Elastomer Technology

Elasticity is the measure of the capability of returning to the original shape of a material which changed its shape under load, after the removal of the load.

e.g.

100 cm…….> stress applied……..>110 cm…….>stress removed…..100 cm (100% elasticity)

100 cm…….> stress applied……..>110 cm…….>stress removed…..105 cm (50 % elasticity)

The polymers that display rubber property are called ***elastomers***.

Natural rubber is an elastomer.

The most improtant industrial field that use elastomers are automobile tyres (85% of elastomers are used in this field).

The other fields are the production of shoes, slippers, profiles, technical materials, hose, gaskets, and etc.)

The polymers that behave rubber-like properties should possess the following properties:

*Being over the Tg temperatures at the atmospheric conditions,

*Having ease of turning around on the bonds that present on the main chain,

*Not being easily crystallization,

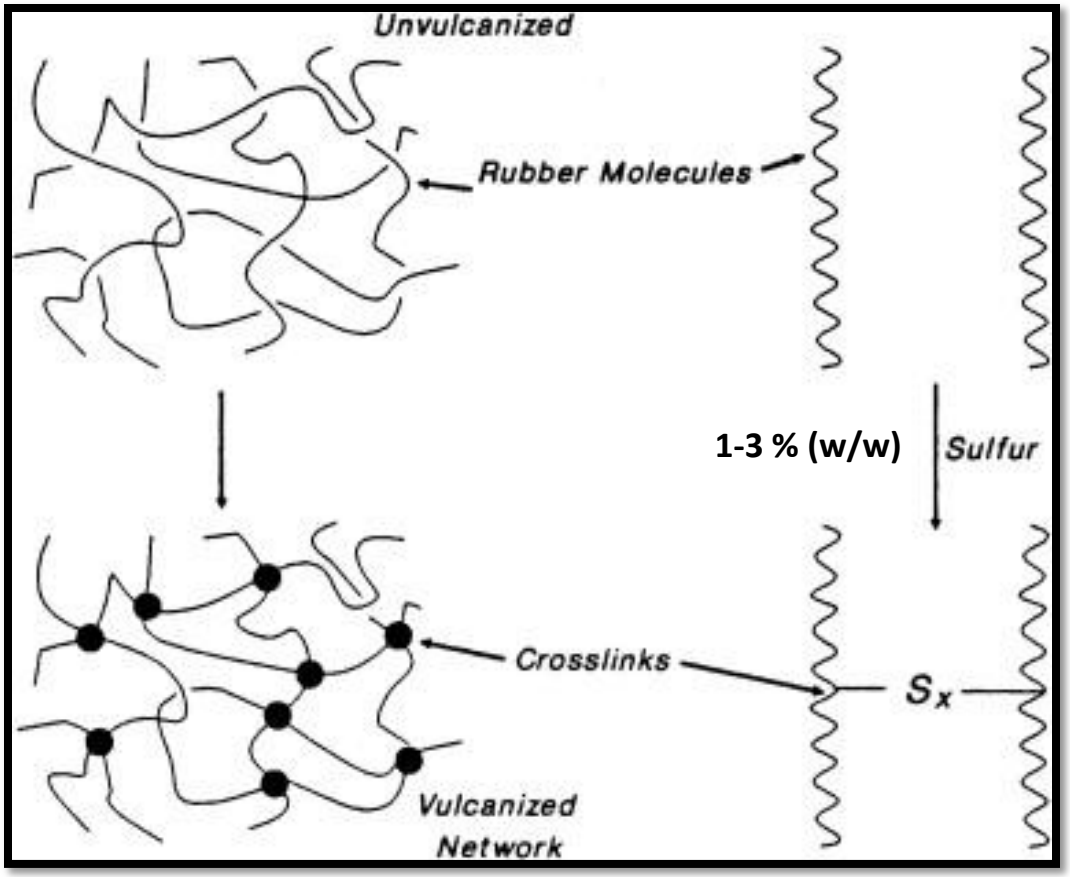
* The resistance to the plastic deformation at the high stress values.

The elastomer polymers have cross-links but not as dense as thermosetting polymers. The presence of lower amonuts of cross-links prevents the removal of polymer chains from each other and thus, reversible deformation.

Vulcanization

- Vulcanization is a process generally applied to rubbery or elastomeric materials.
- These materials forcibly retract to their approximately original shape after a rather large mechanically imposed deformation.
- Vulcanization can be defined as a process that increases the retractile force and reduces the amount of permanent deformation remaining after removal of the deforming force. Thus, vulcanization increases elasticity while it decreases plasticity.
- It is generally accomplished by the formation of a crosslinked molecular network

A.Y. Coran, in The Science and Technology of Rubber (Fourth Edition), 2013



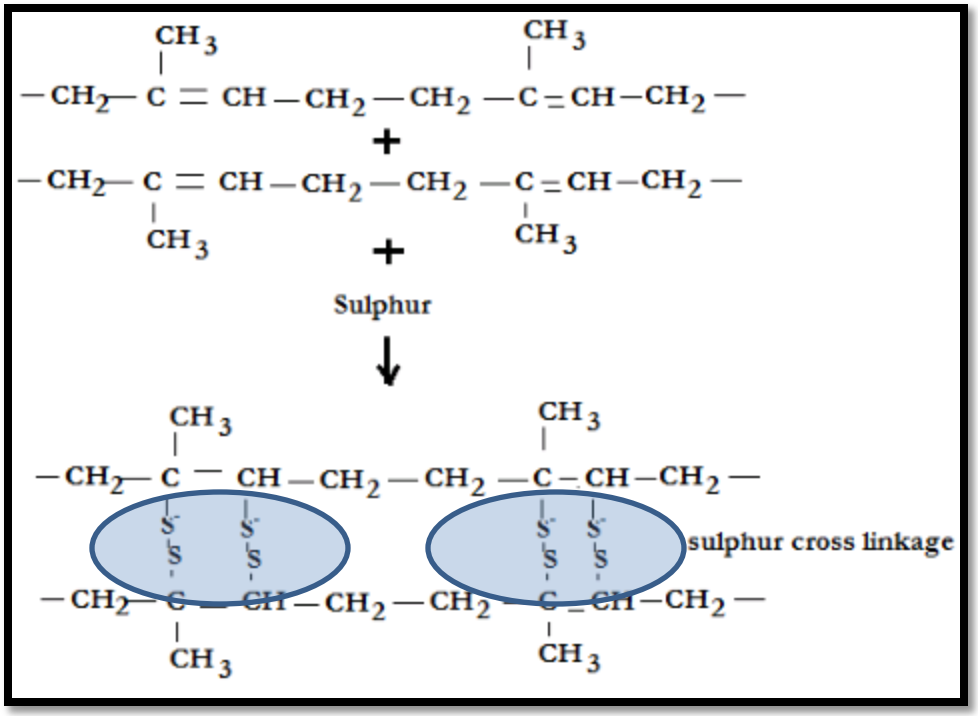
150 °C
Hot vulcanisation

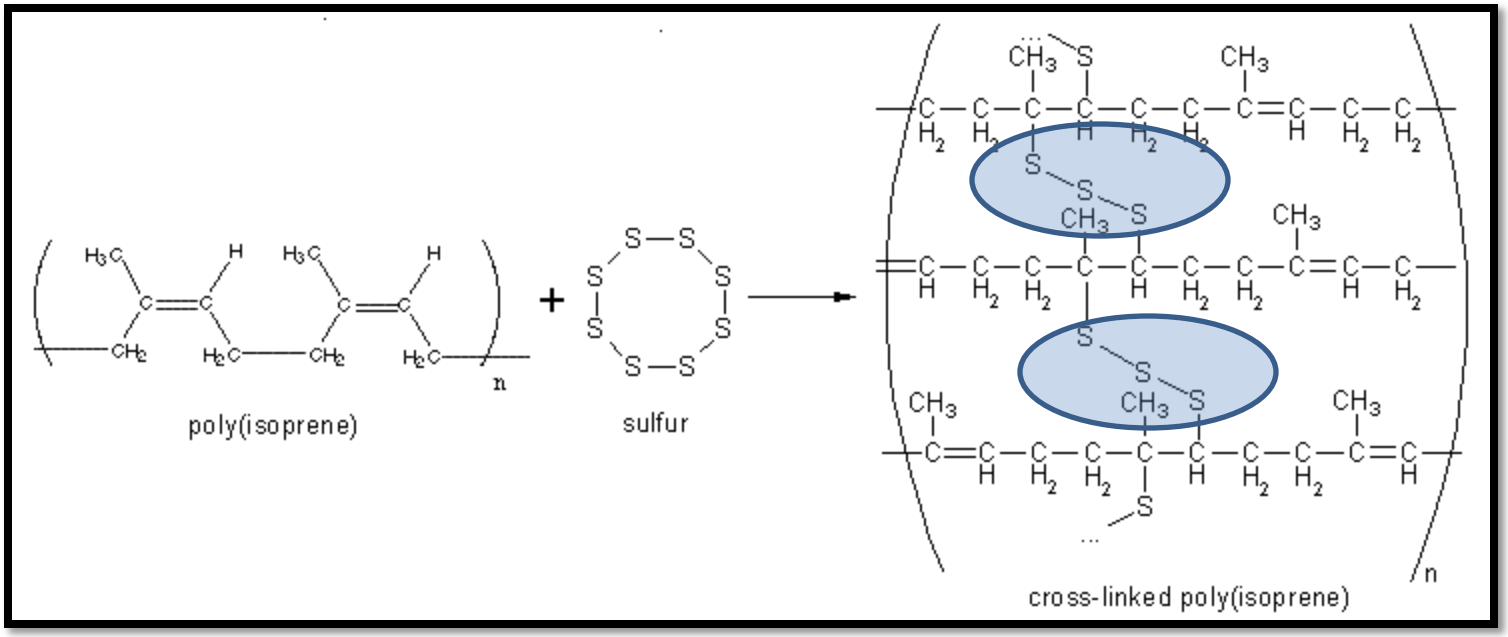
A.Y. Coran, in The Science and Technology of Rubber (Fourth Edition), 2013

After vulcanisation,

- Non-sticky,
- improved mechanical properties,
- Showing high elasticity between an expanded temperature range,
- Less softening when heating,
- Non-soluble,
- Hardened (being more stiff)

rubber can be obtained.


Sulphur
sulphur cross linkage

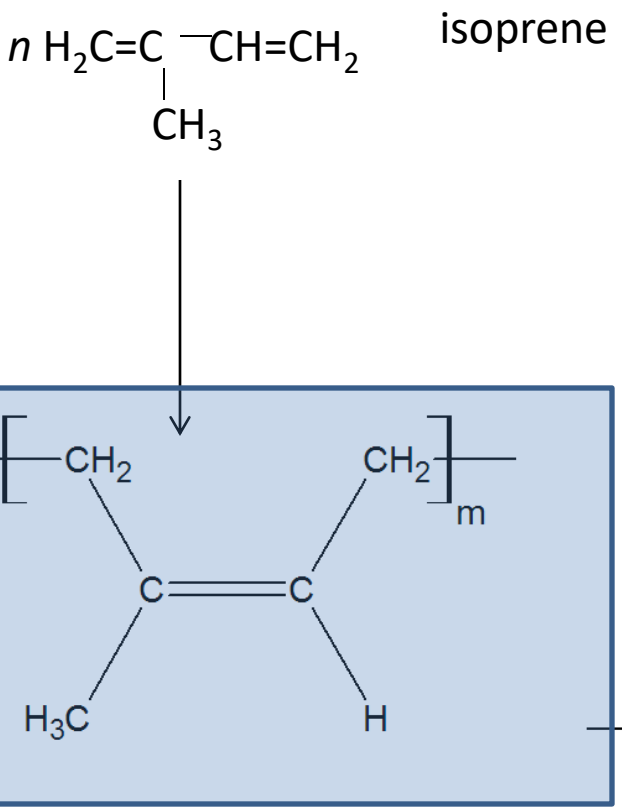

poly(isoprene)
sulfur
cross-linked poly(isoprene)

Some important elastomers

Abbreviation	Name	Polymer
ABR	Acrylate-butadiene rubber	Acrylate-butadiene copolymer
BR	Butadiene rubber	polybutadiene
CR	Neoprene rubber	polychloroprene
EVM	Ethylene-vinyl acetate rubber	Ethylene-vinyl acetate copolymer
NBR	Nitrile rubber	Acrylonitrile-butadiene copolymer
SBR	Styrene-butadiene rubber	Styrene-butadiene copolymer
NR	Natural rubber	Poly(cis-isoprene)

Natural rubber

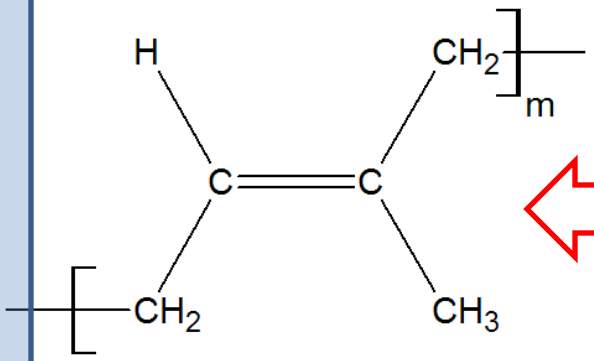
Rubber tree



cis-1,4-polyisoprene

NR

Soft, amorf

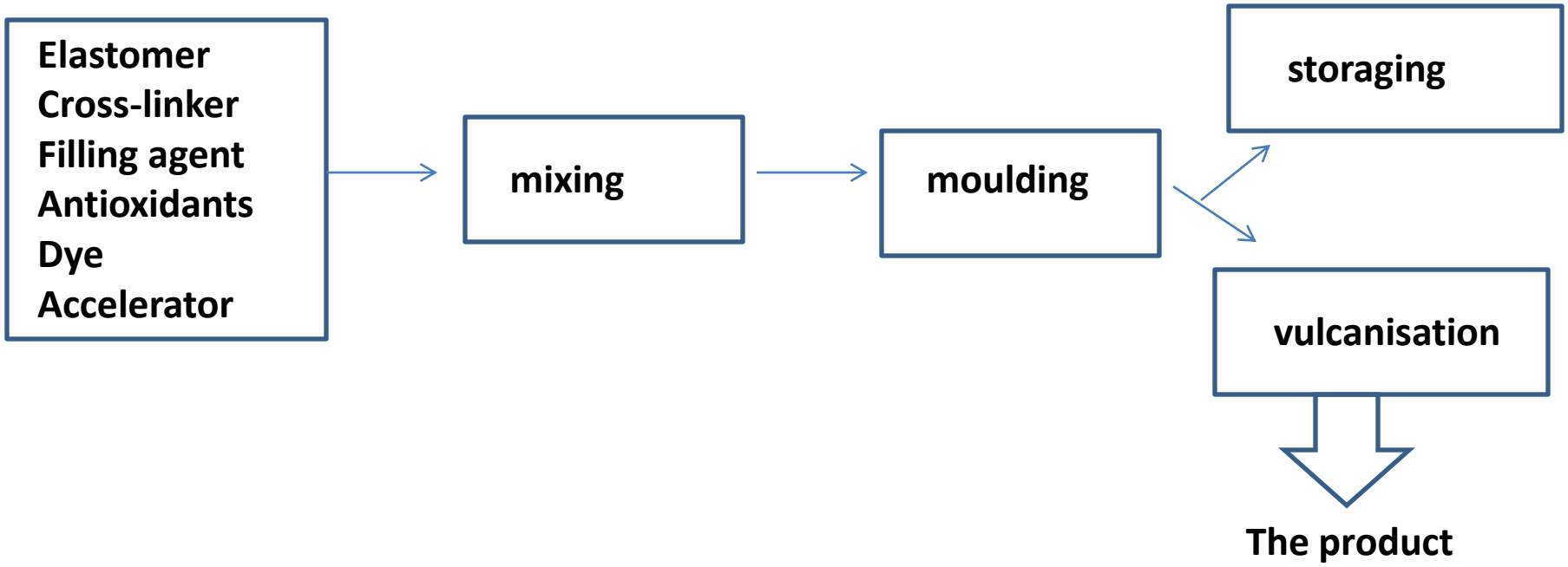


trans-1,4-polyisoprene

Stiff and crystalline

Gutta perka tree

The process steps followed for moulding the elastomers



The methods used for the shaping of elastomers;

- Calendaring
- Compression moulding
- Transfer moulding
- İnjection moluding
- Extrusion moulding

1. preparation of the mixture

Different additives are mixtured for the preparation of rubber pulp. The pulp is mixed in the cylinder and banbury type mixers.

rubber pulps

EPDM and SBR

http://www.guclukaucuk.com.tr/kaucuk-hamuru-detay/renkli-kaucuk-hamuru/137

Preparation of the rubber pulp

kauçuk hamuru.mp4

Calendaring of the rubber pulp between three cylinders

calendaring.mp4

Compression molding of rubber

It is a common method for the shaping of thermosetting and elastomer polymers

a. A certain amount length of rubber sheets (produced from extrusion of calendaring) is placed into the mould and cooked under heat and pressure.
b. The vulcanisation takes place during the molding.
c. The mould is kept for a while under heat and pressure that is sufficient for the complete of crooslinking.
d. Then the product is taken from the mould.

What is Rubber Compression Molding.mp4

Transfer molding

What is rubber transfer molding.mp4