formed has toughness of polyvinyl chloride, thermal stability of polyvinyl acetate. These combination of properties makes it useful as a paint.

(9) ON THE BASIS OF POLARITY ⇒

(i) Ionic polymers

(ii) Non ionic polymers

(10) ON THE BASIS OF Presence of Carbon in polymers

(i) Inorganic polymers :- An inorganic polymer may be defined as a polymer whose backbone chain is not having carbon atom. Exa. of Inorganic polymers are glass, Silicone rubber etc.

(ii) Organic polymer :- A polymer whose back bone chain is essentially made of Carbon atom.

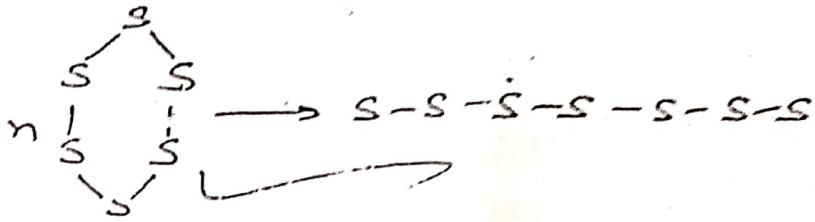
The majority of synthetic polymers are organic polymers

(11) ON THE BASIS OF presence of atom in the polymer chain ⇒ These are of two types

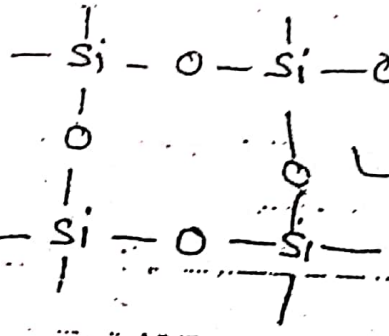
(i) Homo-chain polymers ⇒ Sulphur and selenium have a high tendency to form homo-chain polymeric compounds.

ordinary rhombohedric Sulphur has cyclic

molecules containing eight sulphur atoms. when sulphur is heated in the molten state, the ring appears into a linear polymer.



(ii) Heterochain polymers ⇒ Silicone. form the branched polymers, as represented as



Silicone dioxide

valent Bond
nic bond
valent bond
pole bond
action bond
ession bond
Hydrogen bond

← Primary bonds (1–1.5 Å°) length
← Secondary bonds (3–4 Å°) length

← Bonding in polymers →

There are two kinds of bond which characterised by structural features of polymers.

(i) The atom in the chain are joint to each other by strong bond about 1-1.5 A° length known as pri bond

A ↔ A
Atom

(ii) The force act b/w the chain at distance of about 3 to 4 A° is known as secondary bond.

M ↔ M
molecule

(iii) The pri as well as secondry bond can be subdivided into diff. types of bond.

1. Primary bond
   (i) Ionic bond (ii) covalent bond (iii) co-ordinate bond (iv) metallic bond

(i) Ionic bond ⇒ Ionic bond is formed by the donation of an e⁻ by one atom to another. it is a polar bond.

Li + F → Li⁺ F⁻

Ionic bonds are not usually formed in macro-molecular substance except in the use of divalent ions to provide cross linkage b/w carboxylic grps in natural resins & in ionomers.

Energy of Ionic interaction $\propto \frac{1}{r^2}$

(ii) Covalent bond ⇒ These bonds are formed when one or more pairs of valence e's are shared b/w two atoms.

H + H → H_2

e.g. H_2 is composed of two electrons each atom provides one electron for sharing so that each atom experiences filled shell.

The covalent bond is the predominant bond in polymer, and is extremly non polar covalent bonds are characterised by high energy

(iii) Co-ordinate bond ⇒ In the co-ordinate bond both of the shaired e⁻ come from one atom called the donar which loser an e⁻ and carries a +ve charge whereas the acceptor become -ve charge.

(iv) Metallic bond ⇒ The metallic bond is not utilized in polymeric system.

(2) Secondary Bose forces ⇒

when all the primary valences within covalent molecules are saturated, there are still forces acting b/w the molecules These are generally known as secondry valence or intermolecular forces, or van der waals forces.

(i) Dipole forces ⇒ When different atoms in a molecule carry equal and opposite electric charges, the molecule is said to be polar or to have a dipole moment.

At large distances such a molecule acts like an electrically neutral system, but at molecular distance the charge separation becomes significant, and leads to a net inter molecular force of attraction.

Ans ⇒ The dipole force is strongly depends upon the temperature.

orientational interaction Energy

$$U_{(orient)} = \frac{2}{3} \frac{\mu_1 \mu_2}{KT\, r^6}$$

μ_1 & μ_2 = are dipole moment of two molecules
T = Temperature
K = Boltzmann constant
r = Distance b/w two molecule

(ii) Induction-forces ⇒ (Interaction b/w polar & Non-polar molecule) .. A polar molecule also influences surrounding molecules that do not have permanent dipoles.

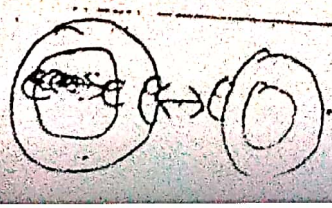
The intermolecular force b/w the permanent and induced dipoles is called induction forces. The energy of the induction force is always small and independent of temp.

$$U = -\frac{2\mu^2\alpha}{r^6}$$

μ = constant dipole moment of molecule
α = polarizability of Non-polar molecule
r = Distance b/w polar - non-polar molecule

Note ⇒ Dipole-forces & Induction-forces occurs only at small distance because Energy is inversely proportional 6th power distance of molecule.

(iii) Dispersion-forces ⇒ It caused by an interaction of the electron in the atom of diff molecules. This forces of attraction exist b/w all atoms the nearer the atom,



stronger the force of attraction these are short range forces. In non polar material only dispersion force exist.

Dispersion interaction can occur in any molecule but in case of polar molecule it is superimposed by orientational interaction.

Hydrogen bond ⇒ The bond in which a hydrogen atom is associate with two other atoms is particularly important in many polymers, including proteins, and is held by many to be essential to life processes.

The Hydrogen bond occurs b/w two functional gps in the same or diff molecules.

Typically hydrogen bonds range b/w 2.4 and 3.2 Å in length and b/w 12 and 30 KJ/mole in dissociation energy. Only fluorine, Nitrogen oxygen, and chlorine are electronegative enough to form hydrogen bonds.