

# Properties of materials.

## Mechanical

Strength, Stiffness, Ductility, elasticity, Plasticity, toughness, brittleness, Hardness, Malleability, Creep, Fatigue.

## Electrical [conductor, semi-conductors, Insulators, Superconductor]

Conductivity, Resistivity, Dielectric permittivity  $\left[ \frac{e}{\text{electrical force} / \text{two charges}} \right]$ , Dielectric strength, Thermoelectricity.

## Magnetic

Permeability, Coercive force, hysteresis.

## Thermal

Specific heat, Thermal expansion, Conductivity.

## Chemical

Corrosions resistance, acidity or alkalinity, composition.

## Physical

Dimension, Density, porosity, structure, Specific gravity.

## Acoustical

Sound transmission, sound reflection.

## Optical

Colour, Light transmission, Light reflection.

Refractive index, Absorptivity & Absorption coefficient, Reflectivity, Transmissivity.

→ optical density of a medium.

## Mechanical Properties of Materials.

\* Strength → greatest stress that it can withstand without failure.

Stiffness → Ability of material to resist deformation.

Elasticity → Property of material that enables it to regain its original unreformed length once the load is removed.

Ductility → Ability of material to undergo a lot of plastic deformation before rupture. {wires}

Brittleness → undergoes very little plastic deformation before rupture. is said to be brittle.

\* Hardness → the resistance of a material to penetration.

Machinability → the ease with which a material can be machined.

✓ Resilience → Capacity of a material to absorb energy within the elastic range.

\* Toughness → Capacity of a material to absorb energy without fracture.

Malleability → Ability of a material to withstand deformation under compression without rupture. {sheets}

## Ductility

Gold  
Silver  
Platinum  
Iron  
Nickel  
Copper  
Aluminium  
Zinc  
Lead.

## Malleability

Gold  
Silver  
Copper  
Aluminium  
Tin  
Platinum  
Lead  
Zinc  
Nickel.

Creep → <sup>Slow and progressive</sup> Slow plastic deformation of materials under constant stresses usually at high temperature.

Fatigue → Slow plastic deformation of materials under fluctuating or repeated loads.

→ low temperature.  
e.g. lead  
Glass.

Strength: The ability of a material to stand up to forces being applied without it bending, breaking, shattering or deforming.

A strong material is one able to withstand large stresses before either breaking or deforming.

Maximum strength = Ultimate strength

Toughness: A characteristic of a material that relates to its response to sudden blows or shocks.

Stiffness/Rigidity → The resistance of material to elastic deformation or deflection is called stiffness.

Resilience → It is the amount of energy per unit volume that is sustained on loading and releasing upon unloading a specimen.

→ Maximum amount of energy stored upto elastic limit → Proof resilience

→ Proof resilience per unit volume is called modulus of resilience.

→ Spring back Potential term used in industry.

Hardness: The ability of a material by which it is able to resist to <sup>scratching</sup> ~~scratching~~, cutting, abrasion, indentation or penetration. It is closely related to strength.

