

# Mechanical Properties of Materials

In metallurgy labs, various material properties are tested to evaluate their suitability for specific applications. Understanding these properties is crucial for selecting materials for various industrial applications, ensuring safety, efficiency, and performance.

# 1. Tensile Strength :

Maximum stress a material can withstand while being stretched. Very important analysis for almost all materials [ Metal , Steel , Plastic , Packaging , Composites , Rebars etc.]. A Universal Testing Machine is used for measuring Tensile Strength

## 2. Compressive Strength:

Maximum stress a material can withstand while being compressed. Important for construction materials, such as concrete, bricks, and stones, as well as for other industries like aerospace, automotive, and manufacturing.

# 3. Malleability

Material's ability to be shaped or deformed without breaking. Crucial to determine a material's suitability for various applications, such as metal forming, forging, and manufacturing.

# 4. Ductility

Measures a material's ability to stretch or deform without breaking. Essential to evaluate a material's suitability for applications requiring flexibility, such as wires, cables, and structural components.

# 5. Plasticity

A material's ability to undergo permanent deformation without breaking . Helps to understand a material's behavior under stress, informing applications such as metal forming, machining, and structural design.

# 6. Elasticity:

Elasticity measures a material's ability to return to its original shape after deformation. In normal case- if the load applied to a material is less than elastic limit, there will not be any permanent deformation happen to the sample. Elasticity helps to measure a material's resilience, stiffness

# 7. Hardness

Hardness measures a material's resistance to indentation, abrasion, and wear, and its lab testing is crucial to evaluate a material's suitability for applications like cutting tools, bearings, and wear-resistant coatings.



# 8. Toughness

Measures a material's ability to absorb energy and plastically deform without breaking. Crucial to evaluate a material's resistance to cracking, shattering, and failure in applications like aerospace, automotive, and construction.

# 9. Fatigue Strength

Fatigue strength measures a material's ability to withstand repeated loading and unloading cycles without failing, and its lab testing is essential to evaluate a material's durability and reliability in applications like aircraft, bridges, and machinery. Also called as Dynamic Testing .

# 10. Impact Strength

A material's ability to absorb energy and resist cracking or breaking when subjected to sudden, high-force impacts, Helps to evaluate a material's safety and performance in applications like steel, automotive, aerospace, and consumer products.