Designation: D476 – 15

Standard Classification for Dry Pigmentary Titanium Dioxide Products[1]

This standard is issued under the fixed designation D476; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 This classification describes eight types of dry pigmentary titanium dioxide products, grouped by composition, typical end use application, and some performance properties.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D34 Guide for Chemical Analysis of White Pigments
D153 Test Methods for Specific Gravity of Pigments
D185 Test Methods for Coarse Particles in Pigments
D280 Test Methods for Hygroscopic Moisture (and Other Matter Volatile Under the Test Conditions) in Pigments
D1394 Test Methods for Chemical Analysis of White Titanium Pigments
D2448 Test Method for Water-Soluble Salts in Pigments by Measuring the Specific Resistance of the Leachate of the Pigment
D3720 Test Method for Ratio of Anatase to Rutile in Titanium Dioxide Pigments by X-Ray Diffraction

3. Significance and Use

3.1 This classification is given as an aid in determining the fitness for use of a titanium dioxide pigment for a coating application. It is limited to dry, hiding pigments. It excludes pigment dispersions, and non-hiding specialty titanium dioxide products.

4. Basis for Classification

4.1 Titanium dioxide pigments can differ in many ways, including composition and performance. This classification outlines differences between pigment types that should be considered when selecting a product for a coating application. A minimum number of properties are given to highlight major differences, while allowing maximum flexibility.

5. Composition and Properties

5.1 *Titanium Dioxide Pigments,* should conform to the requirements for composition prescribed in Table 1. They are chemically prepared pigments consisting of anatase or rutile titanium dioxide with or without modifications with water-insoluble oxides of aluminum, silicon, zinc, etc., or other agents; these reagent materials are introduced specifically to improve those properties for which the pigment is used. The titanium dioxide pigments shall be free of extenders such as barium sulfate, clay, magnesium silicate, whiting, etc.

5.2 The desired properties of the pigment, other than as herein indicated, shall be subject to agreement between the purchaser and the seller and shall be based on a satisfactory match between the submitted pigment sample and a previously agreed upon reference sample (see 6.1.6).

6. Test Methods

6.1 Tests shall be conducted in accordance with the following test methods. Test procedures not covered by ASTM test methods shall be mutually agreed upon between the purchaser and the seller.

6.1.1 *Chemical Analysis*—Guide D34 or Test Methods D1394.

6.1.2 *Specific Gravity*—Test Methods D153.

6.1.3 *Coarse Particles*—Test Methods D185.

6.1.4 *Moisture*—Test Methods D280.

6.1.5 *Matter Soluble in Water, Specific Resistance*—Test Method D2448. The measured specific resistance of the aqueous leachage from the pigment is an index of the level of water-soluble salts.

6.1.6 *Chalking Resistance*—It is recommended that purchaser and seller agree upon standards and methods of test suitable for their requirements (see 5.2). Comparison in a good quality exterior air-dry alkyd enamel (trade sales or industrial) and exposure in Florida at 45° facing south are recommended. Chalking differences are minimized by less durable vehicles, while required exposure times are prolonged by more durable

[1] This classification is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.31 on Pigment Specifications.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

TABLE 1 Classification of Dry, Pigmentary Titanium Dioxide Pigments

	Typical Properties								
Classification Type	I	II	III	IV	V	VI	VII	VIII	ASTM Standards
Crystal type	anatase[A]	rutile	rutile	rutile	rutile	rutile	rutile	rutile	D3720
Chalking resistance, relative	free chalking	low-medium	medium	high	high	medium-high	medium-high	very high	
Typical end use application(s)	white exterior house paint and interior uses	low-medium % PVC	high % PVC	exterior coatings requiring excellent durability	exterior coatings requiring excellent durability with high gloss	int-ext coatings medium-high % PVC	int-ext coatings low-high % PVC	exterior colored coatings and polymers requiring infra-red reflectance with excellent durability	
Titanium dioxide (TiO_2) content, min., %	94	92	80	80	90	90	92	92	D1394
Specific resistance, min, Ω	5000	5000	3000	3000	3000	5000	5000	3000	D2448
Moisture content as packed, max, %	0.7	0.7	1.5	1.5	1	0.7	0.7	1	D280
Specific gravity	3.8–4.0	4.0–4.3	3.6–4.3	3.6–4.3	3.6–4.3	3.6–4.3	4.0–4.3	3.6–4.3	D153
45-μm screen residue, max, %	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	D185

[A] Identification of anatase or rutile or mixtures thereof is made by X-ray analysis (Test Method D3720).

vehicles. Once the reference sample agreed upon between the purchaser and seller has qualified, subsequent shipments of that product may be compared with the reference sample by an agreed upon accelerated weathering test.

7. Keywords

7.1 anatase; dioxide pigments; rutile; titanium; white pigments