SNS COLLEGE OF ENGINEERING

Coimbatore-641 107

(An Autonomous Institution)

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Affiliated to Anna University, Chennai

DEPARTMENT OF PHYSICS

COURSE NAME :23PYT101 & ENGINEERING PHYSICS

I YEAR / I SEMESTER

UNIT 1 – PROPERTIES OF MATTER

TOPIC 1 – INTRODUCTION TO ELASTICITY – STRESS-STRAIN DIAGRAM AND ITS USES

BRAINSTORMING

1. Define of Elasticity.

2. What are the Applications of Elasticity?

3.Do you know the Importance of Elasticity?

4. What is the use of Applications of Stress-Strain Diagram ?

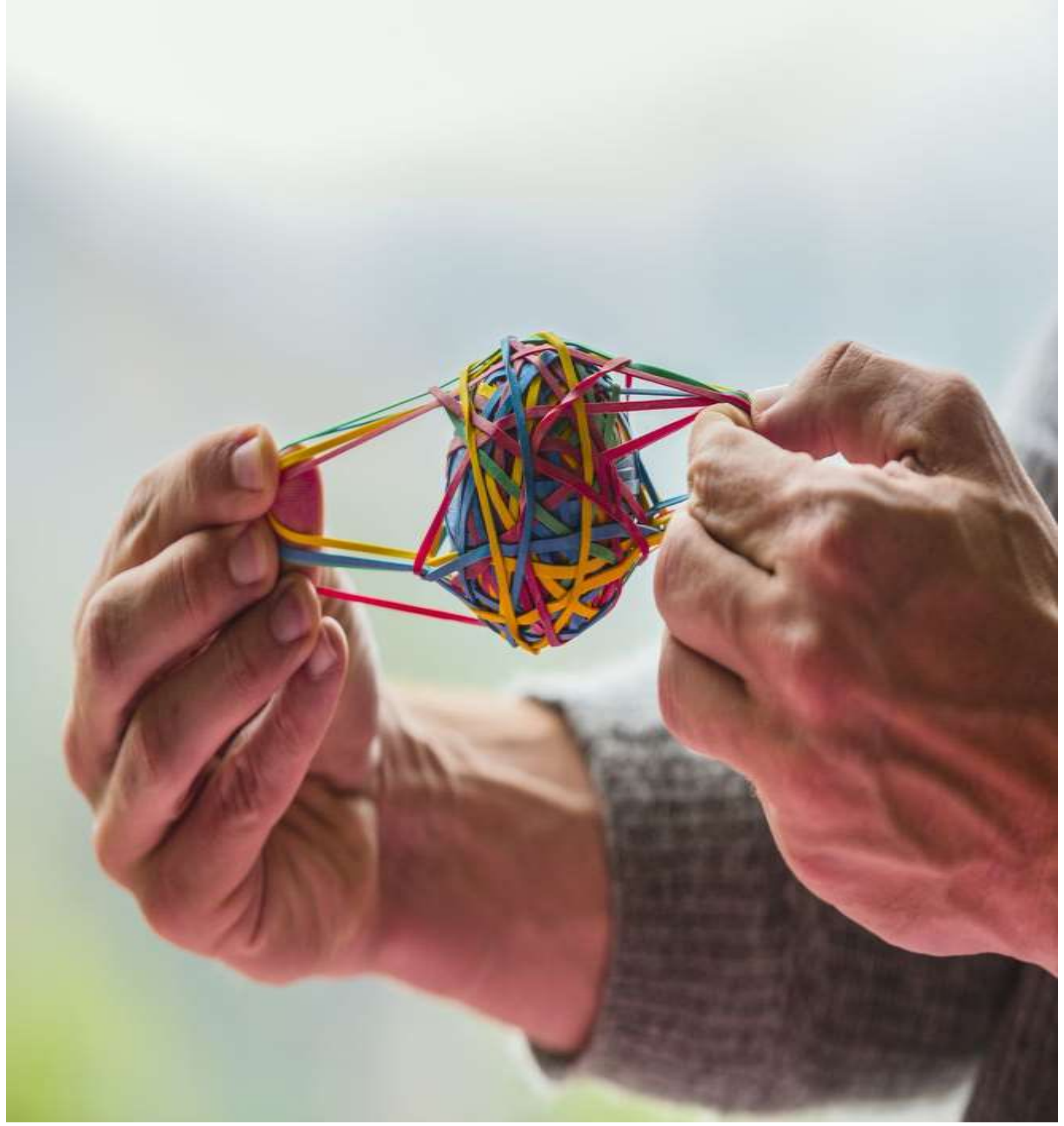
INTRODUCTION TO ELASTICITY

- **Elasticity** as the measure of how much a material deforms in response to applied force.
- Ability of a deformed material body to return to its original shape and size when the forces causing the deformation are removed.
- **Hooke's law** states that the strain of the material is proportional to the applied stress within the elastic limit of that material.

$$\text{Stress} \propto \text{Strain}$$

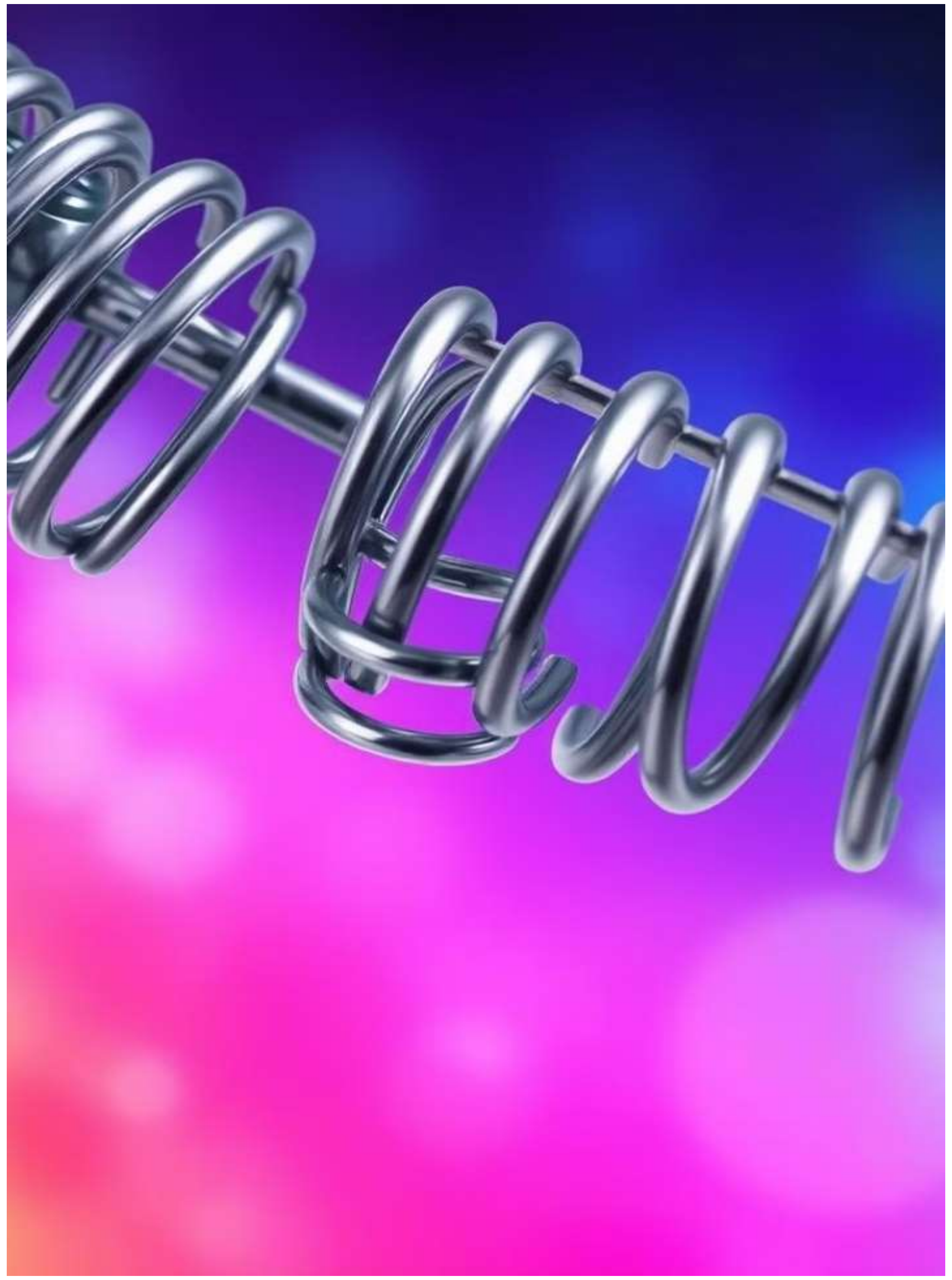
$$\text{Stress} = E \times \text{Strain}$$

$E =$ stress /strain. Here E is a constant



Stress-Strain Relationship

- The stress-strain relationship describes how a material behaves under applied force. It's a crucial aspect of understanding a material's mechanical properties.
- Stress is defined as the force applied per unit area of a material.
- Strain measures the deformation of a material in response to stress, represented as the change in length divided by the original length.



Elasticity is the property of solid material that it gains its original shape and size after the removal of applied force.

Plasticity is the property of solid material that it does not gain its original shape and size after the removal of applied force.

- **Hooke's law** states that the strain of the material is proportional to the applied stress within the elastic limit of that material.

Importance of Understanding Elasticity

Understanding elasticity is crucial for designing and building structures that can withstand loads and remain stable.

1. Bridges

The elasticity of steel and concrete is essential for designing bridges that can safely support traffic loads.

2. Buildings

The elasticity of building materials allows them to deform under wind loads, preventing catastrophic failure.

Importance of Understanding Elasticity

3. Vehicles

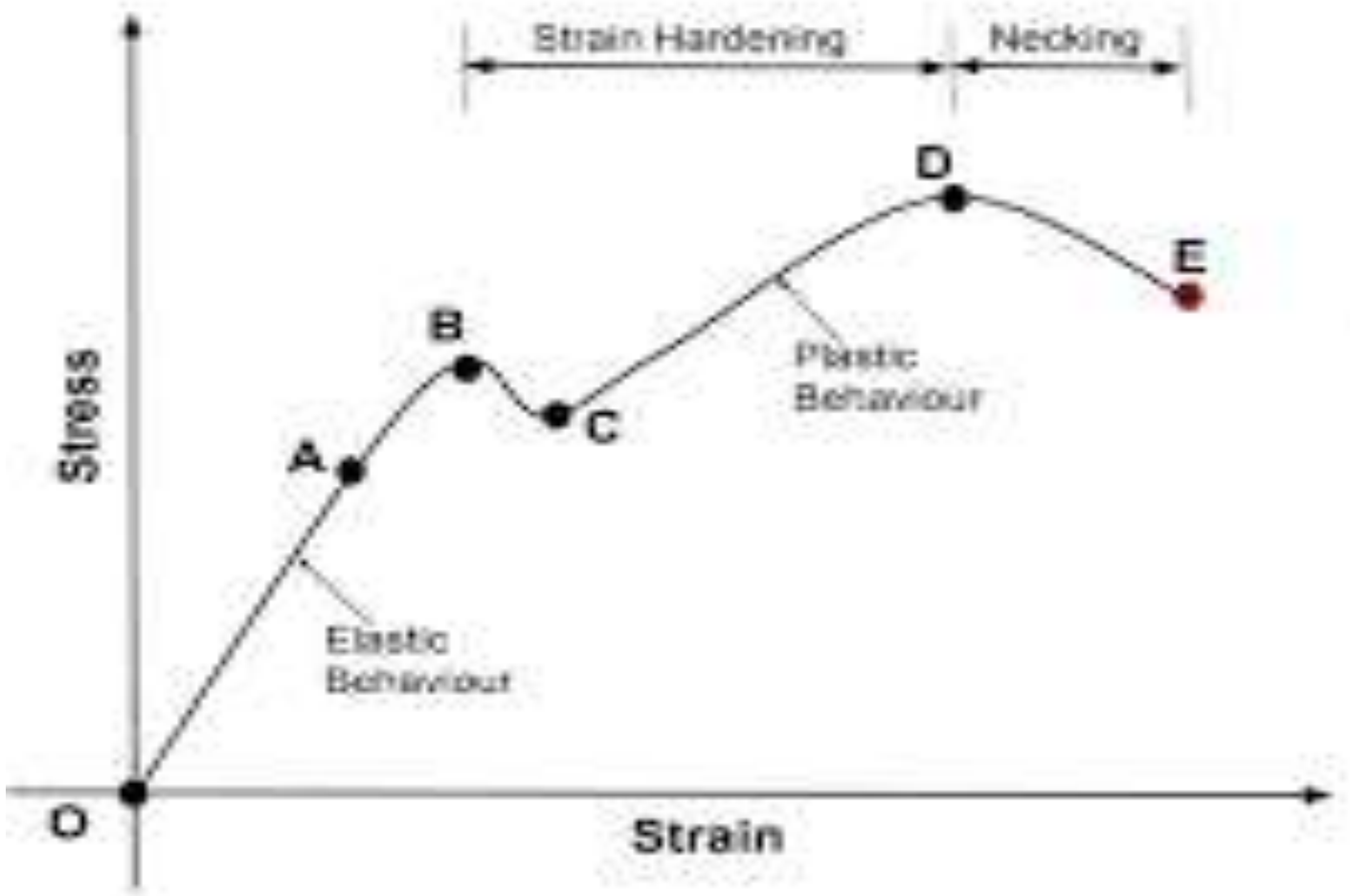
The elasticity of metals and plastics is essential for designing car parts, such as springs and bumpers, to absorb impact and protect passengers.

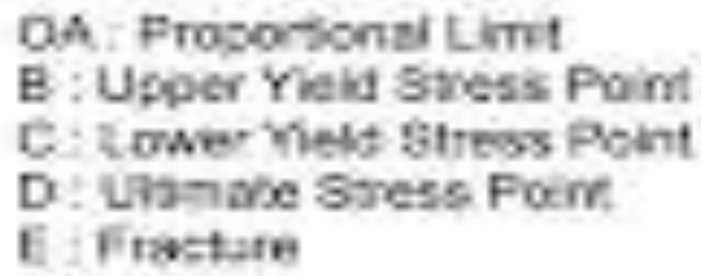
4. Aircraft:

The elasticity of aerospace materials plays a crucial role in the design of aircraft components, ensuring safety and structural integrity during flight.

Stress-Strain Diagram

The stress-strain diagram is a graphical representation of the relationship between stress and strain for a material.





1. Elastic Region

The initial portion of the diagram, where the material deforms elastically, meaning it returns to its original shape after the load is removed.

2. Yield Point

The portion of the diagram beyond the yield point, where the material deforms permanently and does not return to its original shape.

3. Plastic Region

The point on the diagram where the material starts to deform permanently, indicating the end of elastic behavior.

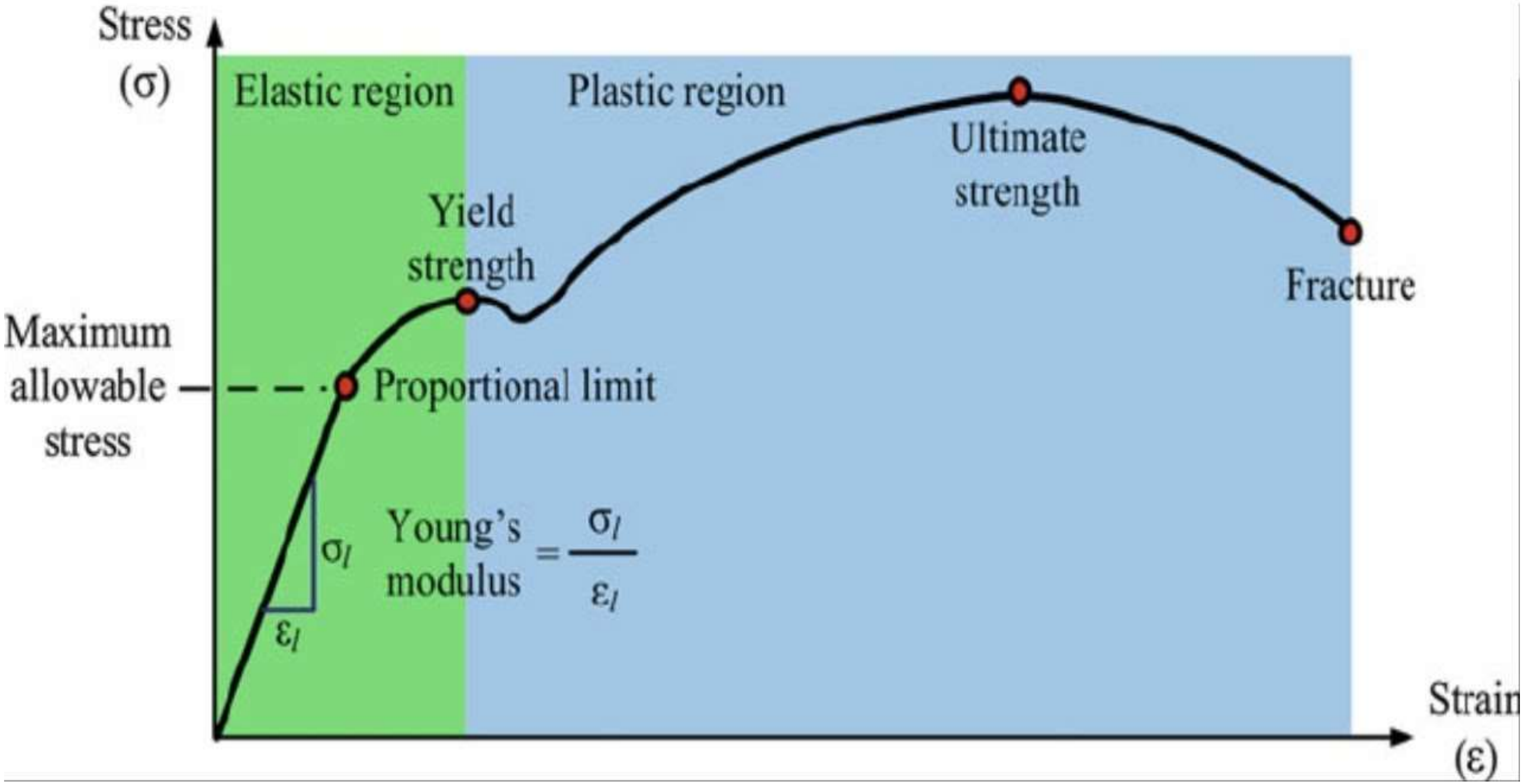
4. Ultimate Tensile Strength

The maximum stress a material can withstand before it begins to fracture. The point on the diagram where the material breaks or fractures.

5. Fracture Point

The point on the diagram where the material breaks or fractures.

STRESS STRAIN CURVE



Elastic Limit and Yield Point

The elastic limit is the maximum stress a material can withstand before it begins to deform permanently. The yield point is the point where the material starts to deform plastically.

1.	Elastic Limit	The maximum stress a material can withstand before permanent deformation occurs
2.	Yield Point	The point where the material starts to deform plastically, even after the stress is removed.

Plastic Deformation and Fracture

Plastic deformation refers to the permanent change in shape of a material after the stress exceeds the yield point. Fracture occurs when the material breaks under stress.

1. Plastic Deformation:

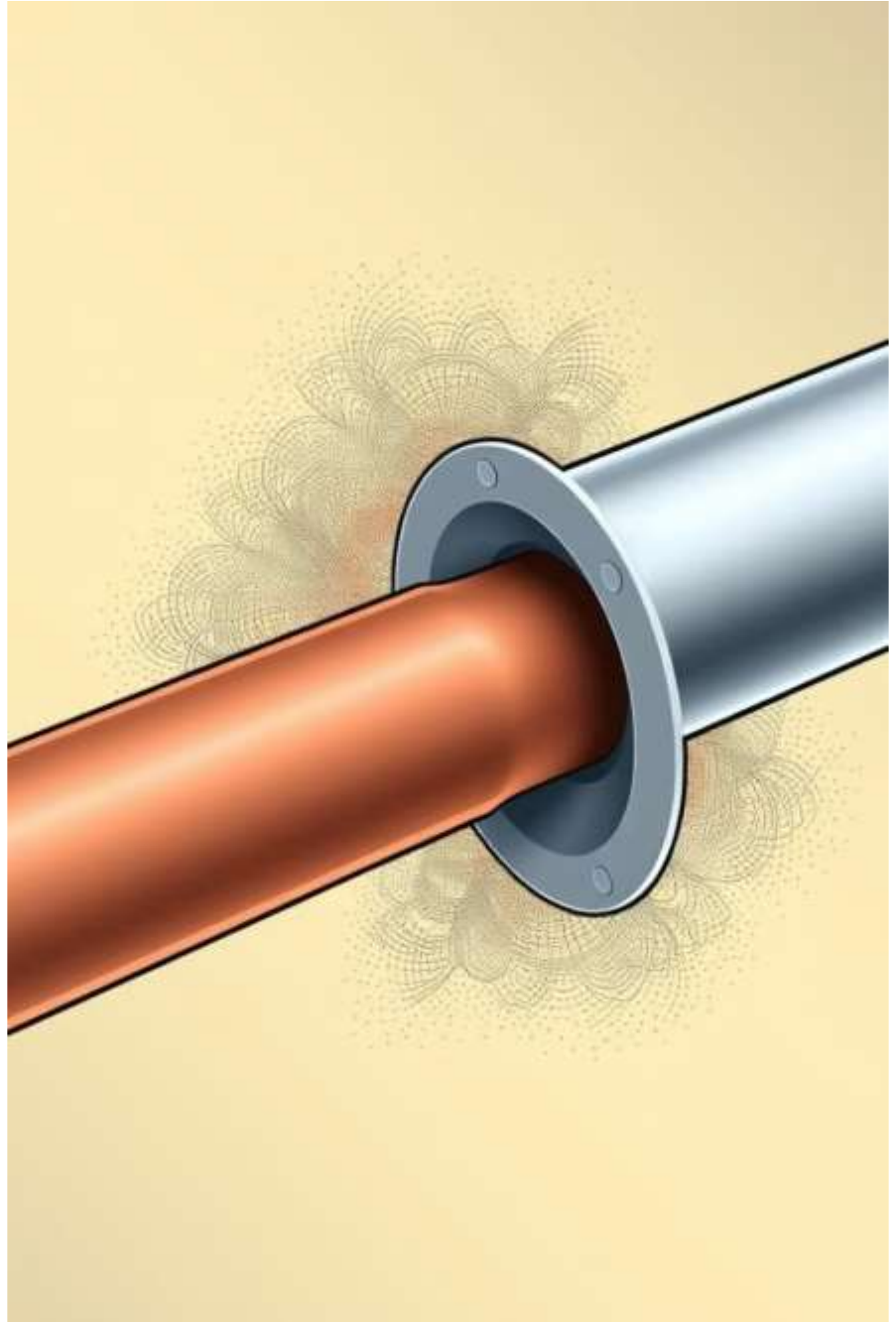
The material undergoes permanent deformation that does not reverse when the stress is removed.

2. Necking:

The material begins to thin in a localized area due to plastic deformation, leading to a reduction in cross-sectional area.

3. Fracture:

The material breaks or separates under the applied stress.



Applications of Stress-Strain Diagram

The stress-strain diagram provides valuable information for engineers and designers to select appropriate materials for specific applications.

1. Material Selection

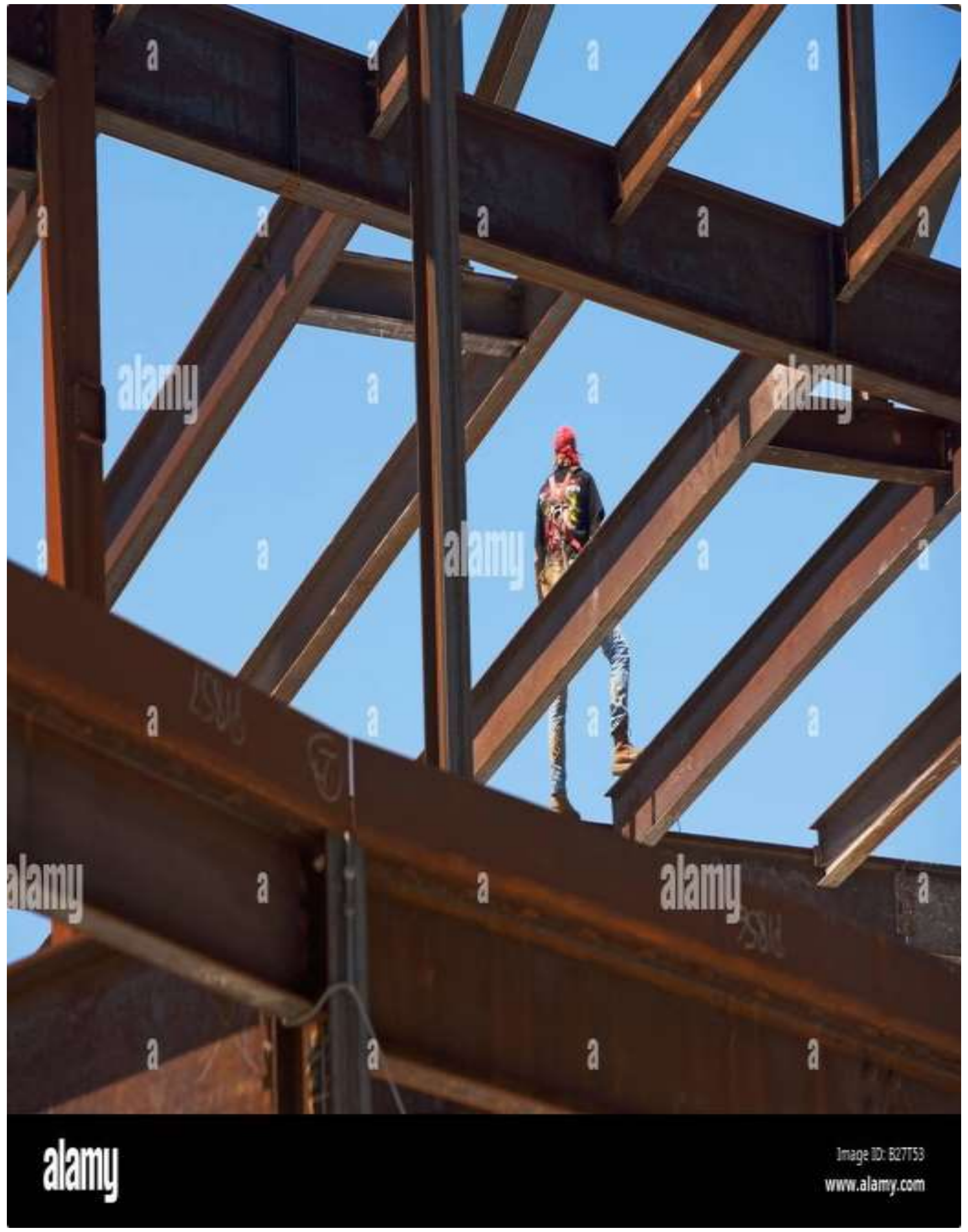
Engineers use the stress-strain diagram to choose materials with suitable strength, ductility, and toughness for specific applications.

2. Design Optimization

Understanding the stress-strain behavior helps optimize designs to minimize stress concentration and prevent failure.

3. Quality Control

Stress-strain testing is used to ensure the quality and consistency of materials, verifying they meet the required specifications.



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