Designation: D 1646 – 04

Standard Test Methods for Rubber—Viscosity, Stress Relaxation, and Pre-Vulcanization Characteristics (Mooney Viscometer)[1]

This standard is issued under the fixed designation D 1646; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 These test methods describe procedures for measuring a property called Mooney viscosity. Mooney viscosity is defined as the shearing torque resisting rotation of a cylindrical metal disk (or rotor) embedded in rubber within a cylindrical cavity. The dimensions of the shearing disk viscometer, test temperatures, and procedures for determining Mooney viscosity are defined in these test methods.

1.2 When disk rotation is abruptly stopped, the torque or stress on the rotor decreases at some rate depending on the rubber being tested and the temperature of the test. This is called 'stress relaxation' and these test methods describe a test method for measuring this relaxation.

NOTE 1—Viscosity as used in these test methods is not a true viscosity and should be interpreted to mean Mooney viscosity, a measure of shearing torque averaged over a range of shearing rates. Stress relaxation is also a function of the test configuration and for these test methods the results are unique to the Mooney viscometer.

1.3 When compounded rubber is placed in the Mooney viscometer at a temperature at which vulcanization may occur, the vulcanization reaction produces an increase in torque. These test methods include procedures for measuring the initial rate of rubber vulcanization.

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

1.5 ISO Standard 289 Parts 1 and 2 also describes the determination of Mooney viscosity and pre-vulcanization characteristics. In addition to a few insignificant differences there are major technical differences between ISO 289 and this test method in that ISO 289 does not provide for sample preparation on a mill, while this test method allows milling sample preparation in some cases prior to running a Mooney viscosity test. This can result in different viscosity values for some rubbers.

1.6 *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 1349 Practice for Rubber—Standard Temperatures for Testing

D 1418 Practice for Rubber and Rubber Latices— Nomenclature

D 1485 Test Methods for Rubber from Natural Sources—Sampling and Sample Preparation

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

D 3185 Test Methods for Rubber—Evaluation of SBR (Styrene-Butadiene Rubber) Including Mixtures with Oil

D 3186 Test Methods for Rubber—Evaluation of SBR (Styrene-Butadiene Rubber) Mixed with Carbon Black or Carbon Black and Oil

D 3896 Practice for Rubber from Synthetic Sources—Sampling

D 4483 Practice for Determining Precision for Test Method Standards in the Rubber and Carbon Black Industries

2.2 *ISO Standard:*[3]

ISO 289 Rubber, Unvulcanized—Determinations Using the Shearing Disk Viscometer,
Part 1 Determination of Mooney Viscosity, and
Part 2 Determination of Prevulcanization Characteristics.

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *Mooney viscosity, n*—a measure of the viscosity of a rubber or rubber compound determined in a Mooney shearing

[1] These test methods are 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.

[3] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

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