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StandardTest Method for Determination of Green Strength and Stress Relaxation of Raw Rubber or Unvulcanized Compounds[1]

This standard is issued under the fixed designation D6746; 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 methods to evaluate a characteristic of raw rubber or unvulcanized rubber compounds that is designated as green strength. This special strength property for uncured rubbers is an important processing performance attribute in rubber product manufacturing.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension

D1349 Practice for Rubber—Standard Conditions for Testing

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

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

3. Terminology

3.1 *Definitions:*

3.1.1 *green strength, n*—a characteristic property of a raw or unvulcanized rubber compound that indicates resistance to deformation when stress is applied.

3.1.1.1 *Discussion*—The word "green," applied to rubber, is a synonym for uncured or unvulcanized rubber.

3.1.2 *tensile green modulus, n*—ratio of stress to strain of a raw or unvulcanized rubber compound that indicates resistance to tensile deformation or strain.

3.1.3 *tensile green strength, n*—yield stress of a raw or unvulcanized rubber compound that indicates loss of resistance to tensile deformation or stress.

4. Summary of Test Method

4.1 This test method is divided into two parts. Part A consists of measurement of tensile stress and tensile modulus while a test specimen of raw or unvulcanized compounded rubber is subjected to a constant rate of crosshead separation. Part B consists of subjecting a test specimen of raw or unvulcanized compounded rubber to a 100 % strain condition and measuring tensile stress after an interval while maintaining the strained condition.

4.2 Part A of this test method consists of measuring the tensile stress-strain characteristics of a dumbbell or other recommended test piece of raw or unvulcanized compounded rubber are determined on a tensile testing machine capable of maintaining a constant rate of separation of the moving jaws.

4.3 In evaluating tensile green strength, several types of stress-strain behavior may be observed, depending on the rubber and the composition of the unvulcanized compound. (See Section 5.) Fig. 1 indicates three typical stress-strain curves. Type 1 has a yield point and exhibits increasing stress beyond the yield point, culminating in rupture at a higher stress and elongation compared to the initial yield stress. Type 2 also has a yield point, but beyond this point follows a decreasing stress behavior as the maximum rupture elongation is attained. Type 3 has a stress-strain curve that is similar to cured rubbers, with no elongation beyond the point of rupture at maximum (yield) stress.

4.4 Part B of this test method consists of a dumbbell or other recommended test specimen being placed in the grips of a tensile machine capable of a constant rate of grip separation, pausing the grip separation when an initial strain condition of

[1] This test method is under the jurisdiction of ASTM Committee D11 on Rubber and is the direct responsibility of Subcommittee D11.12 on Processability 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.

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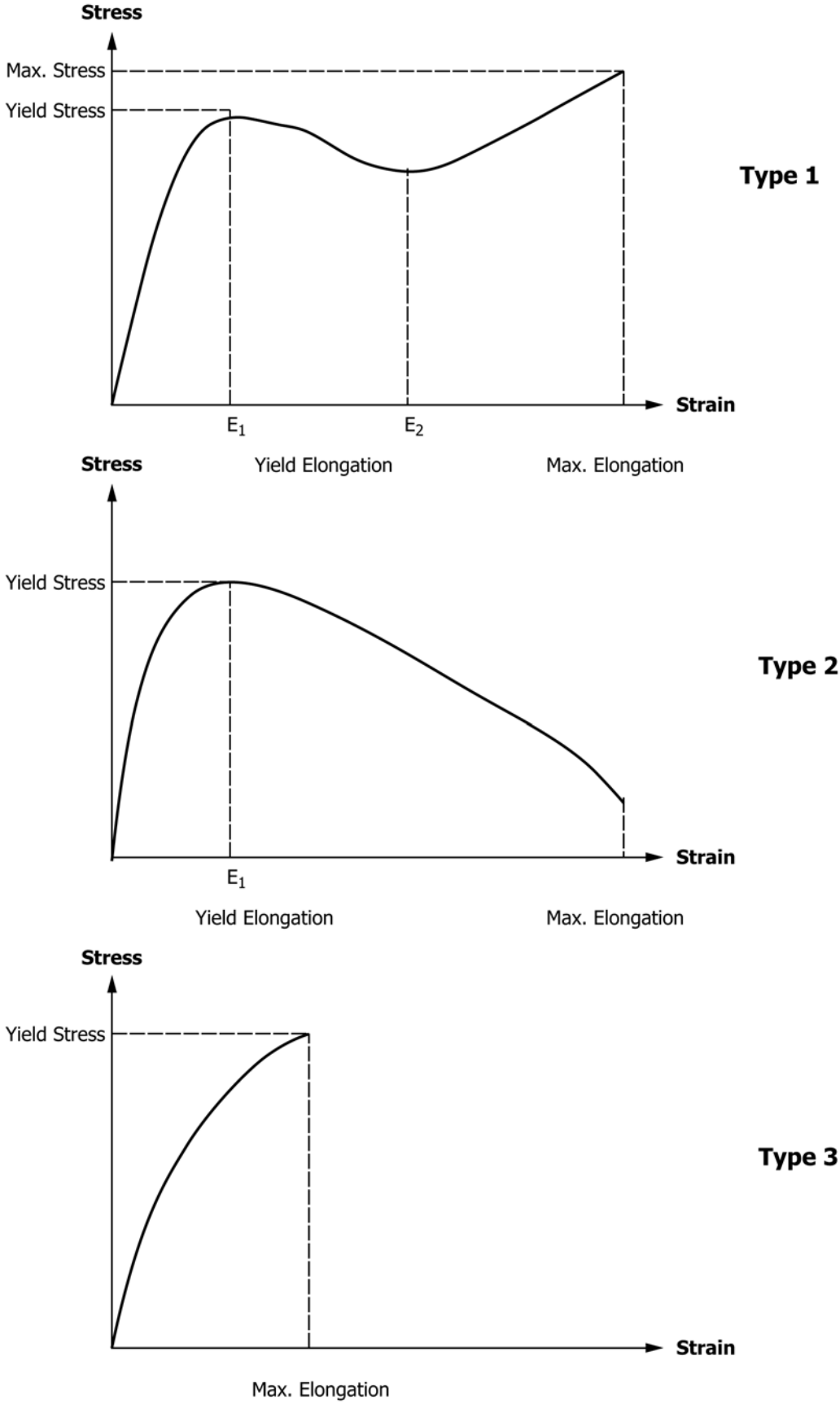

FIG. 1 Typical Tensile Stress-Strain Curves

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