

Application Note

----- Size distribution analysis of Titanium dioxide ----- using the CPS Disc Centrifuge

Titanium dioxide

Titanium dioxide is often used as pigment, sunscreen and thickener. Therefore it has a wide range of applications, from paints to food coloring to cosmetic and skin care products. Titanium dioxide is produced in varying particle sizes, oil and water dispersible, and in certain grades for the cosmetic industry. Titanium dioxide is found in almost every sunscreen with a physical blocker because of its high refractive index, its strong UV light absorbing capabilities and its resistance to discoloration under UV light. This advantage enhances its stability and ability to protect the skin from UV light. Nano-scaled titanium dioxide particles are primarily used in sunscreen lotion, because they scatter visible light less than titanium dioxide pigments while still providing UV protection(1).

The European Parliament in its resolution of 24 April 2009 on regulatory aspects of nanomaterials called, inter alia, for the introduction of a comprehensive science-based definition of nanomaterials in Union legislation. The definition in this Recommendation should be used as a reference for determining whether a material should be considered as a 'nanomaterial' for legislative and policy purposes in the Union. The definition of the term 'nanomaterial' in Union legislation should be based solely on the size of the constituent particles of a material, without regard to hazard or risk. This definition, based only on the size of a material, covers natural, incidental or manufactured materials(2).

In this Recommendation nanomaterial is defined as followed "'Nanomaterial' means a natural, incidental or manufactured material containing particles, in an unbound state or as an aggregate or as an agglomerate and where, for 50 % or more of the particles in the number size distribution, one or more external dimensions is in the size range 1 nm-100 nm"(2).

Because of this recommendation of nanomaterials and the opinion on titanium Dioxide (nano form)(3) it is really important to measure the particle size of titanium dioxide to prove that it is not nanomaterial and save to use in the cosmetic products.

Instrument/Method description

The measurement range of the CPS Disc Centrifuge are particles in the range from 0.005 micron to 50 microns. The CPS Disc Centrifuge is most effective with particles between 0.005 and 20 microns. The analyzer measures particle size distributions using centrifugal sedimentation within an optically clear spinning disc

that is filled with fluid. Sedimentation is stabilized by a density gradient within the fluid, and accuracy of measured sizes is insured through the use of a known size calibration standard.

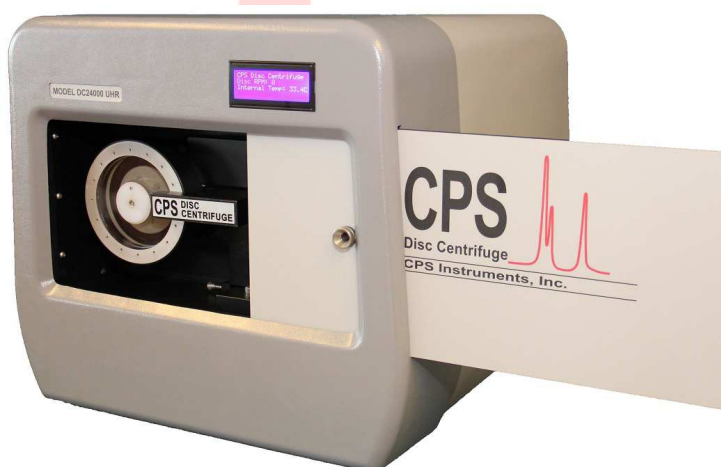


Figure 1 CPS DC24000 UHR with open door

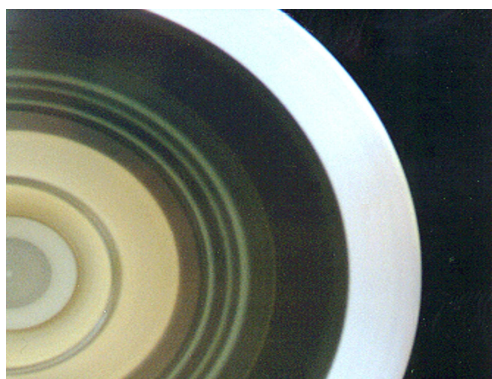


Figure 2 High concentrated sample with different particle sizes sediment in a disc

For the measurements of the titanium dioxide the CPS DC24000 UHR was used. The DC stands for Disc Centrifuge, 24000 stands for the maximum speed (rpm in this case equal to 29000 g-force), and UHR stands for Ultra-High Resolution. This is the most advanced system CPS Instruments offers, but a DC12000 and a DC18000 are available when the ultra-high resolution and high rotation speed/g-force is not needed.

- (1) Winkler, Jochen (2003), Titanium Dioxide, Hannover: Vincentz Network, pp. 5, ISBN 3-87870-148-9
- (2) European Commission Recommendation of 18 October 2011 on the definition of nanomaterial; <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32011H0696:EN:NOT>
- (3) European Commission - Scientific Committee on Consumer Safety, Opinion on Titanium Dioxide (nano form) COLIPA n° S75; http://ec.europa.eu/health/scientific_committees/consumer_safety/docs/sccs_o_136.pdf

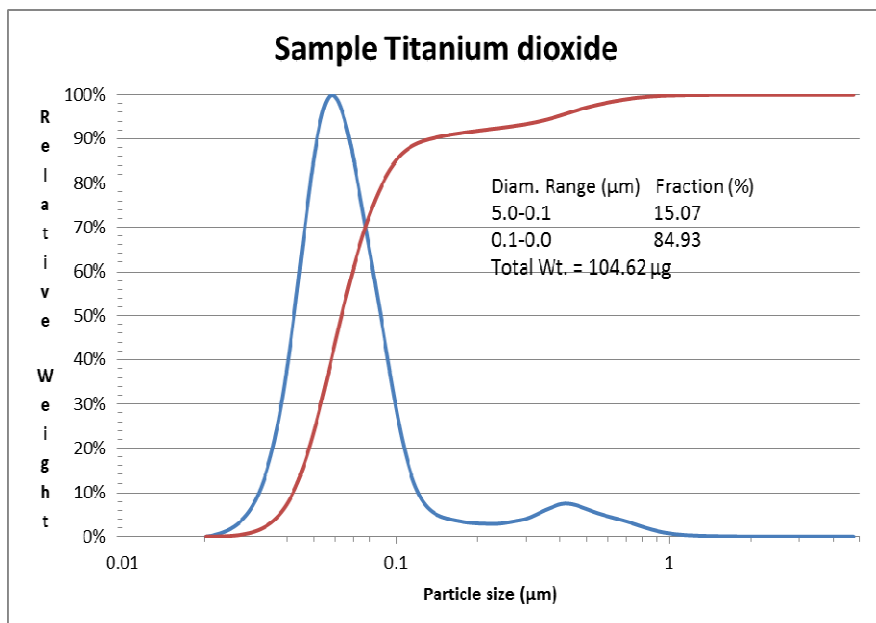


Figure 1 Weight distribution of a titanium dioxide sample

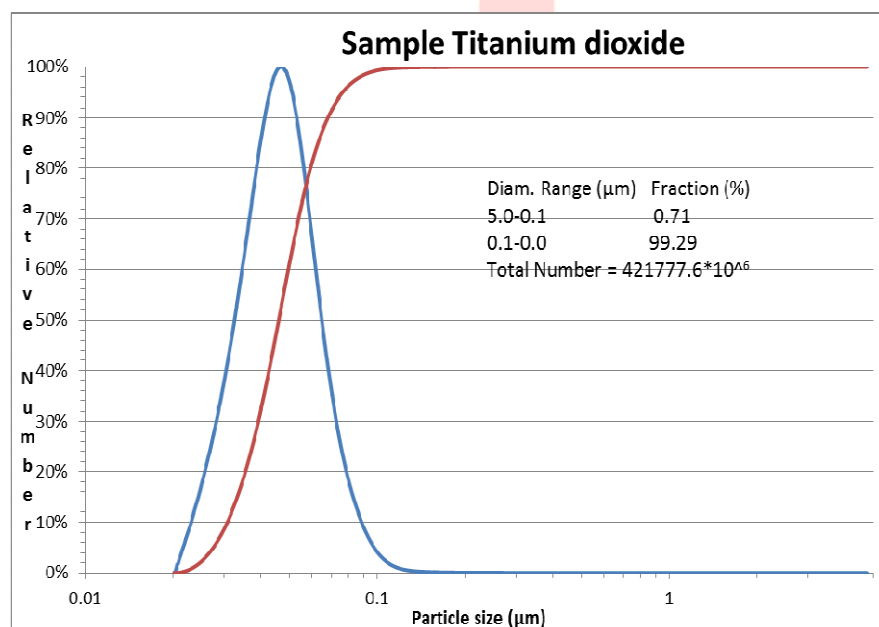


Figure 2 Number distribution of a titanium dioxide

Results

Figure 3 shows the standard display mode, also called the relative weight distribution, of a titanium dioxide sample.

Besides the relative weight distribution the CPS Disc Centrifuge Software is also able to show the relative number distribution with the percentage of particles lower than 100 nm which is needed for the nanomaterial definition. Figure 4 shows the relative number distribution of the same Titanium dioxide sample as shown in figure 3.

The results of the titanium dioxide sample above show that particular sample should be considered as nanomaterial according to the definition of the European Commission.

Conclusion

The CPS Disc Centrifuge is capable of measuring the particle size of titanium dioxide. The resolution, sensitivity, and run-to-run repeatability are unmatched by other particle sizing instruments. With CPS Disc Centrifuge Software it is even possible to generate a measurement report which shows if the sample should be considered as nanomaterial or not.

For more information please contact your local representative or:

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