This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

Designation: D4818 – 89 (Reapproved 2017)

Standard Classification for Rubber Compounding Materials—Vulcanization Accelerators[1]

This standard is issued under the fixed designation D4818; 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 vulcanization accelerators and defines their important chemical and physical characteristics. The properties outlined herein are useful for quality control; they can frequently be directly or indirectly related to the performance characteristics in rubber compounds.

1.2 Test Methods D1519, D4571, D4572 and D4574, for measurement of these properties, are not yet adapted for the vulcanization accelerators. Draft methods are being developed and will be submitted through Subcommittee D11.11 for processing and approval. A discussion of the reasons for determining these properties is contained in Section 6.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D1519 Test Methods for Rubber Chemicals—Determination of Melting Range

D4571 Test Methods for Rubber Compounding Materials—Determination of Volatile Material

D4572 Test Method for Rubber Chemicals—Wet Sieve Analysis of Sulfur

D4574 Test Methods for Rubber Compounding Materials—Determination of Ash Content

3. Significance and Use

3.1 *Class 1, Sulfenamides:*

3.1.1 As a group, the 2-benzothiazyl sulfenamides are the principle sulfur vulcanization accelerators used in the rubber industry today. The role of these materials in vulcanization is dual. They provide scorch time (delay period) in the crosslinking or vulcanization operation at processing temperatures. The delay avoids premature crosslinking during the processing, for example, mixing, extrusion, etc. Once the mixed rubber is at the curing temperature, these materials promote a rapid rate of curing (crosslinking, vulcanization).

3.1.2 The presence of certain impurities in this class of materials can affect their performance characteristics.

3.1.3 The 2-benzothiazyl sulfenamides are subject to degradation on extended storage. Significance degradation can affect their performance characteristics. In particular, the quality of the material is a function of storage time, temperature, relative humidity, and the impurity profile of the material; for example, free amines, salts of 2-mercaptobenzothiazole, etc. Since sulfenamide degradation in storage is an autocatalytic process (degradation products accelerate further degradation), significant degradation may only occur after a long induction period.

3.2 *Class 2, Thiazoles*—Thiazole derivatives are versatile vulcanization accelerators that are widely used in the rubber industry either alone or in combination with other accelerators.

3.3 *Class 3, Guanidines*—The guanidines have little importance as primary vulcanization accelerators, except for thick-sectioned goods, because of a typically slow vulcanization rate. As secondary accelerators they are used with other accelerators of the thiazole class. These resulting combinations vulcanize faster and give higher levels of vulcanization than do their individual constituents when used separately. The thiazole-guanidine combinations are frequently used for technical rubber goods.

3.4 *Class 4, Dithiocarbamates*—Vulcanization with dithiocarbamates is faster than with thiurams. Dithiocarbamates are used as ultra accelerators with normal sulfur levels. They are also employed as secondaries or activators for other accelerators.

3.5 *Class 5, Thiurams (disulfides)*—Thiuram disulfide accelerators are used for vulcanization without elemental sulfur to produce rubber compounds that show essentially no reversion and that have low compression set and good aging characteristics. For low sulfur vulcanization, thiurams are normally used in combination with sulfenamides. With a normal amount of sulfur, thiurams act as ultra accelerators.

3.6 *Class 6, Thiurams (other than disulfides)*—This class contains other thiuram types that are not disulfides. They are

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

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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.

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