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Standard Test Method for Raw Rubber or Unvulcanized Compounds—Determination of Tensile Green Strength[1]

This standard is issued under the fixed designation D 6746; 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 describes a method to evaluate a characteristic of raw rubber or unvulcanized rubber compounds, or both, that is designated as tensile green strength. This special strength property for uncured rubbers is an important processing performance attribute in rubber product manufacturing.

1.2 *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]

D 412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension

D 1349 Practice for Rubber—Standard Temperatures for Testing

D 3182 Practice for Rubber—Materials, Equipment, and Procedures for Mixing Standard Compounds and Preparing Standard Vulcanized Sheets

3. Terminology

3.1 *Definitions:*

3.1.1 *green strength*, *n*—a characteristic property of a raw or unvulcanized rubber compound that indicates the capability of retaining mechanical or structural integrity when the rubber is subjected to deformation of any type.

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

3.1.2 *tensile green strength*, *n*—green strength of a raw or unvulcanized rubber compound that is evaluated by the application of tensile stress or strain.

4. Summary of Test Method

4.1 The tensile stress-strain characteristics of a dumbbell or another 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.

4.2 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 elongational flow 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 yield or elongation beyond the point of rupture at maximum stress.

5. Significance and Use

5.1 The stress-strain properties of unvulcanized rubber (either a prepared mix or in the raw state) are important to certain processing operations in the rubber industry. These unvulcanized rubber properties are frequently referred to as "tensile green strength," denoting that the final vulcanization cycle has not yet been achieved.

5.2 Tensile green strength is determined primarily by the physical and chemical characteristics of polymers, such as molecular weight, tendency to crystallize, degree of branching, and so forth. It is also related to the compound formulation, particularly filler and plasticizer content, and the presence of peptizers. Tensile green strength can be a good indication of processing behavior. It is a particularly important characteristic for all processing operations in which elongation predominates.

[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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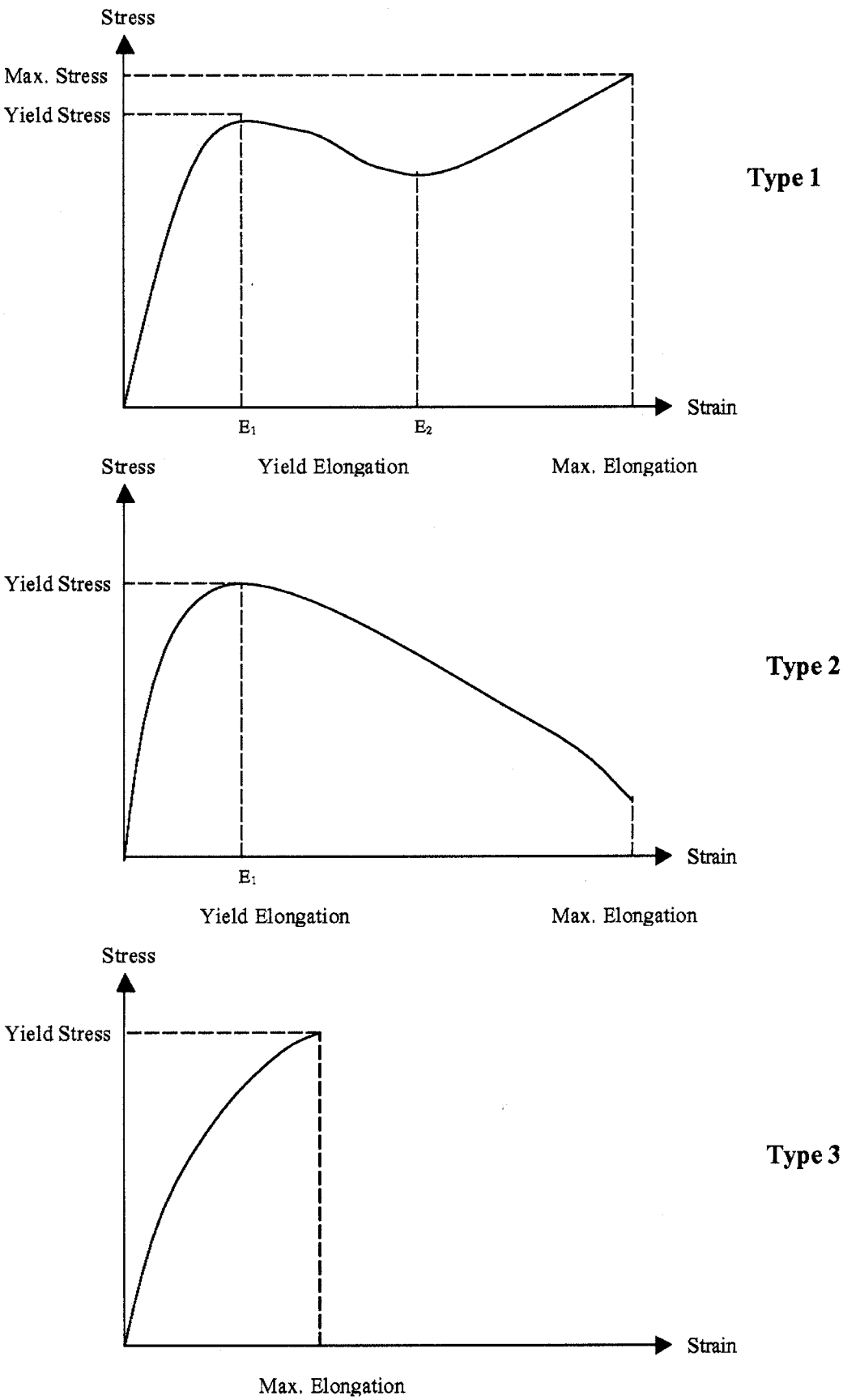

FIG. 1 Typical Tensile Stress-Strain Curves

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