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: D6204 – 19

Standard Test Method for Rubber—Measurement of Unvulcanized Rheological Properties Using Rotorless Shear Rheometers[1]

This standard is issued under the fixed designation D6204; 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 use of a rotorless oscillating shear rheometer for the measurement of the flow properties of raw rubber and unvulcanized rubber compounds. These flow properties are related to factory processing.

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

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]

D1485 Practice for Rubber from Natural Sources—Sampling and Sample Preparation

D1646 Test Methods for Rubber—Viscosity, Stress Relaxation, and Pre-Vulcanization Characteristics (Mooney Viscometer)

D3896 Practice for Rubber From Synthetic Sources—Sampling

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

D5289 Test Method for Rubber Property—Vulcanization Using Rotorless Cure Meters

D6601 Test Method for Rubber Properties—Measurement of Cure and After-Cure Dynamic Properties Using a Rotorless Shear Rheometer

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *complex shear modulus, G*, n*—the ratio of peak amplitude shear stress to peak amplitude shear strain; mathematically, $G^* = [(S^*/Area)/Strain] = (G'^2 + G''^2)^{1/2}$.

3.1.2 *complex torque, S*, n*—the peak amplitude torque response measured by a reaction torque transducer for a sinusoidally applied strain; mathematically, S^* is computed by $S^* = (S'^2 + S''^2)^{1/2}$.

3.1.3 *dynamic complex viscosity η*, n*—the ratio of the complex shear modulus, G^* to the oscillation frequency, ω, in radians per second.

3.1.4 *elastic torque, S', n*—the peak amplitude torque component that is in phase with a sinusoidally applied strain.

3.1.5 *loss angle, δ, n*—the phase angle by which the complex torque (S^*) leads a sinusoidally applied strain.

3.1.6 *loss factor,* tan *δ, n*—the ratio of loss modulus to storage modulus, or the ratio of viscous torque to elastic torque; mathematically, $\tan \delta = G''/G' = S''/S'$.

3.1.7 *loss shear modulus G", n*—the ratio of (viscous) peak amplitude shear stress to peak amplitude shear strain for the torque component 90° out of phase with a sinusoidally applied strain; mathematically, $G'' = [(S''/Area)/Peak\ Strain]$.

3.1.8 *real dynamic viscosity, η, n*—the ratio of the loss shear modulus, G'' to the oscillation frequency, ω, in radians per second.

3.1.9 *storage shear modulus, G', n*—the ratio of (elastic) peak amplitude shear stress to peak amplitude shear strain for the torque component in phase with a sinusoidally applied strain; mathematically, $G' = [(S'/Area)/Peak\ Strain]$.

3.1.10 *viscous torque, S", n*—the peak amplitude torque component, which is 90° out of phase with a sinusoidally applied strain.

[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 D11.12 on Processability Tests.

Current edition approved May 1, 2019. Published May 2019. Originally approved in 1997. Last previous edition approved in 2015 as D6204 – 15. DOI: 10.1520/D6204-19.

[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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