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GB/T 33061.1-2025

**Plastics - Determination of dynamic mechanical properties -
Part 1: General principles
(English Translation)**

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1 Scope

This document specifies the general definitions, principles, apparatus, test specimens, number of test specimens, conditioning, test procedures, and expression of results for the test methods described in other parts of GB/T 33061.

Note 1: The various parts of GB/T 33061 describe methods for determining the dynamic mechanical properties of rigid plastics within the range of linear viscoelastic behavior.

Results obtained from different modes of deformation specified in GB/T 33061 are not directly comparable.

Note 2: In tensile vibration, the stress applied throughout the thickness of the test specimen is uniform; in flexural vibration, the surface properties of the specimen are the dominant factor. Therefore, data obtained from flexural vibration and tensile vibration are comparable only within the strain range in which the specimen structure is homogeneous and the stress-strain relationship is linear.

2 Normative references

The following referenced documents are indispensable for the application 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.

GB/T 2035, Plastics - Vocabulary (GB/T 2035-2024, ISO 472.2013, NEQ)

GB/T 2918, Plastics - Standard atmospheres for conditioning and testing (GB/T 2918-2018, ISO 291.2008, MOD)

GB/T 6672, Plastics film and sheeting - Determination of thickness by mechanical scanning (GB/T 6672-2001, ISO 4593.1993, IDT)

GB/T 33061.2, Plastics - Determination of dynamic mechanical properties - Part 2.Torsion-pendulum method (GB/T 33061.2-2025, ISO 6721-2.2019, MOD)

GB/T 33061.3, Plastics - Determination of dynamic mechanical properties - Part 3.Resonance-curve method under flexural vibration (GB/T 33061.3-2025, ISO 6721-3.2021, MOD)

GB/T 33061.4, Plastics - Determination of dynamic mechanical properties - Part 4.Non-resonance method under tensile vibration (GB/T 33061.4-2023, ISO 6721-4.2019, MOD)

GB/T 33061.5, Plastics - Determination of dynamic mechanical properties - Part 5.Non-resonance method under flexural vibration (GB/T 33061.5-2023, ISO 6721-5.2019, MOD)

GB/T 33061.6, Plastics - Determination of dynamic mechanical properties - Part 6.Non-resonance method under shear vibration (GB/T 33061.6-2023, ISO 6721-6.2019, MOD)

GB/T 33061.7, Plastics - Determination of dynamic mechanical properties - Part 7.Non-resonance method under torsional vibration (GB/T 33061.7-2023, ISO 6721-7.1999, MOD)

GB/T 33061.10, Plastics - Determination of dynamic mechanical properties - Part 10.Complex shear viscosity using a parallel-plate oscillatory rheometer (GB/T 33061.10-2025, ISO 6721.10.2015, MOD)

GB/T 33061.12, Plastics - Determination of dynamic mechanical properties - Part

12. Non-resonance compressive vibration method (GB/T 33061.12-2025, ISO

6721-12:2022, MOD)

ISO 6721-8, Plastics - Determination of dynamic mechanical properties - Part 8.

Longitudinal and shear vibration - Wave-propagation method

ISO 6721-9, Plastics - Determination of dynamic mechanical properties - Part 9.

Tensile vibration - Sonic-pulse propagation method

3 Terms and definitions

For the purposes of this document, the following terms and definitions, as well as those given in GB/T 2035, apply.

3.1

complex modulus

M^*

The ratio of dynamic stress to dynamic strain when a sinusoidal vibration is applied to a viscoelastic material.

4 Principle

A test specimen of known geometry and dimensions subjected to mechanical vibration may be characterized by two types of testing modes: vibration modes and deformation modes.

Depending on the deformation mode, different types of moduli are obtained (see Table 2).

Depending on whether the vibration mode is non-resonant, free (resonant), or near-resonant, four vibration modes, Modes I ~ IV, may be defined. See Table 3.

Table 4 gives commonly used methods for determining various types of moduli. Table 5 provides an overview of all methods covered in the different parts of GB/T 33061.

Table 2 - Types of moduli (deformation modes)

Table 3 - Vibration modes

Table 5 - Methods contained in the different parts of GB/T 33061

5.1 Types

See the relevant parts of GB/T 33061 and Chapter 4.

5.2 Mechanical, electronic and recording system

See the relevant parts of GB/T 33061.

5.3 Temperature control chamber

The test specimen, fixtures and supports shall be enclosed in a temperature-controlled test chamber capable of providing the required test environment, including air or a suitable inert gas.

The temperature control chamber shall provide a sufficient temperature range for testing the material under test conditions (e.g. $-100\text{ }^{\circ}\text{C}$ ~ $300\text{ }^{\circ}\text{C}$). The chamber should be equipped with a programmable temperature control device.

The temperature inside the chamber shall be uniform and controlled within $\pm 1\text{ K}$ along the length of the test specimen, and shall be measured at a position close to the specimen.

When a constant temperature program is used (see 9.5), the temperature during the test shall be maintained within $\pm 1\text{ K}$. When a constant heating (or cooling) rate is applied (see 9.4), the heating (or cooling) rate shall not exceed 120 K/h .

5.4 Gas

The purge gas shall be air or a suitable inert gas.

5.5 Temperature measuring device

A device for measuring the air temperature around the specimen, with an accuracy of at least $\pm 0.5\text{ }^{\circ}\text{C}$. A temperature measuring device equipped with a low-inertia sensor should be used.

5.6 Specimen dimension measuring device

In the various parts of GB/T 33061, specimen dimensions used for modulus calculations shall be measured at room temperature. When determining the temperature dependence of the modulus, the effect of thermal expansion is not taken into account.

The measuring device used to determine specimen length, width and thickness (in accordance with GB/T 6672) shall have an accuracy of at least $\pm 0.5\%$ or $\pm 0.05\text{ mm}$ (whichever is more accurate).