

THE SCIENCE AND ENGINEERING OF MATERIALS

ENHANCED SEVENTH EDITION



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The Science and Engineering of Materials

Enhanced Seventh Edition, SI Edition

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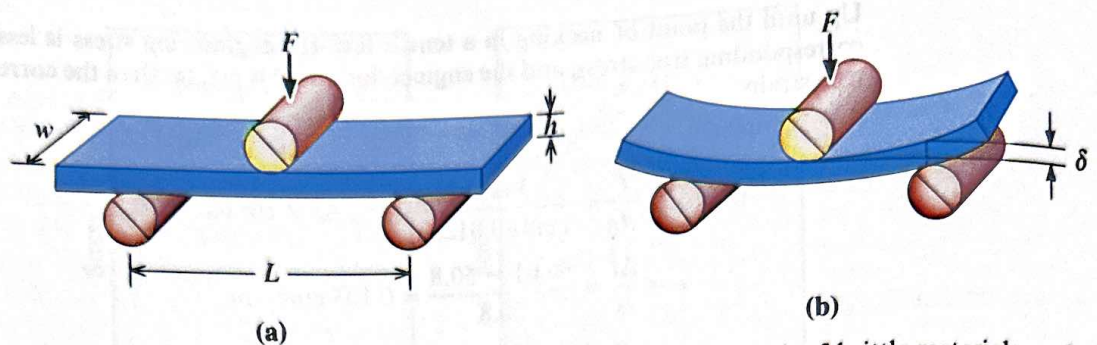


Figure 6-14 (a) The bend test often used for measuring the strength of brittle materials, and (b) the deflection δ obtained by bending.

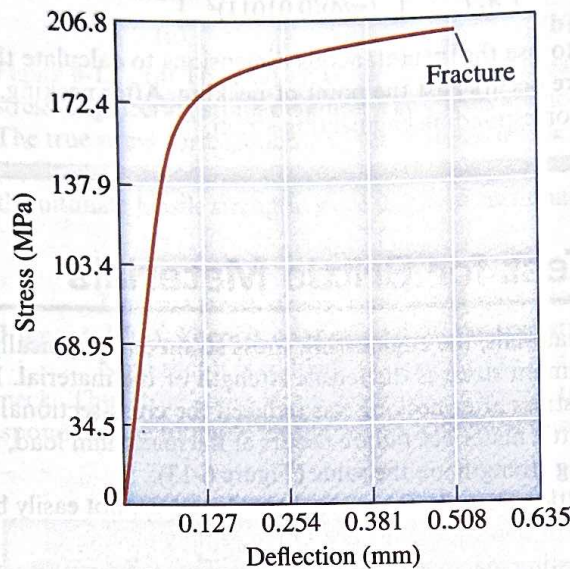


Figure 6-15 Stress-deflection curve for an MgO ceramic obtained from a bend test.

stress. The results of the bend test are similar to stress strain curves; however, the stress is plotted versus deflection rather than versus strain (Figure 6-15). The corresponding bending moment diagram is shown in Figure 6-16(a).

The modulus of elasticity in bending, or the **flexural modulus** (E_{bend}), is calculated as

$$\text{Flexural modulus } E_{\text{bend}} = \frac{L^3 F}{4wh^3 \delta} \quad (6-15)$$

where δ is the deflection of the beam when a force F is applied.

This test can also be conducted using a setup known as the four-point bend test [Figure 6-16(b)]. The maximum stress or flexural stress for a four-point bend test is given by

$$\sigma_{\text{bend}} = \frac{3FL}{4wh^2} \quad (6-16)$$

for the specific case in which $L_1 = L/4$ in Figure 6-16(b).

Note that the derivations of Equations 6-14 through 6-16 assume a linear stress strain response (and thus cannot be correctly applied to many polymers). The four-point bend test is better suited for testing materials containing flaws because the bending moment between the inner platens is constant [Figure 6-16(b)].