

Elasticity

Definition

If forces are applied to a material deformation will occur. In its simplest term a **tension** force will cause an **increase** in the length (extension) while a **compressive force** will give rise to a **reduction** in the length (negative extension).

Stress

Force per unit area of cross-section.

Units: Pascals, Pa or N/m^2 .

Strain

$$\frac{\text{Change in Length}}{\text{Original Length}} \quad (\text{Pure Number})$$

It is the degree or ratio of deformation in a body on which a force is being applied.

Elasticity

A material is said to be elastic if it returns to its original size and shape once the distorting or deforming force would have been removed.

Hooke's Law

*Up to a maximum load (referred to as **the limit of proportionality**) the extension of a wire /or spring would be proportional to the magnitude of the applied force.*

Elastic Limit

This is the maximum load that a body can experience and still be able to regain its original dimensions and shape once the deforming force would have been removed.

Yield Point

*If the stress is increased beyond the elastic limit a point is reached at which there is a marked increase in the length. At the yield point there will be a permanent change in the internal crystalline structure of the material. Effectively the crystalline planes of the material would have slid over each other taking a new configuration giving rise to a phenomenon referred to as the **plastic stage** marked by a pronounced increase in the deformation with the application of small forces.*

Strength *This relates to the maximum force which can be applied to a material before breaking. Therefore the larger the breaking force required is the stronger will be the material.*

Breaking Stress *This is also referred to as the **ultimate tensile** stress in a material and is the maximum limit of force that can be applied to material before it breaks.*

Stiffness *This relates to the maximum force which can be applied to a material before it breaks.*

Ductility *A ductile material is one which can be permanently stretched.*

Brittleness *A brittle material cannot be permanently stretched. It breaks soon after the elastic limit has been reached. Brittle materials on the other hand tend to withstand strong compressions.*