



# Ultramarine Pigments for Colouring Plastics

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The origin and development of Ultramarine as a general pigment - including the manufacturing process - has been described in another publication, 'Ultramarine – The Eternal Pigment'. This explained how, having been in use for thousands of years, Ultramarine has found its way into many and varied applications, each of which has its own demands on pigment properties. What is required of an Ultramarine pigment used for colouring plastics?

When used to colour plastics, it is important that a grade of Ultramarine pigment has consistent colour and dispersion properties. It must be low in unreacted sulphur so that odours are not released when it is heated to plastics processing temperatures and it must not contain excessively high moisture. For sensitive applications where regulatory approval is required, it must also have a low trace metal content. These properties are much less important in most other applications in which Ultramarine is used. It is normal for Ultramarine manufacturers to recommend a specific range of grades for use in colouring plastics in which these properties have been optimised.

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## The Premier Ultramarine Range

While general purpose grades of Ultramarine can be used to colour plastics, for optimum performance Holliday Pigments recommends the use of pigments from its Premier range. The grades in this range are all specifically manufactured with plastics coloration in mind. The main feature of the Premier range is an excellent colour specification. The total colour difference (DE) for a production lot is guaranteed within 0.5 units CIELAB when measured against the Holliday Pigments reference standard. The colour difference is determined using a sophisticated spectrophotometer. General purpose grades are specified to wider tolerances, normally DE 1.0 to 1.5 units, which may require corrections in sensitive applications to compensate for the differences in colour between production lots. With Premier grades of Ultramarine the tight colour specification of DE 0.5, which is almost imperceptible by eye, assures excellent colour consistency and eliminates any need for correction when switching from one production lot to another.

Holliday Pigments evaluates all production lots of Ultramarines recommended for colouring plastics by a standard quality control test. The production lot is dispersed into high impact polystyrene using a small internal mixer. Titanium dioxide is included to obtain a reduced depth of shade so that the tinting strength of the pigment can be evaluated, as well as the shade. When cool, the illustration is measured on a spectrophotometer and the results compared with those obtained from an illustration made at the same time from the grade reference standard.

Some end users store a standard plaque or colour data. Production lots are compared with standards which may have been prepared months or even years before. With this procedure there is a possibility that errors could be introduced, for example by changing the batch of plastic resin or servicing the process equipment during the period between manufacture of the standard and the production lot. To avoid this possibility Holliday Pigments always prepares and measures illustrations of both sample and standard at the same time, using the same batch of plastic resin and process conditions.

Holliday Pigments Premier range of Ultramarine blue and violet pigments developed specifically for the plastics industry comprises the following grades:-

Grade Reference	Description
Premier GS	Greenest shade, strong
Premier GM	Green shade, medium strength
Premier RX	Red shade, high strength
Premier RS	Red shade, strong
Premier RM	Reddest shade, medium strength
Premier AR	Red shade, high acid resistance
Premier XAR	Red shade, very high acid resistance
Premier VB	Bluest shade violet
Premier VX	Blue shade violet
Premier VU	Reddest shade violet

High strength grades of red and green shades are recommended where the maximum colour strength of a masterbatch is the most important consideration. However, when maximum strength is not necessary, the medium strength grades are often used because the lower surface area makes them slightly easier to disperse.

Colour correction of white or clear items is an important use of Ultramarine pigments and for this application it is the redder shade of blue such as Premier RM, and the Ultramarine violets, which are preferred.



## Modified Premier Grades

Whilst Holliday Pigments' Premier grades are perfectly adequate for most plastics applications, there are some modifications that can be made to further improve their performance in particular situations.

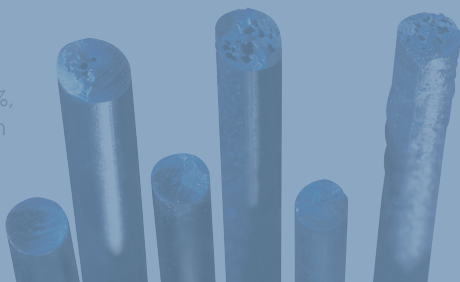
### Premier D Range

Ultramarine pigments are hydrophilic and contain moisture which is adsorbed onto the surface of the pigment and also contained within the lattice structure. When used at low addition levels as a tinting pigment, this moisture is not sufficient to adversely affect the processing of the plastic. However, at high concentrations where masterbatches contain 30% or more Ultramarine, it can be difficult to remove the amount of moisture generated without adequately vented processing equipment, which may not always be available. In this case the answer lies in the use of low moisture versions of the Premier grades. These grades - comprising the Premier D range - are dried at higher temperatures than the standard Premier series to give an exceptionally low moisture content. The specially dried Ultramarine is so hydrophilic that it would slowly re-absorb moisture from the atmosphere, so needs to be packed in moisture proof plastic sacks. The moisture content is less than 0.05%, and with Premier D versions it is possible to manufacture good quality masterbatch at a pigment content in excess of 60% even when vented equipment is not available.

This is demonstrated in photograph 1, which shows the effect of extruding Premier RX at pigment contents of 35%, 55% and 65% without vented equipment. The moisture can only escape in the extruded strands, making them porous and brittle. Under the same conditions, the low moisture version Premier DRX produces perfect strands.

By drying at a similar temperature to that used to process plastics, the already low levels of free sulphur in the Premier grades (0.02% maximum) are eliminated completely in the Premier D versions. For this reason Premier D grades are also recommended in applications which are particularly sensitive to low odour.

Photograph 1:-  
Top row normal  
Premier RX at 35%,  
55%, 65%; bottom  
row Premier DRX  
at 35%, 55%, 65%



## Premier FRX

For applications that are extremely sensitive to pigment particle size, for example the extrusion of fine fibres, Holliday Pigments recommends a special Ultramarine grade, Premier FRX. The particular advantage of this grade, in comparison with the Premier and Premier D ranges, lies in its controlled particle size. Premier FRX contains no pigment agglomerates larger than 10 microns. In trials, Premier FRX has been used to colour fibres as fine as 2 dtex, without blockage of the fine screen packs commonly used in this application.

Such fine screen packs are necessary to filter out oversized particles before they are extruded into the fibres, where they would cause the fibre to weaken and perhaps break. Whilst the normal Premier and Premier D grades are perfectly satisfactory for other applications, the small proportion of large agglomerates that they contain would rapidly block such a fine mesh. This would cause the extrusion pressure to increase unless avoided by frequent interruptions to the process for screen pack replacement. Premier FRX is tested specifically for this property by extruding a compound through a mesh with a 16 micron aperture. All production lots are controlled to produce minimal pressure rise. The difference in particle size distribution between Premier FRX and Premier RX is illustrated in figure 1.

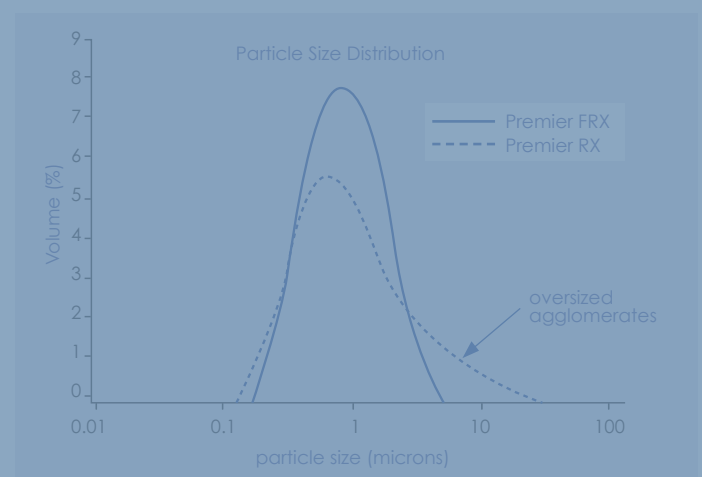


Figure 1:- Particle size distribution chart illustrating the improved particle size control of Premier FRX compared with Premier RX

## Prestige

When processing a number of different colours in close proximity to each other, it is important to avoid contaminating one with dust created from another. In cases where spatial separation is not sufficient to prevent contamination, the use of dust free pigments is recommended. Holliday Pigments offers two ranges of dust free pigments - the Prestige series for polyolefins / styrenics and the Prestige P series for PVC. Both are preparations comprising 80% Ultramarine and 20% of a low melt polymeric resin. The preparations are supplied in the form of a granular powder which does not generate dust but does flow easily for accurate metering. In addition, Prestige grades disperse more easily since the hydrophilic surface of the Ultramarine particles are wetted by the resin and therefore more compatible with the let down polymer.

## Summary

All Ultramarine pigments share the clean shade, exceptional lightfastness and exceptional heat stability that make them so desirable in a wide range of applications. But optimum performance in plastics is only achieved by selecting specially produced grades of Ultramarine such as:-

Premier	Excellent colour consistency
Premier D	Low moisture for high pigment masterbatch
Premier F	Where particle size control is required
Prestige	Dust free preparations with easy dispersion

## About Holliday Pigments

Holliday Pigments is the world's leading supplier of Ultramarine pigments, which are used in a variety of applications including plastics, coatings, cosmetics, artists' colours and printing inks. Exporting to over 80 countries, Holliday Pigments has dedicated customer and technical service teams at its factory in France and its commercial office in Singapore.

Holliday Pigments has a proud 125-year history in the manufacture of technical quality Ultramarine and is the only Ultramarine manufacturer in the world to have invested in Flue Gas Desulphurisation technology, reducing sulphur dioxide emissions inherent in the manufacturing process by more than 99.5%.

In August 2008, Holliday Pigments joined Rockwood Holdings Inc., becoming an important addition to the Color Pigments and Services Division. Rockwood's Color Pigments & Services Division is one of the largest worldwide suppliers of colored pigments for construction, coatings, plastics and specialty applications.

The Division's manufacturing sites and customer service centres are located in the United States, United Kingdom, Italy, Germany, Australia and China with additional sales offices located in Singapore.

The Rockwood Color Pigments & Services Division is part of Rockwood Holdings Inc., Princeton, N.J., U.S.A. Rockwood Holdings, Inc. is a leading global specialty chemicals and advanced materials company. Rockwood has a worldwide employee base of more than 9,500 people and annual net sales of approximately \$3.1 billion. The company focuses on global niche segments of the specialty chemicals, pigments and additives and advanced materials markets.

For more information on Rockwood, please visit [www.rockwoodpigments.com](http://www.rockwoodpigments.com)

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