

EDS

Engineering,
GM DAEWOO Auto & Technology
Standards

TESTING OF PLASTICS DETERMINATION OF THE MODULUS OF ELASTICITY BY TENSILE, COMPRESSION AND FLEXURAL TEST

EDS-T-7510

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1. PURPOSE

This standard is used to determine the elastic modulus of plastics through tensile, compression and flexural tests.

2. SCOPE

This standard applies to the method of determining elastic modulus of plastics by conducting tensile, compression and flexural tests under specified conditions.

3. DEFINITION

3.1. Elastic modulus based on tensile test.

Elastic modulus based on tensile test indicates the relation between the stress (σ) and elongation (ε) depending on extension of test pieces. If the elongation is very little with 0.5% max., Hook's law shall apply to the elastic modulus.

$$E = \frac{\sigma}{\varepsilon} = \frac{\Delta F \cdot L_0}{A_0 \cdot \Delta L}$$

Where, L_0 : Initial marking line length

ΔL : The deformation of length on the initial straight-line portion of the load-deflection curve.

ΔF : The deformation of load on the initial straight-line portion of the load-deflection curve.

A_0 : Sectional area of the test piece

$$\sigma : \frac{F}{A_0}$$

$$\varepsilon : \frac{\Delta L}{L_0}$$

3.2. Elastic modulus based on compression

Elastic modulus based on compression test indicates the relation between the stress (σ) and compressibility (ε_d) depending on compression of the test piece. If the compressibility rate is very little with 0.5% max., Hook's law shall apply to the elastic modulus.

$$E = \frac{\sigma}{\varepsilon} = \frac{\Delta F}{A_0} \times \frac{L_0}{\Delta X}$$

Where, L_0 : Initial marking line length

ΔL : The deformation of length on the initial straight-line portion of the load-deflection curve.

ΔF : Load : The deformation of load on the initial straight-line portion of the load-deflection curve.

A_0 : Sectional area of the test piece

$$\sigma : \frac{\Delta F}{A_0}$$

$$\varepsilon : \frac{\Delta X}{L_0}$$

3.3. Elastic modulus based on flexural

Elastic modulus based on flexural test indicates the relation between the stress (σ), and the compressibility (ε_d) or elongation (ε) on the test piece layer which is perpendicular to the test piece. If the elongation or compression of the outside layer is very little with 0.5% max., the following formula shall apply to the elastic modulus.

$$E = (L_V^3 / 4bh^3) \times (\Delta F / \Delta X)$$

Where, ΔX : The deformation of length on the initial straight-line portion of the load-deflection curve.

ΔF : The deformation of load on the initial straight-line portion of the load-deflection curve.

L_V : Length of the marking line on the test piece (see Fig. 1)

b : Width of the test piece

h : Thickness of the test piece

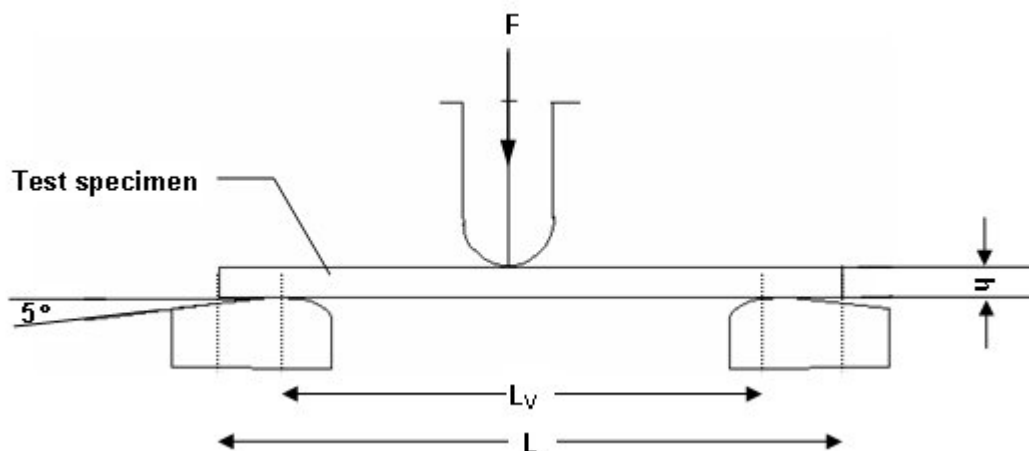


Fig. 1. Flexural load testing

4. PREPARATION OF TEST PIECES

4.1. Test specimens shall be prepared by compression or injection molding of the material to be tested or by machining the material in sheets of an appropriate size. If the sheets are an isotropic ones, they shall be prepared in both of horizontal and vertical direction.

4.2. For tensile test, use a dumbbell type of test piece, the detail dimensions are follow the EDS-T-7511.

4.3. For compression test, test pieces conforming to the following shall be used.

4.3.1. Take test pieces from the products of a thickness of 5 mm min. The test pieces shall be rectangular parallelepipeds having one regular square face(length $a \geq 5$ mm) and of a length (L_P) of $5 \sim 10 \times a$). Here, the length of the marking line shall not exceed $\frac{2}{3}$.

4.3.2. When using products of a thickness of 5 mm max, the test pieces shall be rectangular parallelepipeds of $(80 \pm 5) \text{ mm} \times (12 \pm 0.5) \text{ mm} \times \text{thickness}(\text{mm})$.

4.3.3. When using cylindric products of a diameter (d) of 5 mm min, the test pieces shall be $5 \sim 10 \times a$ long (L_P) and the length of the marking line shall not exceed $\frac{2}{3} L_P$.