



Designation: D 4677 – 87 (Reapproved 1998)

AMERICAN SOCIETY FOR TESTING AND MATERIALS
100 Barr Harbor Dr., West Conshohocken, PA 19428
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Standard Classification for Rubber Compounding Materials—Titanium Dioxide¹

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ϵ^1 NOTE—Section 6, Keywords, was added editorially in March 1993.

1. Scope

1.1 This classification covers the compounding material known as titanium dioxide. It is generally used in rubber compounds to impart whiteness to selected products. Typical chemical and physical properties are included.

1.2 *This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Table 1*

2. Referenced Documents

2.1 ASTM Standards:

- D 185 Test Methods for Coarse Particles in Pigments, Pastes, and Paints²
- D 280 Test Methods for Hygroscopic Moisture (and Other Matter Volatile Under the Test Conditions) in Pigments²
- D 1208 Test Methods for Common Properties of Certain Pigments²
- D 1394 Test Methods for Chemical Analysis of White Titanium Pigments²
- D 3720 Test Method for Ratio of Anatase to Rutile in Titanium Dioxide Pigments by X-Ray Diffraction²

3. Significance and Use

3.1 Titanium dioxide is used in rubber compounding as a colorant to impart whiteness to any desired end product. It is used in sidewalls of automobile tires.

3.2 It is chemically inert and slightly basic with a pH of 7.0

¹ This classification is under the jurisdiction of ASTM Committee D-11 on Rubber and is the direct responsibility of Subcommittee D11.20 on Compounding Materials and Procedures.

Current edition approved March 27, 1987. Published May 1987.

² Annual Book of ASTM Standards, Vol 06.03.

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TABLE 1 Properties of Titanium Dioxide (By Type)

	Test Method	Type I (Anatase)	Type II (Rutile)	Type III (Rutile)
TiO ₂ , min, %	D 1394	95	92	85
pH	D 1208	7–8.0	7–8.0	7–8.0
Coarse particles, max, %	D 185	0.2	0.2	0.2
Moisture, max, %	D 280	0.7	0.7	1.5
Rutile ^A	D 3720	1 % max	99 % min	99 % min
Tint Strength ^B
Brightness ^B

^APercent rutile as a percent of total TiO₂ content.

^BTest methods to be developed and agreed upon by supplier and user. A basic white sidewall formula could be chosen to generate inherent color properties.

to 8.0. The free-chalking, weathering properties of anatase titanium-dioxide provide a (self-cleaning) white appearance in outdoor applications.

4. Basis of Classification

4.1 Titanium-Dioxide By Types:

- 4.1.1 *Type I*—Anatase, free-chalking.
- 4.1.2 *Type II*—Rutile, low/medium chalk resistance.
- 4.1.3 *Type III*—Rutile, high-chalk resistance.

5. Composition and Properties

5.1 The titanium-dioxide commonly used in rubber is the anatase Type 1 material. It is generally 97 to 99 % TiO₂ in composition. Some anatase grades have an inorganic surface treatment (that is, oxides of aluminum or silicon), some have an organic treatment; most have very little treatment.

5.2 The rutile titanium-dioxide consists of many grades for a multitude of end use applications. They are more weather resistant, have a more compact crystal structure, and vary widely in physical properties and surface treatment.

6. Keywords

- 6.1 anatase; rutile; titanium dioxide