INTERNATIONAL STANDARD

ISO 6721-5

First edition
1996-05-15

Plastics — Determination of dynamic mechanical properties —

Part 5:
Flexural vibration — Non-resonance method

Plastiques — Détermination des propriétés mécaniques dynamiques —

Partie 5: Vibration en flexion — Méthode hors résonance

Reference number
ISO 6721-5:1996(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 6721-5 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 2, *Mechanical properties.*

— *Part 1: General principles*

— *Part 2: Torsion-pendulum method*

— *Part 3: Flexural vibration — Resonance-curve method*

— *Part 4: Tensile vibration — Non-resonance method*

— *Part 5: Flexural vibration — Non-resonance method*

— *Part 6: Shear vibration — Non-resonance method*

— *Part 7: Torsional vibration — Non-resonance method*

— *Part 8: Longitudinal and shear vibration — Wave-propagation method*

— *Part 9: Tensile vibration — Sonic-pulse propagation method*

— *Part 10: Dynamic shear viscosity using a parallel-plate oscillatory rheometer*

International Organization for Standardization
Case postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

Plastics — Determination of dynamic mechanical properties —

Part 5:
Flexural vibration — Non-resonance method

1 Scope

This part of ISO 6721 describes a flexural, non-resonance method for determining the components of the Young's complex modulus E^* of polymers at frequencies typically in the range 0,01 Hz to 100 Hz. The method is suitable for measuring dynamic storage moduli in the range 10 MPa to 200 GPa. Although materials with moduli less than 10 MPa may be studied, more accurate measurements of their dynamic properties can be made using shear modes of deformation (see part 6 of ISO 6721).

This method is particularly suited to the measurement of loss factors greater than 0,1 and may therefore be conveniently used to study the variation of dynamic properties with temperature and frequency through most of the glass-rubber relaxation region (see ISO 6721-1:1994, subclause 9.4). The availability of data determined over wide ranges of both frequency and temperature enables master plots to be derived, using frequency/temperature shift procedures, which present dynamic properties over an extended frequency range at different temperatures.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 6721. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 6721 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 6721-1:1994, *Plastics — Determination of dynamic mechanical properties — Part 1: General principles.*

ISO 6721-6:1996, *Plastics — Determination of dynamic mechanical properties — Part 6: Shear vibration — Non-resonance method.*

3 Definitions

See ISO 6721-1:1994, clause 3.

4 Principle

A test specimen is subjected to a sinusoidal transverse force or displacement at a frequency significantly below the fundamental flexural resonance frequency (see 10.2.1). The amplitudes of the force and displacement cycles applied to the specimen and the phase angle between these cycles are measured. The storage and loss components of the Young's complex modulus and the loss factor are calculated using equations given in clause 10 of this part of ISO 6721.

5 Apparatus

5.1 Loading assembly

The requirements for the loading assembly are that it shall permit measurements of the amplitudes of, and phase angle between, the force and displacement cycles for a specimen subjected to a transverse sinusoidal force or displacement. Various designs of apparatus are possible, as illustrated schematically in figures 1 and 2. In figure 1a), a sinusoidal displacement is generated by the vibrator V and applied to the specimen S through moving clamps C_1 located close to the opposite ends of the specimen. The amplitude and frequency of the vibrator table displacement are variable and monitored by the transducer D. The specimen is held at its centre by a fixed clamp C_2 and thus undergoes sinusoidal flexural deformations. The sinusoidal force applied in deforming the specimen is