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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 45159.4-2025

**Mechanical vibration and shock - Characterization of the
dynamic mechanical properties of visco-elastic materials - Part
4: Dynamic stiffness method
(English Translation)**

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Foreword

This document is in accordance with the provisions of GB/T 1.1-2020 "Guidelines for standardization work Part 1: Structure and drafting rules for standardization documents" Drafting.

This document is Part 4 of GB/T 45159 "Characterization of dynamic mechanical properties of viscoelastic materials subject to mechanical vibration and shock".

GB/T 45159 has published the following parts.

- Part 1: Principles and guidelines;
- Part 2: Resonance method;
- Part 3: Cantilever shear beam method;
- Part 4: Dynamic stiffness method;
- Part 5: Poisson's ratio based on comparison of measurement and finite element analysis;
- Part 6: Time-temperature superposition.

This document is equivalent to ISO 18437-4:2008 "Mechanical vibration and shock - Characterization of dynamic mechanical properties of viscoelastic materials - Part 4 Points. Dynamic Stiffness Method.

Introduction

GB/T 45159 provides three methods for measuring the elastic modulus and loss factor of viscoelastic materials, and two methods for measuring Poisson's ratio.

The operating principle, measuring device, measurement and data analysis of the method are presented, thus providing a measurement method for characterizing the dynamic

mechanical properties of viscoelastic materials.

It consists of 6 parts.

--- Part 1: Principles and guidance. The purpose is to describe three methods for measuring the elastic modulus and loss factor of viscoelastic materials, and Two methods for measuring Poisson's ratio are presented, along with the test setup, measurement range, and limitations of each method.

--- Part 2: Resonance method. The purpose is to describe the technical requirements for the resonance method to test the dynamic mechanical properties of viscoelastic materials.

--- Part 3: Cantilever shear beam method. The purpose is to describe the cantilever shear beam method for testing the dynamic mechanical properties of viscoelastic materials.

Technical regulations.

--- Part 4: Dynamic stiffness method. The purpose is to describe the technical requirements for the dynamic mechanical properties characterization of viscoelastic materials using the dynamic stiffness method.

--- Part 5: Poisson's ratio based on comparison of measurement and finite element analysis. The purpose is to describe the Poisson's ratio based on comparison of measurement and finite element analysis.

Poisson's ratio test is a technical provision for characterizing the dynamic mechanical properties of viscoelastic materials.

--- Part 6: Time-temperature superposition. The purpose is to describe the technical requirements for characterizing the dynamic mechanical properties of viscoelastic materials using time-temperature superposition tests.

Mechanical vibration and shock Dynamic mechanics of viscoelastic materials
Characterization of properties - Part 4: Dynamic stiffness method

1 Scope

This document describes methods for measuring the dynamic complex moduli (Young's modulus, shear modulus, and bulk modulus, as well as tensile, shear, and the dynamic stiffness method based on the loss factor under compressive strain state is applicable to polymer materials (such as rubber, viscous polymer) in a wide frequency and temperature range.

The dynamic excitation acting on the specimen and the strain response of the specimen are obtained through the sensor signal.

The sign is proportional to the dynamic force acting on the specimen and the strain generated by the specimen.

The measurement frequency range depends on the specimen size, measurement accuracy, the stiffness of the exciter and specimen, and the resonance characteristics of the test fixture.

This document is applicable to any static preload (including the case where the static load-deformation curve is nonlinear) under the action of superimposed small dynamic Strain (linear behavior) measurement conditions. Under given preload conditions, the relationship between the moduli is unique.

2 Normative references

The contents of the following documents constitute the essential clauses of this document through normative references in this document.

For referenced documents without a date, only the version corresponding to that date applies to this document; for referenced documents without a date, the latest version (including all amendments) applies to this document.

ISO 472 Plastics-Vocabulary Note. GB/T 2035-2024 Plastics Terminology (ISO 472:2013, NEQ) ISO 483 Plastics - Small closed containers for conditioning and testing plastics using aqueous solutions to maintain a constant humidity value) Note. GB/T 40315-2021 Plastics Small closed containers for conditioning and testing using aqueous solutions to maintain constant humidity (ISO 483:2005, IDT) ring-Vocabulary) Note. GB/T 2298-2010 Mechanical vibration, shock and condition monitoring vocabulary (ISO 2041:2009, IDT) ISO 4664-1 Rubber, vulcanized or thermoplastic - Determination of dynamic properties - Part 1: General guidance Note. GB/T 9870.1-2006 Rubber, vulcanized or thermoplastic - Determination of dynamic properties - Part 1: General principles (ISO 4664-1:2005, IDT) Note. GB/T 33061.1-2016 Plastics - Determination of dynamic mechanical properties - Part 1: General principles (ISO 6721-1:2011, MOD) ISO 6721-4 Plastics - Determination of dynamic mechanical properties - Part 4: Tensile vibration non-resonance method Note. GB/T 33061.4-2023 Plastics - Determination of dynamic mechanical properties - Part 4: Non-resonant tensile vibration method (ISO 6721-4:2019, MOD) ISO 6721-6 Plastics-Determination of dynamic mechanical properties-Part 6: Shear vibration non-resonance method Note. GB/T 33061.6-2023 Plastics - Determination of dynamic mechanical properties - Part 6: Non-resonant shear vibration method (ISO 6721-6:2019, MOD)