**MECHANICAL PROPERTIES OF METALS**

Definition: The term property may be defined as the quality which defines the specific characteristics of a metal. A detailed study of all the properties of a metal provides a sound basis for predicting its behavior in a manufacturing shop and also in actual use. Mechanical properties of a metal are those properties which completely define its behavior under the action of external loads or forces. They are the properties which are associated with a metal’s ability to resist failure. A sound knowledge of these properties is very essential for an engineer to enable him in selecting a suitable metal for his various structures or various components of a machine.

1. **Elasticity**

It is the property of a metal by virtue of which it is able to retain its original shape and size after the removal of the load.

1. **Plasticity**

It is the property of a metal by virtue of which a permanent deformation (without fracture) takes place whenever it is subjected to external forces. It depends on the nature of the metal and the environmental conditions, i.e., whether the metal is shaped red hot or in cold.

1. **Ductility**

It is the property of a metal by virtue of which it can be drawn into wires or elongated before rapture takes place. It depends on the size of the metal’s crystals. The measures of the ductility of a metal are its percentage elongation and percentage reduction in cross-sectional area before rupture. Metals with more than 15% elongation are considered as ductile. Those with 5-15% elongation are considered of intermediate ductility while those with less than 5% elongation are considered as brittle ones.

1. **Brittleness**

It is the property of a metal by virtue of which it will fracture without any appreciable deformation. It is the opposite of ductility.

1. **Hardness**

It is the property of a metal by virtue of which it is able to resist abrasion, indentation ( or penetration) and scratching by harder bodies.

1. **Toughness**

It is the property of a metal by virtue of which it can absorb maximum energy before fracture takes place. Tenacity and hardness are measures of toughness of a metal. It decreases with increase in temperature. It is important in selection of a material where the load increases beyond the yield point / elastic limit. e.g,. power press punch and pneumatic hammer.

1. **Stiffness**

It is the property of a metal by virtue of which it resists deformation. It is measured by the modulus of elasticity.

1. **Resilience**

It is the property of a metal by virtue of which it stores energy and resists shocks or impacts. It is measured by the amount of energy that can be stored per unit volume after the metal is stressed up to the elastic limit. It is an important factor when selecting materials for making various types of springs.

1. **Creep**

It is the property of a metal by virtue of which it deforms continuously under a steady load.

1. **Endurance**

It is the property of a metal by virtue of which it can withstand varying stresses. The maximum value of stress that can be applied for an indefinite number of times without causing failure is known as endurance limit.

1. **Strength**

It is the property of a metal by virtue of which it can withstand or support an external force/load without rupture. **Types of strength**: Elastic, plastic, tensile, compressive, shear, bending and torsional strength

Factors affecting mechanical properties of a metal

* Grain size
* Temperature
* Heat treatment
* Atmospheric exposure