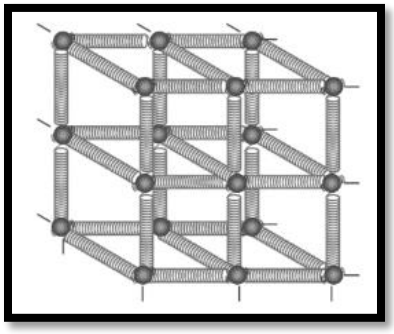
MECHANICAL PROPERTIES OF SOLIDS

ELASTIC BEHAVIOUR OF SOLIDS

What happens to a rubber band when you stretch it and let go? It deforms but regains its original nature when you stop applying force. But suppose you try to bend an aluminum rod using your arm strength. You somehow do manage to bend it a little and then stop applying force. Does the rod regain its original shape? Of course not.

Elastic Behavior of Solids



This difference in the behavior of the materials is based on their elastic and plastic nature. The rubber band has high elasticity. Elasticity is the ability of a body to resist any permanent changes to it when stress is applied. The body regains its original shape and size when stress application ceases.

All materials have an elastic limit beyond which, if continuous stress is applied, they will start losing their ability to exhibit perfect elastic behaviour and start deforming. In contrast, plastic deformation is the non-reversible deformation of solid materials on the application of forces.

Looking at the elasticity at the atomic level, solids are made of atoms (or molecules). They are surrounded by other such atoms, which are held in a state of equilibrium by interatomic forces. When an external force is applied, these particles are displaced, resulting in the deformation of the solid. When the application of the deforming force is stopped, interatomic forces drive the atoms to regain their state of equilibrium.

The concept of elasticity is an idealization as no material is perfectly elastic. For example, if you use a hair tie to groom yourself, you may have noticed that its size tends to deform after prolonged use. After a point, it may snap as well. This is because the hair tie eventually loses its elastic nature.

Important Points on Elastic Behavior of Solids

- An elastic body is one that regains its original shape and size when deforming forces are removed
- A plastic body is one that succumbs to deforming forces (however small) and cannot return to its original shape and size
- Elasticity is the property of a body to regain its original shape and size when deforming forces are removed. It exhibits an opposition to change.