



DuPont™ RPS Vantage®

RUTILE PAPER SLURRY TITANIUM DIOXIDE

TiO₂ FOR PAPER

Product Description

DuPont™ RPS Vantage® TiO₂ is specifically designed and manufactured for use in the paper industry. It is the highest opacifying white pigment available for coatings or wet end applications. **Table 1** shows the advantages of RPS Vantage® TiO₂ over anatase titanium dioxide.

Key Features

- Highest Opacity/Hiding Power
- Precise Optical Density
- Excellent Brightness
- Superior Pigment Dispersion
- Stable Slurry
- Good Compatibility
- Better Grit Performance

Opacity/Hiding Power

RPS Vantage® TiO₂ provides the best opacifying performance available to the paper industry due to highly efficient light scattering. The higher the TiO₂ light scattering, the less TiO₂ that is needed to achieve an opacity target. The higher refractive index of the rutile TiO₂ crystal provides an inherent light scattering advantage over anatase TiO₂. In addition, the particle size distribution of the RPS Vantage® TiO₂ is scientifically designed to provide enhanced light scattering performance. This gives RPS Vantage® TiO₂ a 20–25% higher light scattering performance than anatase TiO₂.

Optical Density

A direct measurement of TiO₂ light scattering efficiency has been developed that correlates well with end-use performance in paper. The DuPont™ Optical DensitySM test is a proprietary test that uses a spectrophotometer to measure the relative light scattering performance of a dilute TiO₂ slurry. Measurements from the DuPont™ Optical DensitySM test, in conjunction with particle size distribution results, is used to control DuPont TiO₂ manufacturing. This has led to the improved consistency and quality of RPS Vantage® TiO₂, providing more consistent performance for the papermaker.

Brightness

RPS Vantage® TiO₂ is produced by chloride process technology and has extremely high inherent brightness—97.2 TAPPI Pigment Brightness and 99.4 L*. High brightness combined with superior light scattering provides excellent brightness and whiteness to paper and paperboard products.

Pigment Dispersion

Proper dispersion of the TiO₂ particles is the key to achieving optimum optical performance. Flocculated or agglomerated TiO₂ particles significantly reduce light scattering performance and require the use of more TiO₂ to achieve a desired opacity. The TiO₂ particles in RPS Vantage® TiO₂ are extremely well dispersed as indicated by the low high-shear viscosity data and narrow particle size distribution.

Slurry Stability

RPS Vantage® TiO₂ is a very stable slurry. Because it is highly resistant to bacterial growth, does not gel, and settles very slowly, the consumed amount of TiO₂ is consistent from paper run to paper run.



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Compatibility

RPS Vantage® TiO₂ is compatible with all other pigments commonly used in paper applications. It is anionic, so some interaction with strongly cationic chemicals should be expected.

Grit Performance

RPS Vantage® TiO₂ has less than 0.0010% unbrushed grit. The specification has been lowered recently by 20% as a direct result of improvements to the manufacturing process. Better grit performance means improved light scattering and less blade scratches for the paper mill.

FDA Status

RPS Vantage® TiO₂ is acceptable for FDA indirect food use as a colorant under 21 CFR 176.170 and CFR 176.180, without restriction on Conditions of Use (compliant for Conditions A–H) or Food Type (compliant for Food Types I–IX). In addition, this product may be used in contact with all types of foods (I–IX) as described in Table 1 of 21 CFR 176.170, under microwave susceptor conditions.

Safety Precautions

If this product is allowed to dry, dust may form. Titanium dioxide is classified as a nuisance dust. Follow all local regulations

and DuPont recommendations for exposure limits as described in the Material Safety Data Sheet (MSDS). If the recommended exposure limits of TiO₂ dust are to be exceeded, air-purifying respirators with particulate filters should be used.

Due to the alkalinity of the TiO₂ slurry, protective gloves should be worn to prevent prolonged skin contact.

As a matter of good industrial hygiene, safety glasses with side shields or better eye protection should be worn when handling TiO₂. For more details, refer to the MSDS.

First Aid

If large amounts of dry TiO₂ are inhaled, remove victim to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

In case of eye contact, immediately flush with water for at least 15 minutes. Call a physician. In case of skin contact, this product is not likely to be hazardous, but cleaning the skin after use is advised.

Table 1. RPS Vantage® Typical Properties versus Anatase

Property	Anatase TiO ₂	RPS Vantage® TiO ₂
Optical Density SM Measurement	0.780–0.920	1.10
Refractive Index	2.55	2.72
Median Particle Size, μm*	0.31–0.60	0.385
Geometric Standard Deviation (GSD)**	1.60–1.90	1.49
% Solids	70–76	71.5
Viscosity (Hercules® High-Shear Viscometer), cP at 10,430 s ⁻¹	20–60	16
Brookfield Viscosity, cP	400–1000	168
pH	8–10	8.9
+325 Mesh Unbrushed Grit, %	0.0010–0.0050	0.0010
TAPPI Brightness	94–97	98

* Horiba Laser Light Scattering Particle Size Analyzer

** Geometric Standard Deviation (GSD) characterizes the width of a log-normal particle size distribution like that of RPS Vantage® TiO₂. For monodisperse (same size) particles, GSD = 1.00.

RPS Vantage® TiO₂ Narrow Particle Size Distribution Delivers Superior Opacifying Performance

Small particle light scattering theory predicts that narrow particle size distributions near the optimum diameter maximize TiO₂ light scattering efficiency. This relationship between particle size distribution and light scattering is confirmed by laboratory data as shown in **Figure 1**. The DuPont™ Optical Density™ test has the same relationship with width of particle size distribution as S_{TiO₂} and demonstrates the value of the DuPont™ Optical Density™ test as a direct measurement of TiO₂ scattering efficiency.

Particle Size Distribution Analysis

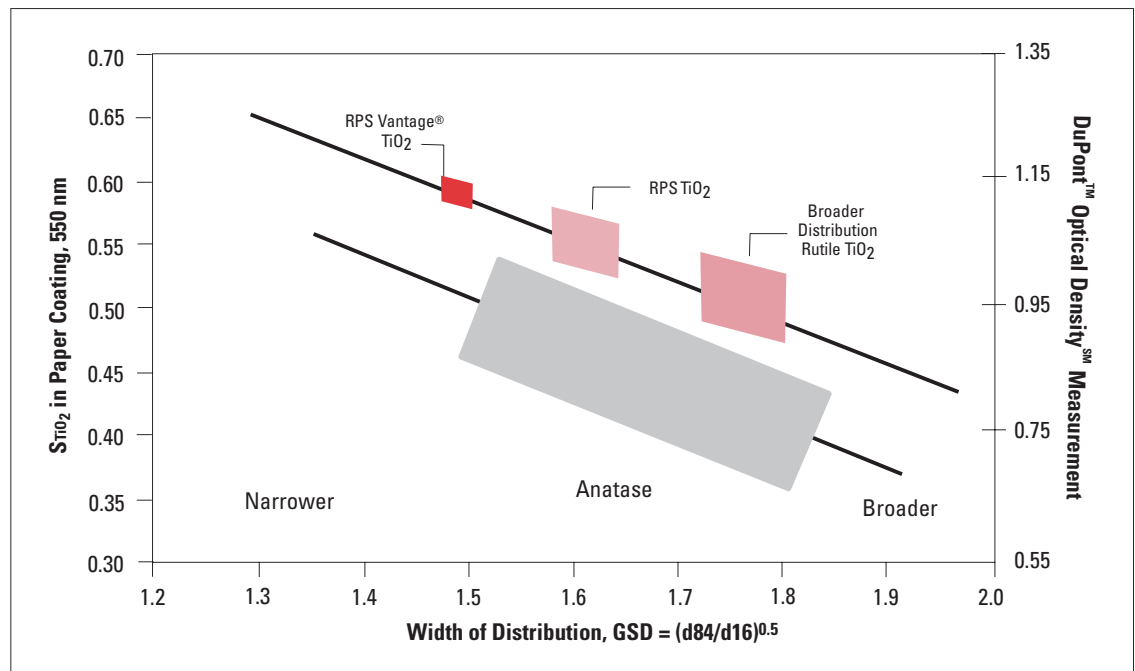
State-of-the-art laser light scattering technology is used to measure RPS Vantage® TiO₂ particle size distribution. This technology offers precise size measurements over the full range of TiO₂ particle diameters, an improvement over sedigraph technology.

The width of TiO₂ particle distributions is defined by Geometric Standard Deviation (GSD). Lower GSD indicates narrower particle size distribution. The minimum GSD of 1.0 is achieved only when all particles are the same size.

Light Scattering Efficiency

The TiO₂ light scattering coefficient is determined by applying paper coatings to a Mylar® polyester film at precise coat weights. This permits accurate separation of the TiO₂ light scattering contribution from that of the other coating components. As shown by the TiO₂ scattering coefficients (S_{TiO₂}) in **Figure 1**, rutile TiO₂ outperforms anatase TiO₂ due to the narrower particle size distribution and higher refractive index of rutile TiO₂.

Figure 1. Correlation of S_{TiO₂} and DuPont™ Optical Density™ Measurement with Particle Size Distribution



DuPont Titanium Technologies

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