ADDITION POLYMERS

POLYTHENE [ETHYLENE] CH₂=CH₂

POLYPROPYLENE [PROPYLENE] CH = CHCH. Ropes, Toys, Pipes,

High density polythene

* High pressure of 1000 to 2000 atm at a temperature of 350K to 570 K

Low density polythene

- * Presence of traces of dioxygen or a peroxide initiator
- * Highly branched structure
- * Chemically inert & tough but flexible Poor conductor of electricity
- * Used in the insulation of electricity carrying wires and manufacture of squeeze bottles, toys & flexible pipes

Fibres, etc.

- Low pressure of 6-7 atm and a temperature of 333 K to 343 K
- * Presence of a catalyst such as triethylaluminium and titanium tetrachloride (Ziegler-Natta catalyst
- * Linear polymers
- * Chemically inert and more tough and hard
- * Used in the manufacturing buckets, dustbins, bottles, pipes, etc

POLY VINYL CHLORIDE (PVC)

(VINYL CHLORIDE) CH2=CHCI Rain coats, Hand bags, Vinyl flooring

POLY STYRENE [STYRENE]

Insulator. wrapping material,

CH2=CHC4H5

POLY **ACRYLONITRILE** IPAN, ORLON, ACRILANI

[ACRYLONITRILE]

CH₂=CH-CN blankets, clothing

POLY TETRAFLUORO ETHYLENE (TEFLON) **ITETRAFLUORO ETHYLENEI**

CF,=CF,

Non-stick surface coated utensils

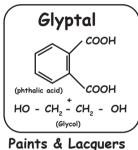
POLY METHYL METHACRYLATE [PMMA, Lucite, Plexiglas]

[MFTHYL METHACRYLATE] CH,=C(CH,) CO,CH,



CONDENSATION **POLYMERISATION**

POLYESTERS



Terylene HOOC + (Terephthalic acid) HO - CH₂ - CH₂ - OH (Glycol)

Dacron or

Crease resistant, used in blending with cotton & wool fibres, glass reinforcing materials in safety helmets, etc

Poly B-hydroxybutyrate-co-B-hydroxy valerate (PHBV)

CH,-CH-CH, -COOH + CH,-CH,-CH,-CH-COOH (3 - hydroxy butanoic acid) (3 - hydroxy pentanoic acid) PHBV is used in speciality packaging, orthopaedic devices and in controlled release of drugs

CLASSIFICATION OF POLYMERS

Based on molecular forces

Elastomers: Rubber like solids with elastic property eg: Buna-S,Buna-N,

Based on

structure

Fibres: High tensile strength & high modules eg: Polyamides (nylon-6,6) Polyesters

Linear

Thermoplastic polymers: Intermediate b/w elastomer & fibres
Capable of repeat
softening on heating
& hardening on cooling eg: Polythene, polystyrene, polyvinyl

Thermosetting polymers: Crosslinked & heavily branched polymers. reused eg: Bakelite, resins, urea-formaldehyde etc.

eg: high density polythene, poly vinyl chloride

eg: low density polythene

Semi-Synthetic

polymers eg:Cellulose acetate

(rayon), cellulose nitrate etc.

Condensation

polymers Eg: Nylon 6,6

Cross-linked eg: Bakelite formaldehyde resin 💡

Synthetic polymers

eg: Nylon-6, 6,

Buna-S

Based on source

Natural polymers starch, resins,

Based on

mode of **Addition** polymerisation polymers

Types of Polymerisation Reactions

Addition Polymerisation or Chain Growth Polymerisation

Condensation Polymerisation or Step Growth Formaldehyde polymer

Novolac used in paints

- Novolac on heating with formaldehyde undergoes cross linking to form an infusible solid mass called bakelite
- Electrical switches and handles of various utensils

Nylon 6

(Caprolactam)

-CH

RESINS



Manufacture of unbreakable crockery

Urea-Formaldehyde polymer NH,-CO-NH, + HCHO For making unbreakable cups & laminated sheets

Nylon 6.6 nHOOC(CH2)4COOH + n H2 N (CH2)6 NH2

Making sheets, bristles for brushes & in textile industry.

Nylon 2 - Nylon 6
$$H_2N - CH_2 - COOH$$

$$+ (Glycine)$$

$$H_2N - (CH_2)_5 - COOH$$
(Amino caproic acid

(Heating with H₂O)

POLYAMIDES

Nylon 2 - Nylon 6 H2N - (CH2)5 - COOH (Amino caproic acid)

1. NATURAL RUBBER

1 Natural rubber

(Isoprene) (2-methyl-1 3-butadiene)

$$H_3C$$
 CH CH H_2C H

Vulcanisation of rubber:

Heating a mixture of raw rubber with sulphur and an appropriate additive at a temperature range between 373K to 415 K.

2. SYNTHETIC RUBBER

Neoprene

(Chloroprene) (2-Chloro-1) 3-butadiene)

$$CH_2 = C - CH = CH_2$$

Manufacturing of conveyor belts, gaskets & hoses

Buna - N

1,3-Butadiene+Acrylonitrile

CH, = CH - CH = CH, + CH, = CH Making of oil seals. tank lining, etc

Buna - S

1, 3 - Butadiene + Styrene CH3=CH-CH=CH3+C4HECH=CH3 Auto tyres, floor tiles, foot wear, cable insulation