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: D4676 – 94 (Reapproved 2021)

Standard Classification for Rubber Compounding Materials—Antidegradants[1]

This standard is issued under the fixed designation D4676; 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 antidegradants used in rubber and where appropriate defines their important chemical and physical characteristics for use in rubber.

1.2 The general term "antidegradant" describes materials used in rubber to protect against the effects of oxygen and ozone. Materials that fall in this general category include both antioxidants and antiozonants.

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

1.4 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D1218 Test Method for Refractive Index and Refractive Dispersion of Hydrocarbon Liquids

D1519 Test Methods for Rubber Chemicals—Determination of Melting Range

D1747 Test Method for Refractive Index of Viscous Materials

D2702 Practice for Rubber Chemicals—Determination of Infrared Absorption Characteristics

D3461 Test Method for Softening Point of Asphalt and Pitch (Mettler Cup-and-Ball Method)

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

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

D4937 Test Method for *p*-Phenylenediamine Antidegradants Purity by Gas Chromatography

D5376 Test Method for Rubber Compounding Materials—Determination of the Basic Nitrogen Content in Rubber Antioxidant: Polymerized TMQ

E28 Test Methods for Softening Point of Resins Derived from Pine Chemicals and Hydrocarbons, by Ring-and-Ball Apparatus

3. Significance and Use

3.1 There are many different antidegradants available for use in the rubber industry.

3.2 This classification of the various materials covers their chemical structure along with a brief reference to their overall use and their properties.

4. Basis of Classification

4.1 Rubber antidegradants included in this classification document are divided into the six classes shown below. The classification in general is based on the chemical structure categorization but in most cases it also classifies the materials according to their potential rubber applications.

4.2 *Class 1, p-Phenylenediamines (PPDs)*—This group of additives represents the primary materials used in tires and other mechanical goods to impart ozone protection. These additives are also used as antioxidants and antiflex agents in a number of applications but are considered to be strongly staining and thus limited to black rubber applications. They can also be used as raw polymer stabilizers.

4.2.1 Although all PPDs have similar performance characteristics, the different types are frequently preferred for certain end use conditions; for example, selection is based on the type and degree of flexing to be experienced by the rubber article.

4.3 *Class 2, Trimethyl-dihydroquinolines (TMQs)*—These materials are primarily used to protect rubber articles from degradation by atmospheric oxygen at higher temperatures. They are moderately staining.

[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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