can be used in many thermosetting plastics, including unsaturated polyester, acrylic, urethane, and epoxy as well as cast polyester cultured marble and onyx components for countertops, floors, furniture, and fireplace elements. Pearlescent pigments can also be added to cast acrylic sheet and alloyed or blended materials such as rubber-toughened polycarbonate, nylon/ABS, and PC/ABS.

Compounding Pearlescent Pigments in plastics

Pearlescent pigments can be master batched containing 25% pearlescent pigments (up to 50%) in most resins by drum tumbling or mixing in twin-shell, ribbon, or high-speed blenders. Pearlescent pigments are never ground or subjected to extended cycles or heavy shear because these can shear off the metal oxide cladding and damage the platelets. Banbury-type or continuous mixers are most often used to create pearlescent master batches, although two-roll mills, calendars, vertical intensive mixers, and double planetary mixers are also suitable as long as you avoid excessive shear. Pearlescent pigments are usually incorporated in powdered polymers such as PVC and PE by simple blending. Blending usually begins with organic pigments, followed by inorganic pigments, and lastly the pearlescent pigments.

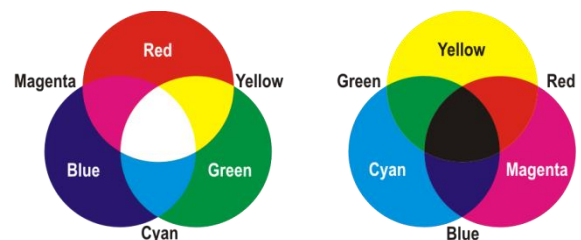
When pearlescent pigments are used with pelletised polymers, the difference in size between the pellets and the pearlescent pigments may cause separation after blending. Compounders usually use shorter blending times with pellets pre-blended with mineral oil so they are slightly tacky than with powders as the pellets can damage the pearlescent pigment platelets. For some compounders who wish to avoid preblending and potential separation problems do so by feeding pearlescent pigments into the molten polymer through a downstream feeder.

Dispersion aids include low-molecular-weight polyethylene waxes and calcium or magnesium stearate. Moulders often add 1% LMW-PE wax to polyolefins and mix for 20-30 min. With PS they typically use only about 0.1% of a dispersion aid.

Injection moulders who dry blend usually follow a three step process. 1/ Blend powdered resin and mineral oil for 10 minutes. 2/ All colorants, except pearlescent pigments with a dispersing aid are added and blended for 10 more minutes. 3/ Pearlescent pigments are then added and blended for another 20 minutes.

Mixing Colours

Combining pearlescent pigments colours together and with conventional colorants is as much art as it is science due to how they interact. Colour mixing falls into two categories: Additive and Subtractive. In additive colour mixing such as with light (RGB = Red, Green, Blue) complementary colours mix and form white. In subtractive colour mixing such as with printing (CYM = Cyan, Yellow, Magenta) complementary colours mix to form black or grey.



Additive Colour Mixing

Subtractive Colour Mixing

Additive Colour Mixing

The three primary colours of light for additive colour mixing are blue, green, and red combined to reproduce the range of visible colours. Additive Colour Mixing works by adding different colours of light on top of each other so the more light that is mixed the brighter the result. Mixing all primary colours equally is WHITE thereby subtracting each colour one by one BLACK is eventually the result.

Subtractive Colour Mixing

The three primary pigment colours for subtractive colour mixing are Yellow, Magenta, and Cyan combined to reproduce the range of visible colours. Subtractive Colour Mixing involves mixing the reflected colours from pigments. A pigment's colour is the colour not absorbed but reflected. The more pigments that are added the darker the result. Mixing all primary colours equally is BLACK, thereby subtracting each colour one by one WHITE is eventually the result.

Mixing Interference Pearlescent Pigments

The interference colours formed by pearlescent pigments must be treated as additive colours. Combining absorption and interference colours can create a variety of single- or dual-color effects. The presence of an absorption pigment used with interference pearlescent pigments produces intense specular reflection colors that give way to the color of the absorption pigment at non-specular angles. There is also a transmission color that combines the effects of the two pigments. Experimentation is suggested before use.