Designation: D 4677 – 87 (Reapproved 2002)

Standard Classification for Rubber Compounding Materials—Titanium Dioxide[1]

This standard is issued under the fixed designation D 4677; 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.

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 Paints[2]

D 280 Test Methods for Hygroscopic Moisture (and Other Matter Volatile Under the Test Conditions) in Pigments[2]

D 1208 Test Methods for Common Properties of Certain Pigments[2]

D 1394 Test Methods for Chemical Analysis of White Titanium Pigments[2]

D 3720 Test Method for Ratio of Anatase to Rutile in Titanium Dioxide Pigments by X-Ray Diffraction[2]

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.

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]	...	...	...	...

[A] Percent rutile as a percent of total TiO_2 content.

[B] Test methods to be developed and agreed upon by supplier and user. A basic white sidewall formula could be chosen to generate inherent color properties.

3.2 It is chemically inert and slightly basic with a pH of 7.0 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 % TiO_2 in composition. Some antase 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

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

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[2] *Annual Book of ASTM Standards*, Vol 06.03.