
**Plastics — Determination of dynamic
mechanical properties —**

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

*Plastiques — Détermination des propriétés mécaniques
dynamiques —*

Partie 4: Vibration en traction — Méthode hors résonance



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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 5, *Physical-chemical properties*.

This third edition cancels and replaces the second edition (ISO 6721-4:2008), which has been technically revised. The main changes compared to the previous edition are as follows:

- the document has been revised editorially;
- normative references have been changed to undated.

A list of all parts in the ISO 6721 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Plastics — Determination of dynamic mechanical properties —

Part 4:

Tensile vibration — Non-resonance method

1 Scope

This document describes a forced, non-resonance method for determining the components of the tensile complex modulus E^* of polymers at frequencies typically in the range 0,01 Hz to 100 Hz.

NOTE Higher frequency measurements can be made, but significant errors in the dynamic properties measured are likely to result (see [10.2.2](#) and [10.2.3](#)).

The method is suitable for measuring dynamic storage moduli in the range 0,01 GPa to 5 GPa. Although materials with moduli outside this range can be studied, alternative modes of deformation are intended to be used for higher accuracy [i.e. a shear mode for $G' < 0,01$ GPa (see ISO 6721-6) and a flexural mode for $E' > 5$ GPa (see ISO 6721-3 or ISO 6721-5)].

This method is particularly suited to the measurement of loss factors and can 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). 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 display dynamic properties over an extended frequency range at different temperatures.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6721-1 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

4 Principle

The specimen is subjected to a sinusoidal tensile force or deformation at a frequency significantly below the fundamental resonance frequency for the clamped/free longitudinal mode (see [10.2.2](#)). 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 factor are calculated using formulae given in [Clause 10](#).