



Standard Terminology Relating to Dynamic Mechanical Measurements on Plastics¹

This standard is issued under the fixed designation D 4092; 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 This terminology is a compilation of definitions and descriptions of technical terms used in dynamic mechanical property measurements on polymeric materials, including solutions, melts, and solids. Terms that are generally understood or defined adequately in other readily available sources are either not included or sources identified.

1.2 A definition is a single sentence with additional information included in notes. It is reviewed every five years and the year of the last review or revision is appended.

1.3 Definitions identical to those published by another standards organization or ASTM committee are identified with the abbreviation of the name of the organization or the ASTM committee; for example, ICTA is the International Conference on Thermal Analysis and ISO is the International Standards Organization, Specifically ISO 472: 1988 (E/F) document.

1.4 Descriptions of terms specific to dynamic mechanical measurements are identified with an italicized introductory phrase.

NOTE 1—This terminology is similar to ISO 6721-1 1994 in title only. The ISO document cites only 13 terms and this terminology defines 49 relevant terms.

2. Referenced Documents

2.1 ASTM Standards:

D 653 Terminology Relating to Soil, Rock, and Contained Fluids²

D 883 Terminology Relating to Plastics³

D 2231 Practice for Rubber Properties in Forced Vibration⁴

E 6 Definitions of Terms Relating to Methods of Mechanical Testing⁵

2.2 ISO Standards:⁶

ISO 472: 1988 (E/F) Definitions

ISO 6721-1 1994 (E) Plastics-Determination of Dynamic

¹ This terminology is under the jurisdiction of ASTM Committee D-20 on Plastics and is the direct responsibility of Subcommittee D20.10 on Mechanical Properties.

Current edition approved March 10, 1996. Published July 1996. Originally published as D 4092 – 82. Last previous edition D 4092 – 90.

² Annual Book of ASTM Standards, Vol 04.08.

³ Annual Book of ASTM Standards, Vol 08.01.

⁴ Annual Book of ASTM Standards, Vol 09.01.

⁵ Annual Book of ASTM Standards, Vol 03.01.

⁶ Available from American National Standards Institute, 11 West 42nd St., 13th Floor, New York, NY 10036.

Mechanical Properties, Part 1, General Principles

3. Terminology Definitions and Descriptions

alpha (α) loss peak (*in dynamic mechanical measurement*)—the first peak in the damping curve below the melt, in order of decreasing temperature or increasing frequency. (1981)

beta (β) loss peak (*in dynamic mechanical measurement*)—the second peak in the damping curve below the melt, in order of decreasing temperature or increasing frequency. (1981)

complex modulus, E^* or G^* —the ratio of the stress to strain where each is a vector that may be represented by a complex number.

$$E^* = E' + iE''$$

$$G^* = G' + iG''$$

$$K^* = K' + iK''$$

where:

E^* = complex modulus, measured in tension or flexure,

E' = storage modulus, measured in tension or flexure,

E'' = loss modulus, measured in tension or flexure,

G^* = complex modulus, measured in shear,

G' = storage modulus, measured in shear,

G'' = loss modulus, measured in shear,

K^* = complex modulus, measured in compression,

K' = storage modulus, measured in compression

K'' = loss modulus, measured in compression, and

$i = \sqrt{-1}$, measured in compression.

DISCUSSION—The complex modulus may be measured in tension (E^*), compression (K^*), flexure (E^*), or in shear (G^*). (1981)

complex shear compliance, J^* —the reciprocal of complex shear modulus. (1981)

$$J^* = \frac{1}{G^*}$$

complex tensile compliance, D^* —the reciprocal of complex tensile modulus. (1981)

$$D^* = \frac{1}{E^*}$$

compliance, C (Pa^{-1})—the quotient of strain and stress.

$$C = \frac{\epsilon}{\sigma} = \frac{1}{M}$$

D is the tensile compliance; J is the shear compliance; B is the bulk compliance; O is the longitudinal compression compliance.