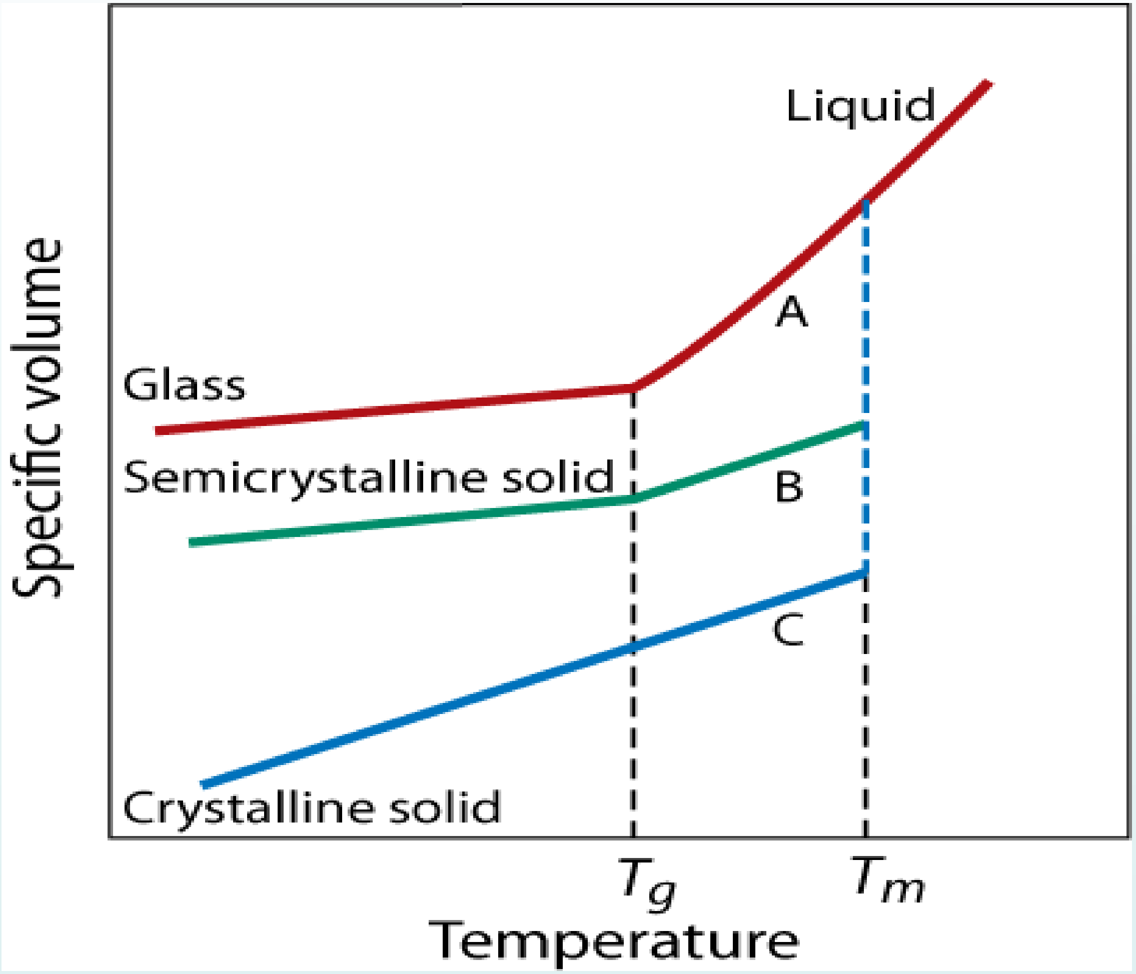
Basic concepts of polymer chemistry-2



Plastics made of these polymers are stretchy and have a low melting point. They are called **thermosoftening** plastics

What are the tensile properties of polymers and how are they affected by basic microstructural features?

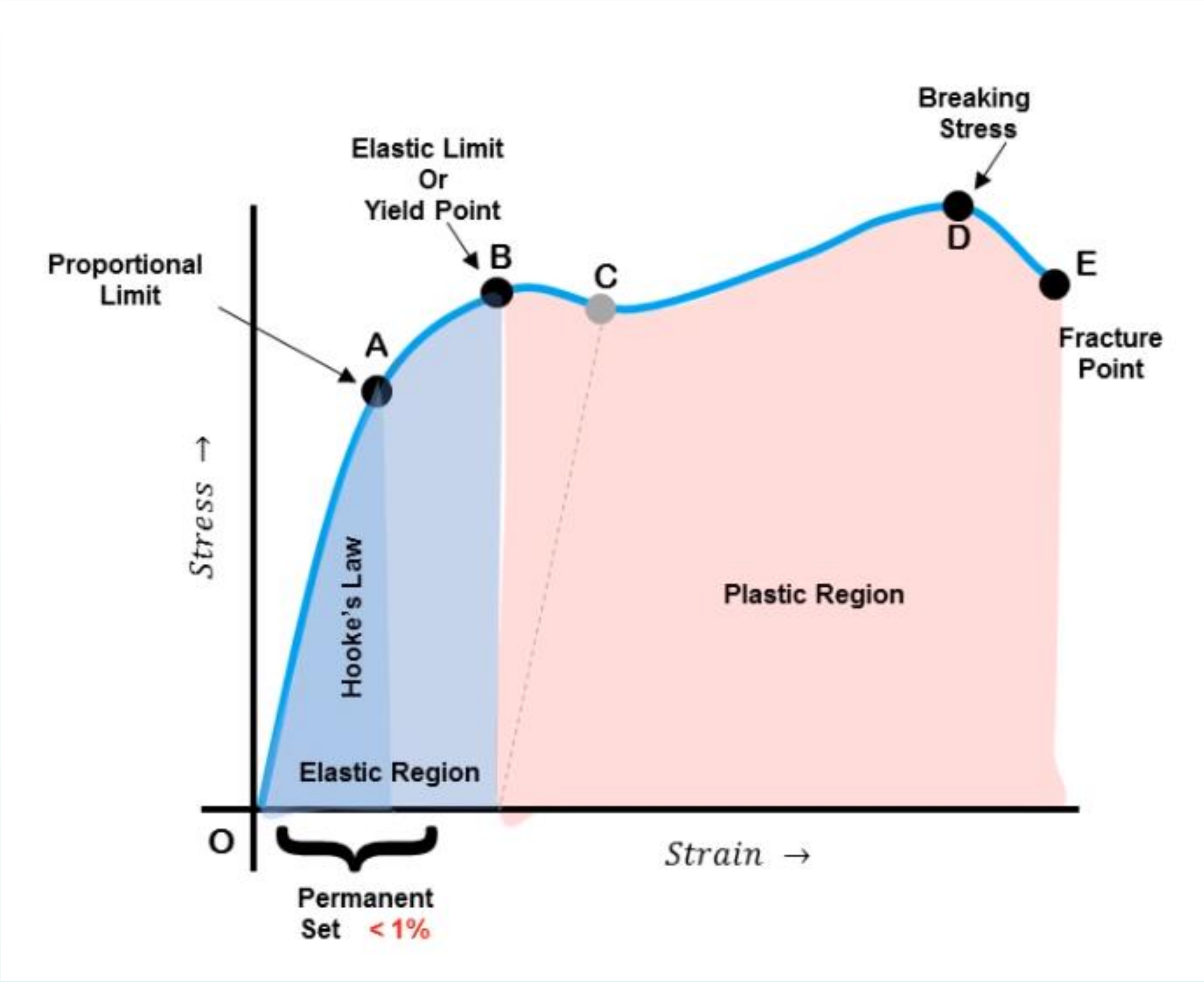


Figure shows typical strain-strain graph obtained at loading applied until the breaking of a elastomer material.

https://polymerdatabase.com/polymer%20physics/Stress-Strain%20Behavior.html

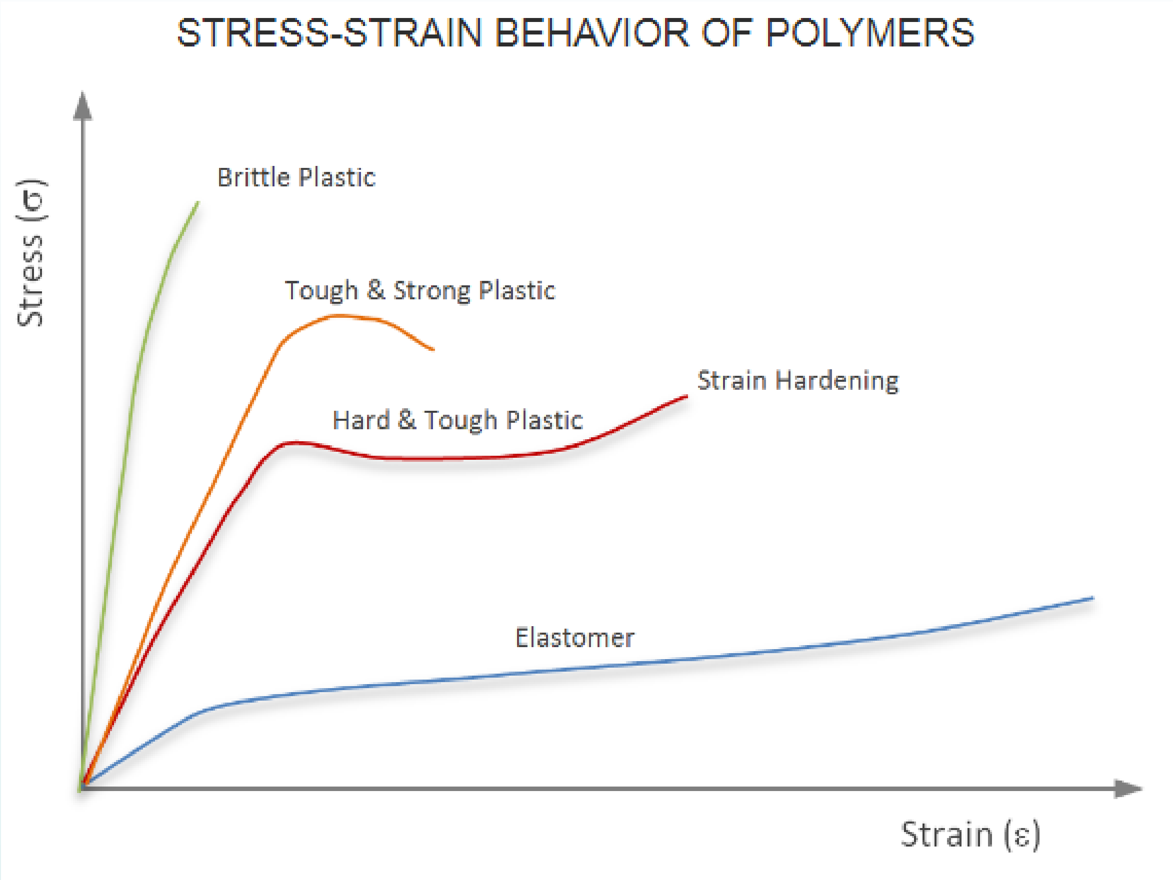


Figure depicts some strain-stress curves that can be encountered in polymers. It indicates (a) hard and brittle, (b) though and strong, (c) hard and though, (d) elastomer.

Stress = Constant x Strain

where *constant* is the tensile (or Young's) modulus of the plastic.

Hard and solid polymers have the highest energy absorption, and their tensile strength can be considered high.

The elastic modules of soft and durable polymers are small, so they are prone to size change, show high elongation before breaking.

Soft and weak polymers break off in small loads, their energy absorption and elastic modules are small.

Young modules of hard and durable polymers are at a high level. In addition, since their energy absorption is good, they are durable polymers.

Young modules of hard and brittle polymers are large, the polymer breaks off at high stress and low strain (elongation).

The elasticity is derived from the ability of the long chains to reconfigure themselves to distribute an applied stres and mechanical energy.

The **term 'rubber elasticity'** refers to the remarkable property of crosslinked rubber: it can be stretched by up to a factor of 5-10 from its original length and, when released, returns very nearly to its original length.

When an elastic material is stressed, there is an immediate and corresponding strain response. when the stress is removed the strain also returns to zero. Viscous behaviour, viscous flow is not recoverable. When the stress is removed from a viscous fluid the strain remains.

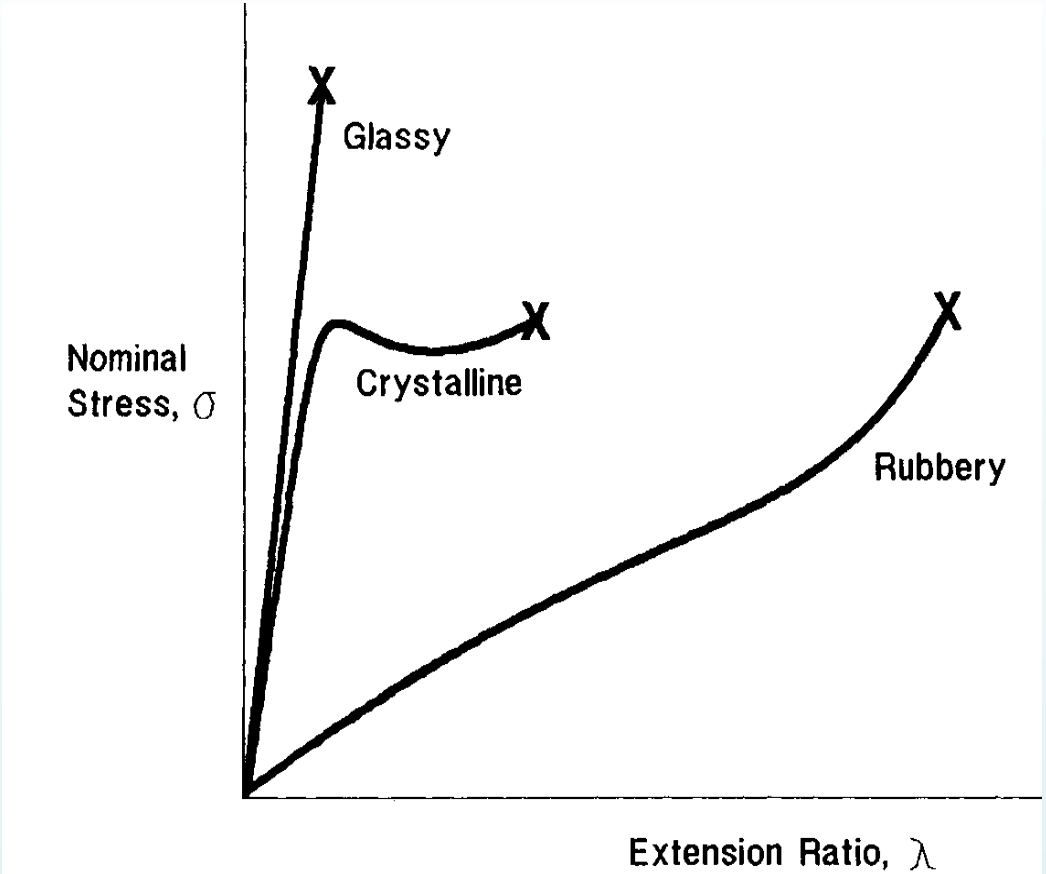


Figure shows tensile stres-strain diagrams for polymers in three physical states and fiber, rubber, hard and soft polymers

Natural Rubber

"Natural rubber" is a polymeric material. For man-made rubber materials is used synthetic rubber. Natural rubber is an elastomer and a thermoplastic. Once the rubber is vulcanized, it is a thermoset. if it is heated and cooled, it is degraded but not destroyed.

The final properties of a rubber item depend not just on the polymer, but also on modifiers and fillers, such as carbon black, factice, whiting and others.

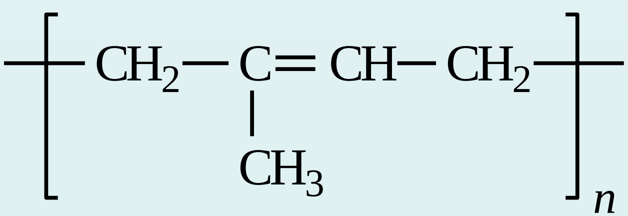
rubber, **latex**, **Amazonian rubber**, ***caucho*** or ***caoutchouc***. Natural rubber consists of polymers of the organic compound isoprene, with minor impurities of other organic compounds and water. Currently, rubber is harvested mainly in the form of the latex from the rubber tree or others. Natural rubber (NR) exists as a single, naturally derived isomer. It is impossible to manipulate the properties of NR by changing the stereochemistry.

Natural rubber is the substance obtained from latex, which is the extract of rubber tree named Hevea Brasiliensis.

This milky substance, which flows when the bark of the tree is slightly split, does not lose its softness even though it freezes immediately.

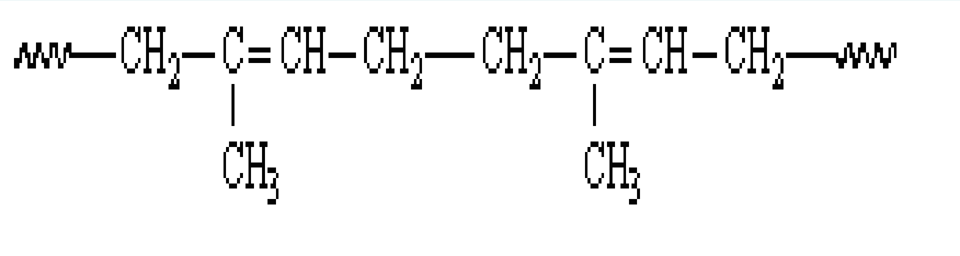
The polymer obtained here is a poly (cis-1,4-isoprene) polymer [also called cis-polyisoprene or poly (cis-isoprene)]. The chemical structure of the polymer is as follows.

The latex is a sticky, milky colloid drawn off by making incisions in the bark.



poliizopren

[poli(1,4-izopren)]



cis-1,4-Isoprene rubber (IR) is the synthetic analog of NR, whereas its isomeric form trans-1,4 IR is a tough, semicrystalline polymer. IR polymers

Containing intermediate amounts of these isomers display intermediate properties. A similar example is the difference between isotactic and atactic polypropylene. These isomers differ in the stereochemical orientation of the methyl group on the propylene monomer.