Ti-Pure™

R-350 Titanium Dioxide

Formulation Freedom for Masterbatch Producers

Allowing the freedom to formulate

Plastic films are everywhere in our lives. They are used to protect contents from spoiling, provide much needed shade for plants, hide the contents of packages for birthday surprises…the examples are endless! The plastic film versatility is the secret to its success.

Chemours™

Plastic films can be bent, molded, printed on and twisted in shapes and designs unachievable with other materials. The versatility of plastic films is only limited by the imagination of the artist shaping and designing the film. A film fabricator wants to produce the next film masterpiece with a high level of quality and ease of production especially for films requiring a high level of opacity. And, much like an artist, a film fabricator starts with a blank, white film on which to start the next creation. The best way to convert the naturally transparent, plastic film into the white canvas for the next masterpiece is with rutile TiO_2, titanium dioxide.

Adding a pigment such as titanium dioxide to a plastic has many desirable effects. For example, the film is turned white because of the high opacifying strength of titanium dioxide. This strength, due to TiO_2 particle size and refractive index, restricts the amount of light passing through a film. This restriction has several consequences, one of which is the sharpness of images that are printed or painted on a white film. Another consequence of using titanium dioxide to make a white film is the elimination of using white ink to paint the design on film masterpiece.

The use of certain titanium dioxide materials can limit the processing and quality of a plastic film; hence, a film fabricator has to be aware of the titanium dioxide limitations. For example, the dispersion of a pigment in a plastic matrix is critical for the optical performance as well as the mechanical integrity of the film. Any dispersion shortcoming from the TiO_2 masterbatch results in a plastic film with reduced visual appeal. Also, inadequate dispersion can be responsible for depressed mechanical strength, holes and defects in thin films, complications in welding of plastics articles, etc. Proper dispersion of a pigment is needed to make the plastic appear pleasing but also allows the plastic to perform at the required level.

The TiO_2 surface chemistry can also cause some undesirable effects. For example, the chemical composition of a pigment can cause defects in a film especially at high temperature and processing speeds. Typically, moisture is adsorbed and entrapped with coatings on the TiO_2 surface. The moisture boils during film processing temperatures and causes the polymer matrix integrity to degrade. The degradation of the polymer matrix causes a weak spot in a film structure that can be aggravated during strenuous film processing. This problem is magnified as the thickness of the film is decreased. Careful selection of processing conditions and TiO_2 allows a film producer to manufacture high quality materials without creating the weak links in the film structure. Now there is a TiO_2 choice in the masterbatch market that requires no compromises and promises more.

Now there is a TiO_2 that can match the versatility of the plastics, Ti-Pure™ R-350. Ti-Pure™ R-350 has the versatility to be used in thin films, toughness for moderate outdoor exposure, and stability for extreme film processing conditions. Ti-Pure™ R-350 is a titanium dioxide that also has a high degree of chemically inertness to allow for mixing/matching with other polymer additives AND can be used in films requiring superior dispersion for demanding applications. Ti-Pure™ R-350 can adapt to the processing conditions and expand operating windows with minimum impact on the finished product quality.

Finally, a TiO_2 that can match the versatility of a plastic film and allow the plastic artist to express their unique creativity.

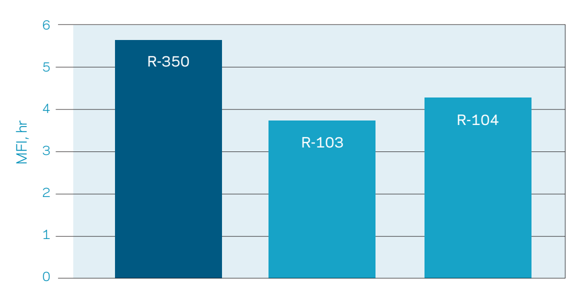
Technical Innovations

Ti-Pure™ R-350 is designed to provide the unique combination of functionalities not possible with any other TiO_2.

Surface Chemistry

Ti-Pure™ R-350 chemistry significantly hinders the interaction of the pigment surface with additives, especially during ultraviolet stress. The chemical inertness of R-350 allows it to be mixed and matched with a wide variety of necessary polymer additives with little worry of delayed chromophore formation.

Figure 1 Melt Flow Index ASTM D1238 (condition 190/2160)



Also, Ti-Pure™ R-350 chemistry allows the TiO_2 to slide into polymers during let down from a TiO_2 concentrate with ease. Matching of resin and TiO_2 masterbatch melt viscosity values is getting simpler (see **Figure 1**). At times, Ti-Pure™ R-350 can be used without utilization of low molecular weight dispersion aids to let the polymer chains slip through the polymer matrix of a film. The freedom to use Ti-Pure™ R-350 without dispersing aids allows a film fabricator to create films when prevention of die build up or mold plate out characteristics are key.

The chemistry also allows the freedom to use Ti-Pure™ R-350 at a wide variety of pigment loadings, and in combinations with other inorganic fillers, without fear of TiO_2 dispersion quality concerns.

Excellent Processing Robustness

The technology used for Ti-Pure™ R-350 minimizes the effect of TiO_2 on the formation of defects in severe, quality-critical, high temperature extrusion coating and cast film applications. The design of Ti-Pure™ R-350 allows the product to be used at high temperatures without the fear of losing polymer matrix integrity. This functionality is unique considering Ti-Pure™ R-350 has a chemical composition that, with traditional TiO_2 materials, would demonstrate low tolerance for extreme film processing conditions.

Moderate Durability

Ti-Pure™ R-350 utilizes a unique coating that passivates the TiO_2 surface. TiO_2 can accelerate the polymer decomposition when placed in an ultraviolet flux. The passivation allows the TiO_2 to be incorporated in polymer articles that are frequently exposed to ultraviolet bombardment without creating anxiety that the TiO_2 will rapidly accelerate the polymer decomposition.

R-350 Performance

Supreme Dispersion Performance

Today's TiO_2 market offers several types of TiO_2 materials based on the dispersion performance. Ti-Pure™ R-350 exceeds the TiO_2 dispersion performance of other materials as indicated by the screen pack retention values. Lower screenpack dispersion values result in better processing and more importantly, minimum quality concerns (see **Figure 2**).

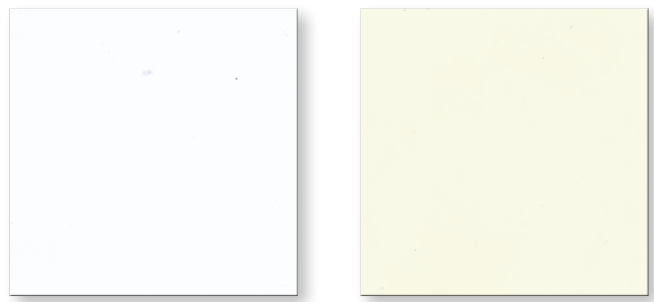
Figure 2 Screenpack Dispersion

Ti-Pure™ R-350 | Typical General Purpose Grade

Additive Flexibility

In many TiO_2 masterbatch formulations or down stream matrices, the TiO_2 is in the presence of other polymer additives. Certain combinations of TiO_2 and additives can cause a discoloration once an appropriate trigger has been released. The most common trigger is ultraviolet irradiation. Ti-Pure™ R-350 has demonstrated the ability to resist discoloration in the presence of a sensitive antioxidant/HALS combination. The resistance to discoloration soothes concerns about polymer additive and TiO_2 surface interactions (see **Figure 3**).

Figure 3 Polyethylene Yellowing Test, One Week.

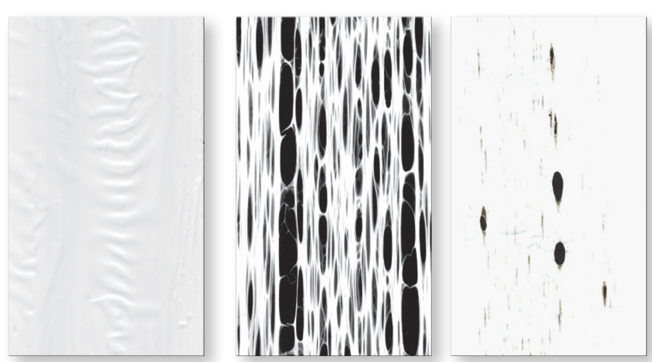


Ti-Pure™ R-350 | Typical General Purpose Grade

Low Volatility

At elevated temperatures, most inorganically coated grades of TiO_2 can liberate gases that can create quality issues like holes or other imperfections (particularly in thin films). To overcome this deficiency in the TiO_2, plastic products are relatively thick, contain less TiO_2 or be produced at less severe conditions. However, in certain end uses, the process must be stressed to the severe conditions to produce the necessary quality product. Ti-Pure™ R-350 contains a minimum amount of volatile material and has amazing ability to maintain film integrity during stressful processing conditions (see **Figure 4**).

Figure 4 Unmatched Lacing Resistance

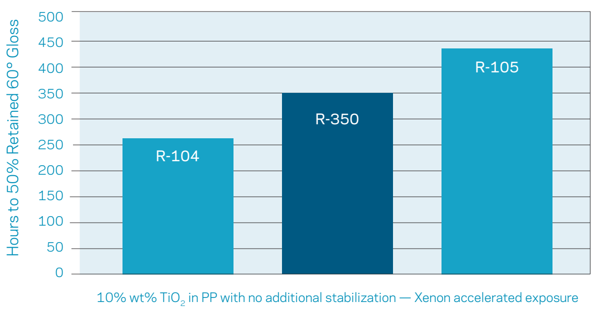


Ti-Pure™ R-350 | R-108 | R-103

Moderate Durability

A truly unique characteristic of Ti-Pure™ R-350 is the inorganic coating that provides a moderate level of durability. Ti-Pure™ R-350 utilizes a state-of-the-art technique to coat the titania particle with a thin shell of SiO_2. This thin shell insulates the TiO_2 surface from the polymer matrix to hinder chemical interaction amongst them. Typically, during UV exposure, a chemical interaction between the TiO_2 pigment particle and the polymer matrix results in gloss loss. This coating prevents accelerated degradation of the plastic surface and is completely novel to TiO_2 pigment industry (see **Figure 5**).

Figure 5 Enhanced Durability in Polyethylene.



Ti-Pure™ R-350 — Request Your Sample Today!

Ti-Pure™ R-350+ titanium dioxide — for plastic films. Available in 25 kg bags and 1 metric (1000 kg) tonne flexible intermediate bulk containers. If you need additional information or would like to request a sample, please visit our website or contact your local representative

For more information, visit www.titanium.chemours.com

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