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: D4482 – 11 (Reapproved 2017)

Standard Test Method for Rubber Property—Extension Cycling Fatigue[1]

This standard is issued under the fixed designation D4482; 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 test method covers the determination of fatigue life of rubber compounds undergoing a tensile-strain cycle. During part of the cycle, the strain is relaxed to a zero value. The specimens are tested without intentionally initiated flaws, cuts, or cracks. Failure is indicated by a complete rupture of the test specimen.

1.2 No exact correlation between these test results and service is given or implied. This is due to the varied nature of service conditions. These test procedures do yield data that can be used for the comparative evaluation of rubber compounds for their ability to resist (dynamic) extension cycling fatigue.

1.3 The values stated in SI units are to be regarded as standard. The values given in parentheses are for information only.

1.4 *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.*

1.5 *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]

D3182 Practice for Rubber—Materials, Equipment, and Procedures for Mixing Standard Compounds and Preparing Standard Vulcanized Sheets

D3767 Practice for Rubber—Measurement of Dimensions

D4483 Practice for Evaluating Precision for Test Method Standards in the Rubber and Carbon Black Manufacturing Industries

2.2 *British Standard:*

BS5324 Guide to Application of Statistics to Rubber Testing[3]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *extension ratio*—the ratio of the extended length of a specimen, L, to the unextended length, L_o, calculated as follows:

$$\lambda = \frac{L}{L_o} \tag{1}$$

3.1.2 *fatigue life (sample)*—the geometric mean or median value of the number of cycles required to cause failure for a number of specimens of the sample.

3.1.3 *fatigue life (specimen)*—the total number of cycles required to cause failure of a specimen, defined as a complete rupture or separation of the specimen.

3.1.4 *strain energy*—the energy per unit of volume required to deform the specimen to the specified strain. It is measured by the area under a stress-strain curve and expressed in kJ/m3 (see Annex A1).

4. Summary of Test Method

4.1 The dumbbell test specimens are cyclically strained at a fixed frequency and a series of fixed maximum extension ratios such that little or no temperature rise is induced. This cyclical straining action is called flexing. As a result of the flexing, cracks usually initiated by a naturally occurring flaw, grow and ultimately cause failure which is defined as complete rupture of the test specimen. The number of cycles to failure (fatigue life) is recorded.

4.2 Fatigue, as used in this test method, implies a rupture failure mechanism that results from the growth of flaws in the specimen. Fatigue does not refer to the drastic alteration of the physical-chemical rubber structure characteristic of high frequency flexing tests that give rise to a substantial temperature increase.

[1] This test method is under the jurisdiction of ASTM Committee D11 on Rubber and Rubber-like Materials and is the direct responsibility of Subcommittee D11.15 on Degradation Tests.

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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.

[3] Available from British Standards Institute, 2 Park St., London W1A 2BF, United Kingdom.

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