

CROSS-LINK POLYMERS

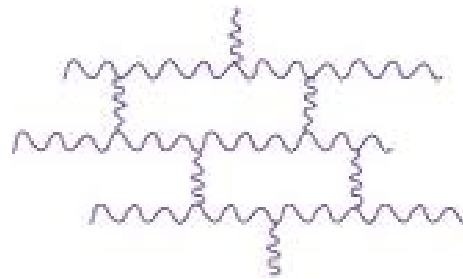
Background Information



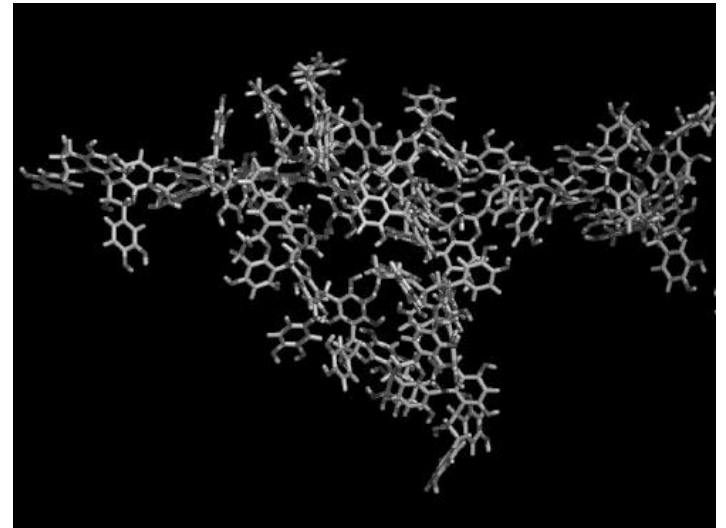
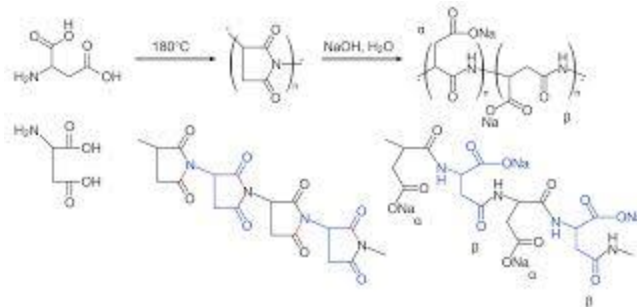
POLYMERS

Two Variations on a Theme

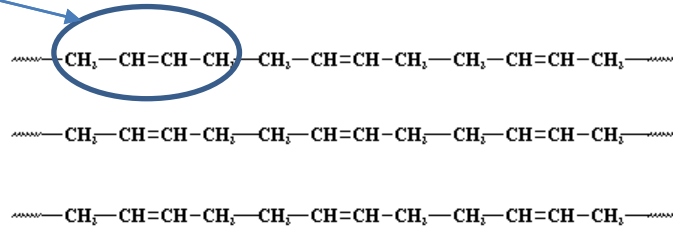
- Cross-linked



- Ringed

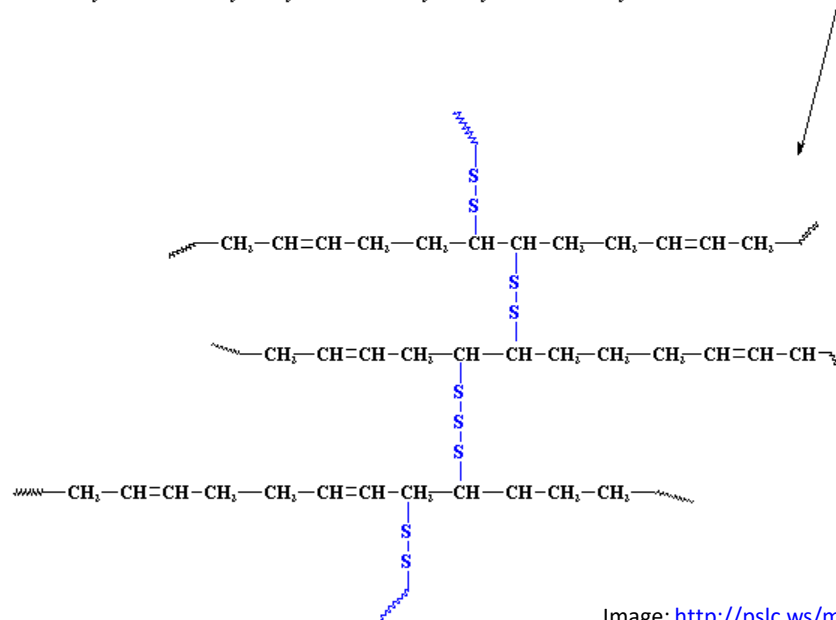
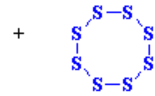


A mer in a polymer of rubber



Mer: a group of atoms

Polymer: A group of repeating “mers”



For the rubber polymer, introducing sulfur forms cross links between the polymer chains and significantly strengthens the rubber...

It changes the physical properties by changing the atomic structure and the cross linked polymer is 1 giant molecule

Image: <http://pslc.ws/macrog/xlink.htm>
University of Southern Mississippi

POLYMERS: CROSS-LINKED

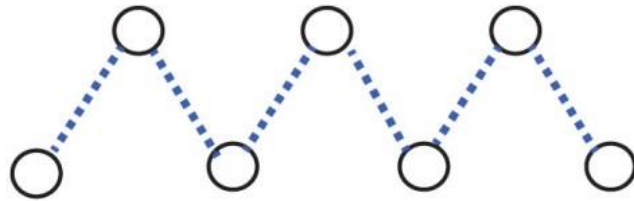
Experiment

Observe

Document

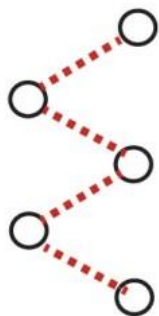
Ponder





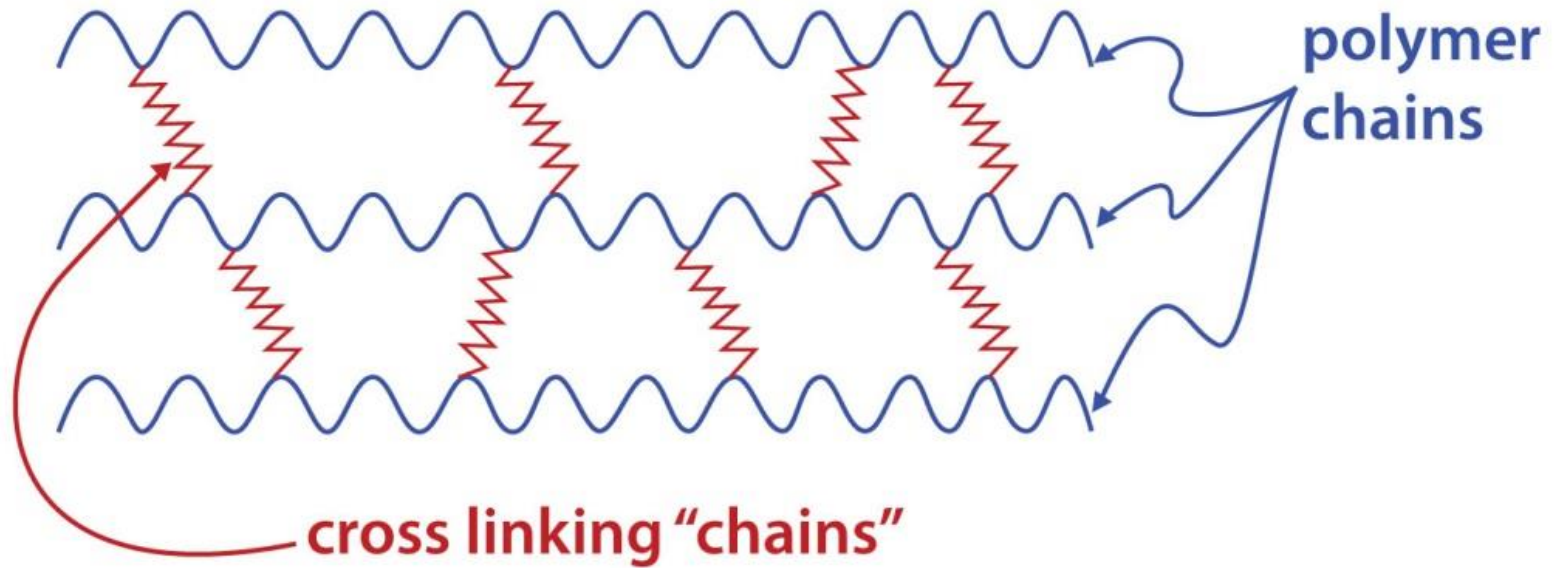
Assume atoms can be represented as spheres

Zigzag lines represent the predominant forces between the atoms- often just draw the zigzags...atoms are implied.

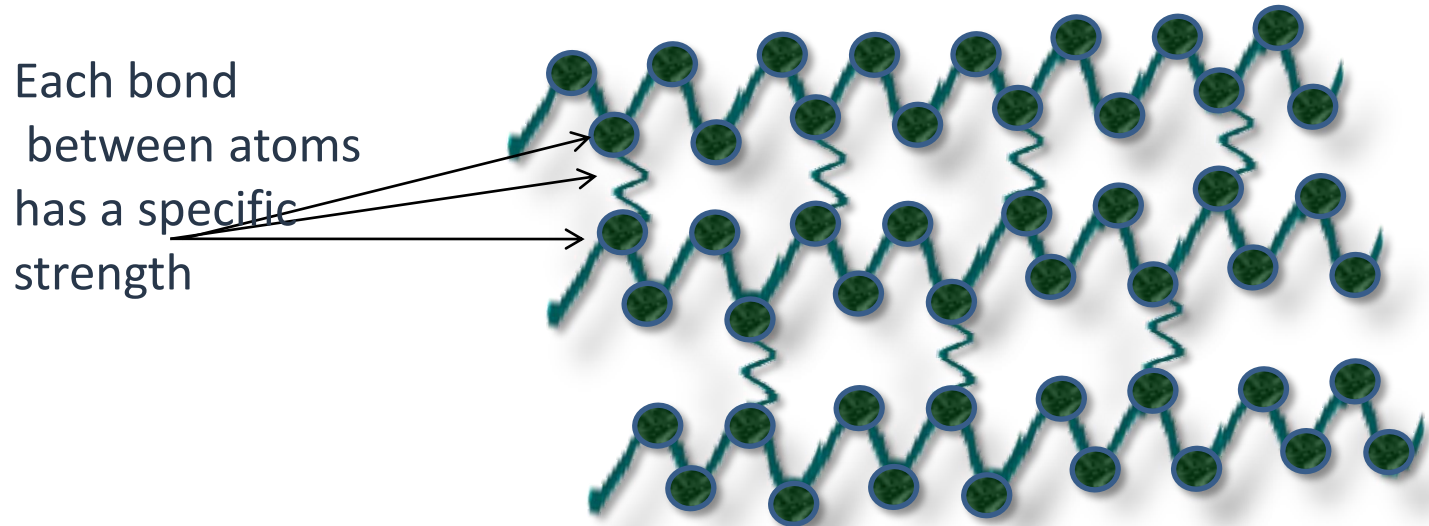


Same is true for the cross links.

Cross-linked Polymers



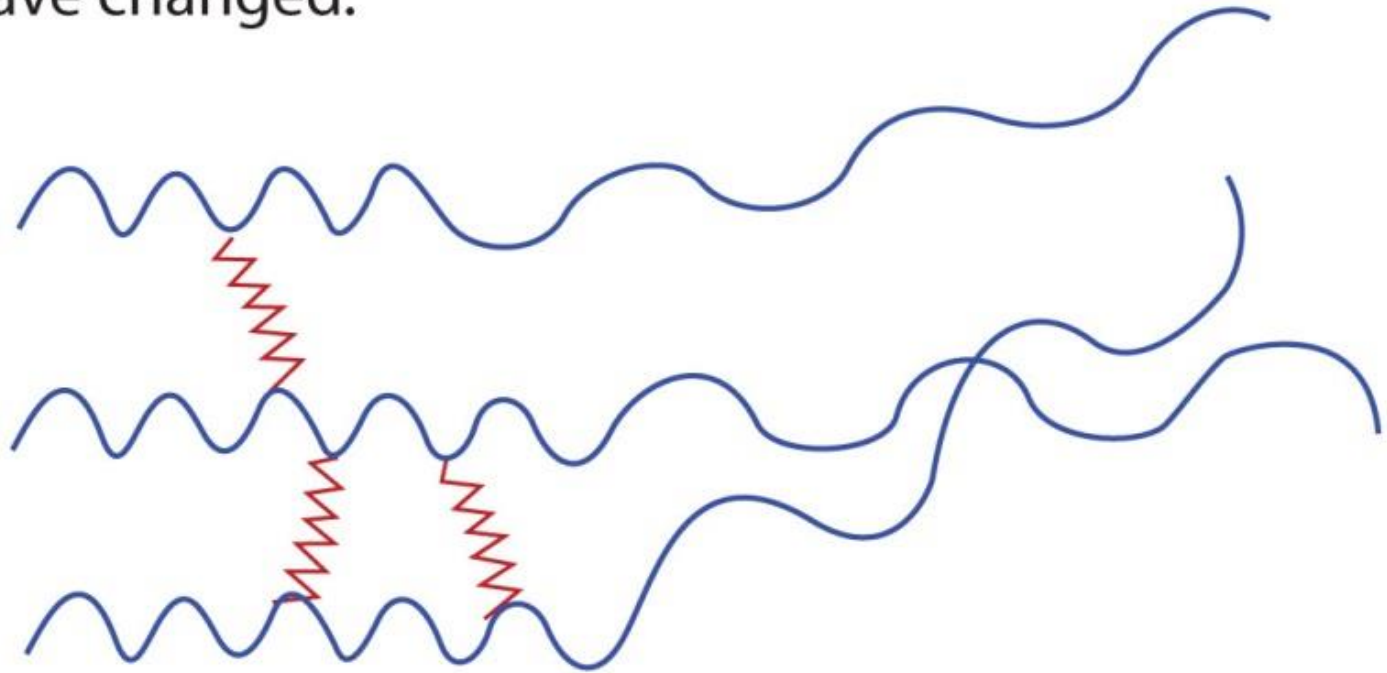
CROSS-LINKED POLYMER

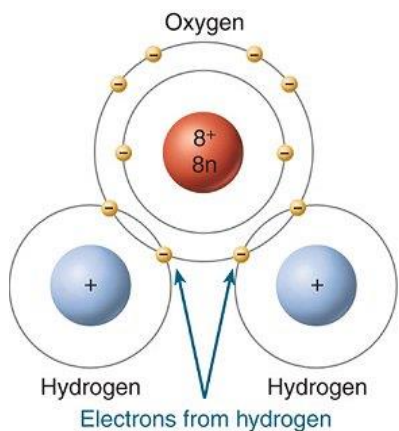


A different atom or molecule introduced into this polymer “system” can form or break bonds dependent upon the relative strengths

Changes in bonds will result in a change in the atomic arrangement (molecular structure) and potentially change the properties of the “system”

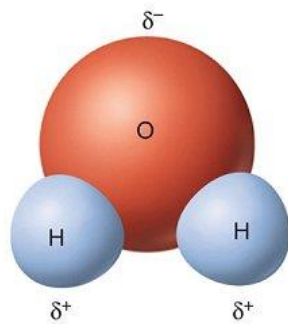
As multiple crosslinks are removed from the system the polymer chain will change shape because the total forces acting on any one atom have changed.



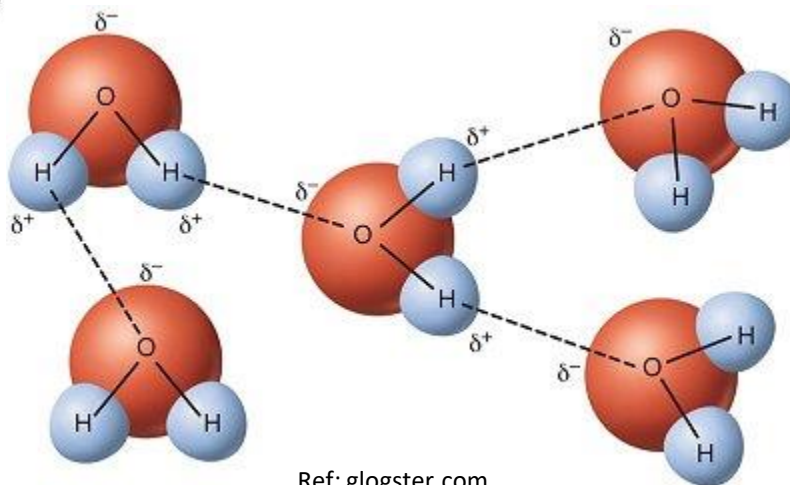


(a) Electron shells in a water molecule

Ref: alevelnotes.com

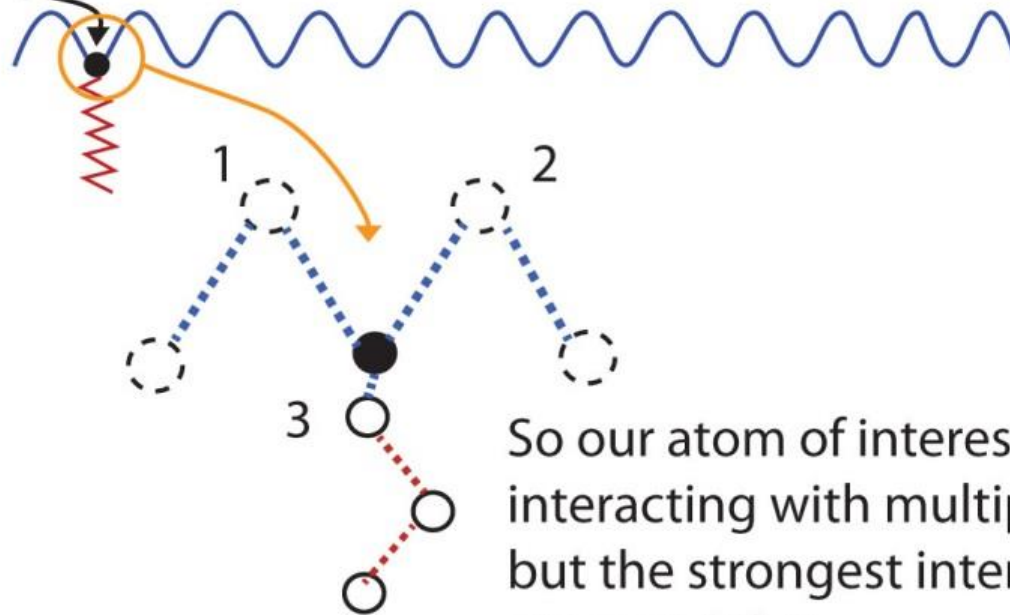


(b) Distribution of partial charges in a water molecule



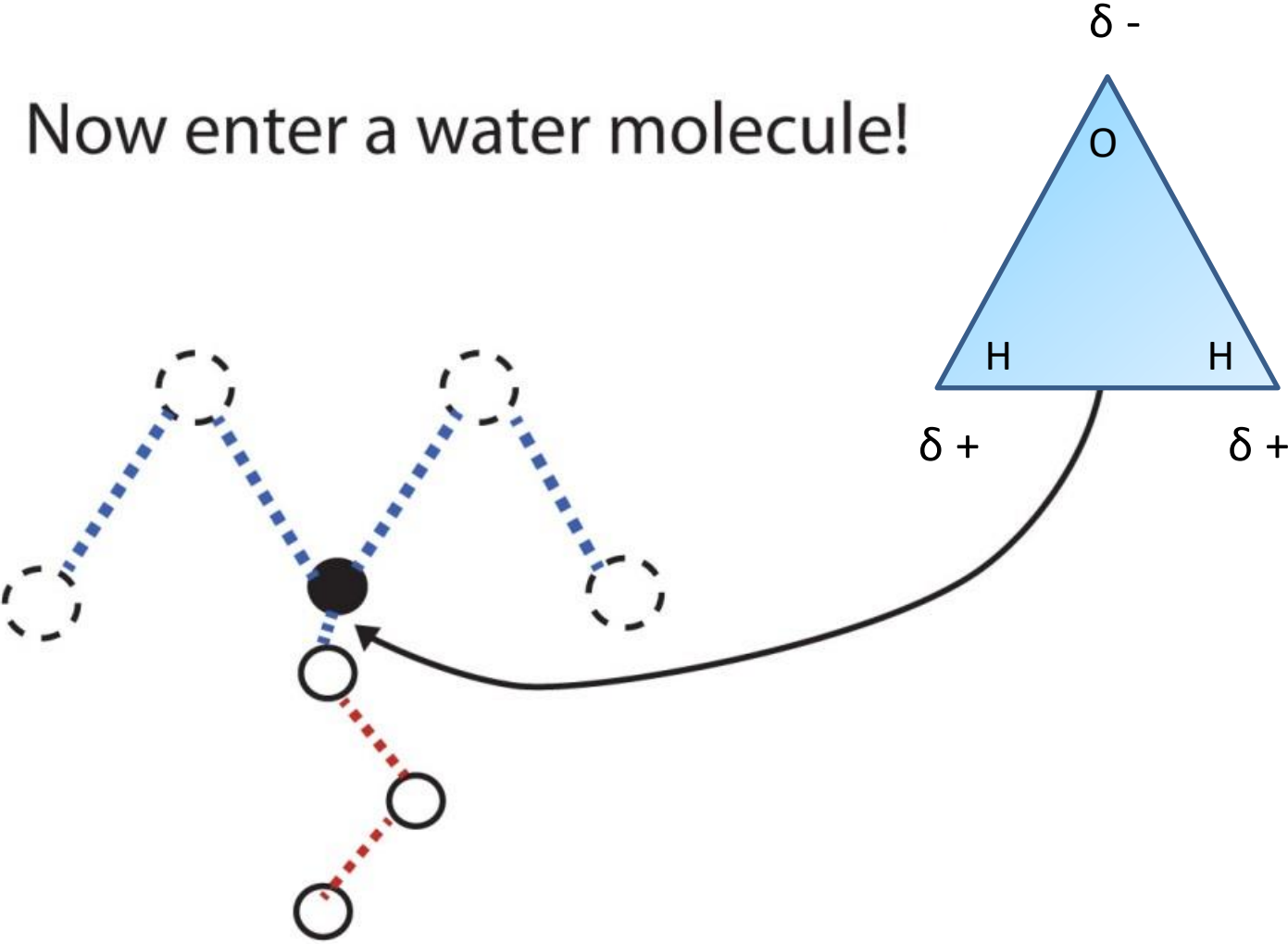
Ref: glogster.com

Observe an atom in the polymer chain that is also at a cross-link point



So our atom of interest is, in reality, interacting with multiple atoms - but the strongest interactions are with atoms 1,2,& 3.

Now enter a water molecule!



If the attraction between the water molecule and any of the atoms in the system is stronger than the bonds between the atoms in the system, then the polymer/crosslink system will be disrupted.

