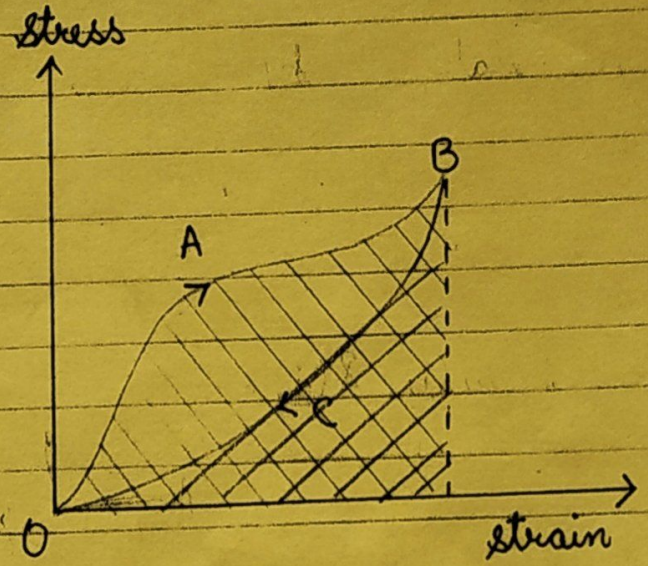
Elastic Hysteresis

The fact that stress - strain curve is not retraced on reversing the strain is known as elastic hysteresis.

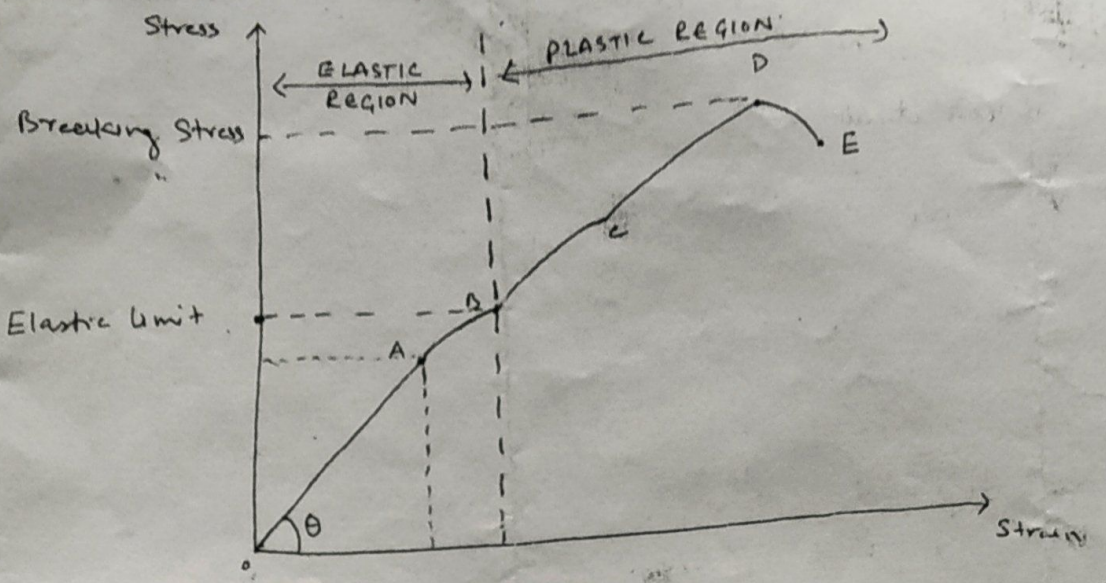
1) The area under the curve OAB gives the work done per unit volume in stretching the material (rubber)



2) Area under the curve BCO represents the energy given up by the material on unloading.

3) The area of the hysteresis loop gives the energy loss as heat during the loading and unloading process.

STRESS STRAIN CURVE



OA :- • Region where Hooke's Law is obeyed. We get Straight line
• Stram is Small.
• Point A is called limit of proportionality.
• Slope of OA i.e tanθ gives Y

AB :- • Stress not proportional to Strain. Hence AB is a curve
• In this region also if deforming force is removed wire regains its original length.
• Point B is called elastic Limit or Yeild point
• Force Corresponding to Yield point is called Yeild Strength

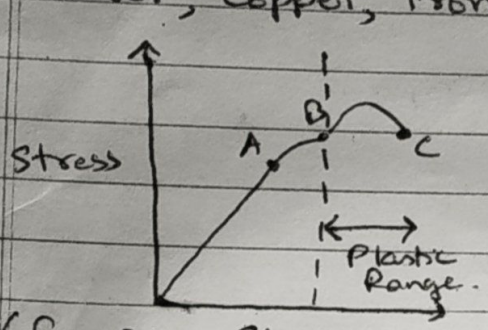
BC :- • Region beyond elastic limit.
• Wire does not regain its original length after removal of force
• Some permanent increase in length takes place in this Condition and the material is said to have acquired permanent Set
• Strain is much larger in this region.

CD :- } :- If the load is increases further then is a very
DE :- } large increase in strain (C → D). After reaching point D the strain increases even if the wire is unloaded and breaks at point E the max stress corresponding to point D after which the wire begins to flow and ~~fire~~ breaks, is called breaking or ultimate tensile strength. Point E is called Fracture point.

* The increase in strain in plastic region is called plastic flow or plastic deformation

CLASSIFICATION OF MATERIAL ON THE BASIS OF STRESS-STRAIN CURVE:-

1 DUCTILE MATERIALS: The materials which have large plastic range are called ductile materials. Such materials can be easily changed into different shapes and can be drawn into thin wires. Ex:- Silver, Copper, iron, etc. (fig 1)



(fig-2)

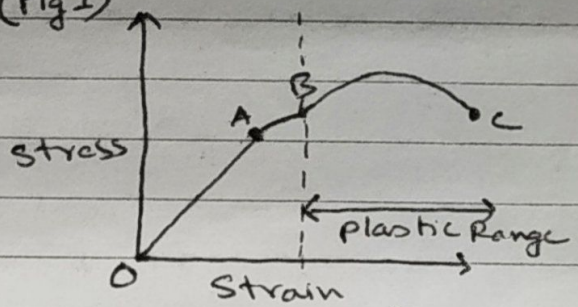
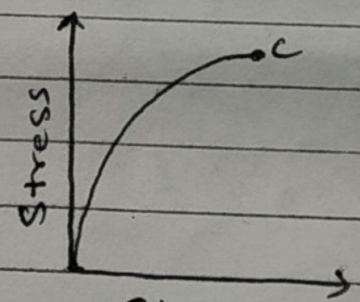


fig (1)

2. BRITTLE MATERIAL: The plastic region is very small for brittle material and it will break soon after the elastic limit is crossed. Ex: Glass, Cast iron etc. (fig-2)

3. ELASTOMERS:- Stress-Strain curve is not a straight line within elastic limit for elastomers and strain produced is much larger than the stress applied. Such materials have no plastic range and the breaking point lies very close to elastic limit. Ex:- Rubber Their Young's Modulus is very small.



(fig-3)

4. MALLEABILITY:- When a solid is compressed, a stage is reached beyond which it cannot recover its orignal shape after the deforming force is removed. This is the elastic limit (A') for compression. The solid then behaves like a plastic body. The Yeild point (B') obtained under compression is called Crushing point. At this stage, metals are said to be malleable. Ex:- gold, Silver etc