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

GB/T 1040.1-2025

**Plastics - Determination of tensile properties - Part 1: General
principles**

(English Translation)

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Table of Contents

Foreword...	3
Introduction...	7
1 Scope...	8
2 Normative References...	8
3 Terms and Definitions...	9
4 Principle and Method...	14
5 Equipment...	15
6 Specimen...	20
7 Number of Specimens...	22
8 Conditioning...	22
9 Test Procedures...	22
10 Calculation and Expression of Results...	25
11 Precision...	29
12 Test Report...	29
Appendix A (informative) Determination of Yield Strain...	31

1 Scope

This document specifies the general principles for determining the tensile properties of plastics and composite materials under specified conditions. Other parts of this document specify the methods for determining the tensile properties of different types of specimens for different types of materials.

This document is used to study the tensile properties of specimens and to determine the tensile strength, tensile modulus, and other aspects of the tensile stress-strain relations under specified conditions.

This document applies to the following materials.

---Unfilled, filled and reinforced rigid and semi-rigid (see 3.12 and 3.13) thermoplastic molding, extrusion and casting materials; rigid and semi-rigid thermoplastic sheets and films.

---Rigid and semi-rigid thermosetting molding materials, including filled and reinforced composite materials; rigid and semi-rigid thermosetting board materials, including laminates.

---Unidirectional or non-unidirectional fiber-reinforced thermosetting and thermoplastic composite materials, with reinforcements, such as felt, fabric, roving, chopped strand, hybrid fiber reinforcements and milled fibers; sheets made from pre-impregnated materials (prepregs).

---Thermotropic liquid crystal polymers.

This document is generally not applicable to rigid foam materials (see ISO 1926) or sandwich structures containing microporous materials.

2 Normative References

The contents of the following documents constitute indispensable clauses of this document through the normative references in the text. In terms of references with a specified date, only versions with a specified date are applicable to this document. In terms of references without a specified date, the latest version (including all the modifications) is applicable to this document.

GB/T 2918 Plastics - Standard Atmospheres for Conditioning and Testing (GB/T 2918-2018,

ISO 291.2008, MOD)

GB/T 2941 Rubber - General Procedures for Preparing and Conditioning Test Pieces for Physical Test Methods (GB/T 2941-2006, ISO 23529.2004, IDT)

GB/T 12160-2019 Metallic Materials - Calibration of Extensometers Systems Used in Uniaxial

Testing (GB/T 12160-2019, ISO 9513.2012, IDT)

GB/T 16825.1 Metallic Materials - Calibration and Verification of Static Uniaxial Testing

Machines - Part 1. Tension / Compression Testing Machines - Calibration and Verification of the Force-measuring System (GB/T 16825.1-2022, ISO 7500-1.2018, IDT)

GB/T 37426 Plastics - Test Specimens (GB/T 37426-2019, ISO 20753.2018, IDT)

GB/T 44535 Plastics - Determination of Linear Dimensions of Test Specimens (GB/T 44535-

2024, ISO 16012.2015, MOD)

3 Terms and Definitions

The following terms and definitions are applicable to this document.

3.1

gauge length

L_0

The initial distance between the two gauge lines in the middle of a specimen.

NOTE 1: the unit is millimeters (mm).

NOTE 2: the gauge length values of different types of specimens in all parts of GB/T 1040 represent the corresponding maximum gauge length.

3.2

thickness

The initial dimension of the smaller side of the rectangular cross-section in the middle of a specimen.

NOTE: the unit is millimeters (mm).

3.3

width

The initial dimension of the larger side of the rectangular cross-section in the middle of a specimen.

NOTE: the unit is millimeters (mm).

E_t

The slope on the stress-strain curve $\sigma(\epsilon)$ between the interval of strain $\epsilon_1 = 0.05\%$ and strain $\epsilon_2 = 0.25\%$.

NOTE 1: the unit is megapascals (MPa).

NOTE 2: calculated using the chord modulus or the slope of the linear least squares regression line for this interval (see Curve 4 in Figure 1).

NOTE 3: this definition does not apply to all films.

3.10 Poisson's ratio

Within the initial linear portion of the curve of the longitudinal strain versus normal strain relations, the negative value of the ratio of the tensile deformation $\Delta\epsilon_{\perp}$, perpendicular to one of the two coordinate axes in the tensile direction, to the deformation $\Delta\epsilon_{\parallel}$ in the tensile direction.

NOTE 1: it is expressed as a dimensionless ratio.

NOTE 2: since the variation in transverse strain $\Delta\epsilon_{\text{transverse}}$ is negative and the change in longitudinal strain $\Delta\epsilon_{\text{longitudinal}}$ is positive, the Poisson's ratio defined in 3.10 is positive.

3.11 gripping distance

The initial length of the specimen portion between the grips.

NOTE: the unit is millimeters (mm).

3.12 rigid plastic

Under specified conditions, a plastic with a flexural modulus or a tensile modulus (if flexural modulus is not applicable) greater than 700 MPa.

3.13 semi-rigid plastic

Under specified conditions, a plastic with a flexural modulus or tensile modulus (if flexural modulus is not applicable) between 70 MPa and 700 MPa.

4.1 Principle

Stretch the specimen at a constant rate along its longitudinal principal axis, until it breaks or its stress (load) or strain (elongation) reaches a certain pre-determined value. Measure the load and elongation of the specimen during this process.

4.2 Method

4.2.1

This method is applicable to specimens prepared by molding and from finished or semi-finished products (such as molded parts, laminates, films, and extruded or cast sheets) by machining, cutting or punching. Specimen types and their preparation are described in the relevant parts of GB/T 1040. For multi-purpose specimens and small-sized specimens, see GB/T 37426.

4.2.2

The relevant parts of GB/T 1040 specify the preferred specimen dimensions. Test results from specimens of different dimensions or prepared under different conditions are not comparable. Furthermore, factors such as test speed and specimen conditioning may also affect test results. Therefore, when comparing data, these factors shall be strictly controlled and recorded.

5.1.1 General requirements

The testing machine shall comply with the provisions of GB/T 16825.1 and GB/T 12160, as well as 5.1.2 ~ 5.1.6.