

SRI AKILANDESWARI WOMEN'S COLLEGE, WANDIWASH

POLYMER CHEMISTRY

Class: II PG CHEMISTRY

Mrs. E. GANGADEVI

Assistant Professor Department of Chemistry

SWAMY ABEDHANADHA EDUCATIONAL TRUST, WANDIWASH

polymer

polymer

POLYMERIZATION: the process monomers undergoes a chemical reactions, as a result of these reactions, monomers bind together to form 'polymer' process known as the **polymerization**.

POLYMER: The word polymer literally means "many units", A polymeric solid material may be considered as to be one that contains many chemically bonded parts or units which themselves are bonded together to form a solid.

properties of polymers

□ Advantages:

- It can easy formed into very complex shapes.
- Relatively less expensive.
- High strength to weight ratio.
- Can quickly produce a lot of parts.
- Good insulation properties, thermal as well as electrical.
- Having corrosion resistance.
- Can be transparent or easily colored.
- 8. Capable of being foamed and light and flexible.

properties of polymers

□ Disadvantages:

- Dimensional instability.
- Many are flammable.
- Some are attacked or dissolved by certain chemicals.
- Many take a long time to degrade when disposed.
- Some are absorb moisture.

plastic

Two industrially important polymeric materials are:

- 1. Plastics
- 2. Elastomer

Plastics can be divided into two classes.

- 1. Thermo plastics
- 2. Thermo setting plastics,

depending on how they are structurally and chemically bonded

THERMO PLASTICS

□ Thermo plastics:

These plastics can be softened by heating and hardened by cooling any number of times without changing the properties of the material.

- It is thus possible to shape and reshape these plastics by means of heat and pressure.
- One important advantage of this variety of plastics is that scrap obtained from old and warn out articles can be effectively used again.

□ Properties :

Advantages

- Softens and liquefies on heating and hardens up to cooling.
- Retains shape after manufacture.
- 3. Suitable for recycling.
- 4. Can be reshaped by heat.
- It may melt before passing to a gaseous state.
- Allow plastic deformation when it is heated.
- 7. They are soluble in certain solvents.
- They have low melting point.

Disadvantages:

They are not so strong as the thermosetting plastics because they can be repeatedly used.

- Examples and applications of thermoplastic plastic materials:
- Polystyrene applied for electrical insulation, handles of tools...
- II. Polyamide used for making ropes, belts, etc...
- III. PVC or polyvinyl chloride for the manufacture of insulation materials, pipes, containers, etc.

THERMO PLASTIC MATERIALS

1. Polyethylene (or polythene) -:

- PROPERTIES:
- 1. It is light in weight.
- Excellent resistance to corrosion .
- It is tough & Flexible.
- It has high electrical resistivity.
- It has low density.
- It is easily moulded and machined.
- In is comparatively cheap and find wide range of applications.
- It has low coefficient of friction.
- It has low strength and cannot absorb moisture!

Uses: bags, tubes, containers, bottles, buckets, ice trays, electric insulator, used as large storage bottles, water tank.

POLYETHYLENE



THERMO PLASTIC MATERIALS:

2. Polyvinyl chloride (PVC)

PROPERTIES:

It is from vinyls group(CH2=CH)derived from ethylene.

- It has resistance to water and alkalies.
- It has excellent dielectric properties.
- They absorb low moisture.
- Rigid , tough , elastic to feel.
- 5. It has low cost and widely used in many applications.

Uses: Plumbing pipes and sanitary fittings,

Shower curtains, window frames, flooring,

plastic coating to steel sheets tanks, car instruments pa

THERMO PLASTIC MATERIALS :

3. Acrylic:

- PROPERTIES:
- It is from vinyl group plastic which is most widely used polymethyl methaceylate(PMMA)
- It is tougher and lighter than glass and easily moulded into desired shapes.
- It transmit 90% daylight.
- It has low abrasion resistance. So PPMA lenses scratch easily.
- It is good electrical insulator.
- It has high resistance to weathering and sunlight.

Uses: sanitary wares, bath rooms and sinks.



THERMO PLASTIC MATERIALS :

4. ABS(Acrylonitrile Butadiene Styrene):

- PROPERTIES:
- It is copolymer of Acrylonitrile, Butadiene & Styrene.
- They has outstanding strength and toughness.
- They are hard and rigid.
- They has good impact resistance.
- They has resistance to acids ,alkalies and some organic solvents.

Uses: Automobile panel, radiator grills,

TV cabinets, Refrigerator liners etc.



ABS

THERMO PLASTIC MATERIALS :

5.Teflon(PTFE: polytetrafluroethylene)/flurocarbon:

- PROPERTIES:
- Low coefficient of friction
- Resistance to chemical attack
- It has high temperature capability
- Non Wetting
- Dielectric Properties
- It has high resistance to weathering and sunlight.

Uses: chemical pipes, frying pans, non stick coatings.



PTFE

THERMOSETTING PLASTICS

- These plastics are either originally soft or liquid or they soften once upon heating, they harden permanently.
- They can not soften by again application of heat.
- The thermo setting plastics are durable, strong and hard.
- They are available in a variety of beautiful colours.
- Typical examples; melamine, epoxides etc.

Properties :

- 1. Permanently hard on heating above a certain temperature.
- Undergoes chemical changes during manufacture.
- 3. Cannot be melted and reshaped.
- 4. Little potential for recycling.

Examples and uses:

- Polyester fibreglass systems: sheet molding compounds and bulk molding compounds)
- Bakelite, a phenol-formaldehyde resin used in electrical insulators and plastic ware
- Urea-formaldehyde foam used in plywood, particleboard and medium-density fiber board
- Melamine resin used on worktop surfaces
- Epoxy resin used as the matrix component in many fiber reinforced plastics such as glass-reinforced plastic and graphite-reinforced plastic)

THERMOSETTING PLASTIC MATERIALS

1. Melamine formaldehyde(Formica):

□ Properties:

- This plastic is known as aminoresin.
- 2. Harder than any other plastics, more heat resistant.
- They have resistance to water.
- It has good heat and strain resistance.
- They have excellent dielectric properties.
- 6. They are expensive.

□ Applications:

The household cups, saucers, baths & different kitchen utensils, paints, plywood glues, decorative laminate etc.

FORMICA

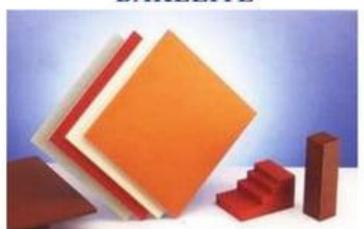


THERMOSETTING PLASTIC MATERIALS

2. Phenolics/Phenol-formaldehyde (bakelite):

- PROPERTIES:
- The cheapest.
- Bakelite is unaffected by water.
- It has chemical resistance.
- Heavy solid plastic material.
- It has good electric insulation.
- It has excellent thermal stability up to 250°C
- Heat resistant.
- ☐ Uses: Bottle caps, plastic automobile parts, bonding plywood and chip board, glues, laminates with other materials, electrical parts etc.

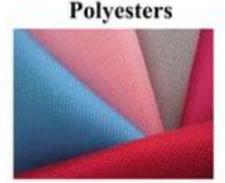




3. Polyesters:

☐ PROPERTIES:

- They are introduced as constituents of paints, enamels, lacquers.
- They are available saturated and unsaturated form.
- They are available in rigid and flexible type.
- They have excellent dielectric properties.
- They do not dissolved in acid and organic solvents.
- They have high resistance to heat.
- They can used from room temp. to 180°C



Uses: small boats structure, car bodies, used in enamels, lacquers for automobiles, stoves, refrigerators and washing machines, helmets, fans, etc.

4. Epoxies:

- □ Properties:
- They have adhesion property.
- Resin and hardener.
- They have excellent chemical resistance.
- They are relatively expensive.
- They have good strength and toughness. Uses: Used as adhesives.

☐ Uses:

Manufacturing laminates, plotting electrical equipment, adhesives, protected coating, insulating materials in electric applications etc.

EPOXY



Elastomers/Rubber:

☐ Properties:

- Long fatigue life, very useful for spring applications.
- They have high strength.
- They compounded to give wide range of hardness.
- Poor resistance to oil and solvent.
- Good temperature flexibility
- Required to protect against oxidation, ozone and heat.
- It can be extended by oil with little loss of mechanical properties.

Types

- Butadiene rubber(BR)
- Styrene butadiene rubber(SBR)
- Acrylonitrile butadiene rubber(NBR)
- Butyl rubber
- Silicon rubber(SIL)

1. Acrylonitrile Butadiene Rubber:

□ PROPERTIES:

- Trade name of this rubber is 'Buna N' or 'Nitrile'
- This are co-polymer of Acrylonitrile, butadiene.
- 3. Nitrile is relatively expensive.
- It is used for sealing applications(gaskets)
- It has excellent resistance to oil and fuels at room as well as high temp.
- 6. Resilience is one half that of natural rubber.

NBR



Uses: Hoses, conveyor belts cable sheathing, washing machine parts etc.

2.Silicon Rubber(SIL):

□ PROPERTIES:

- Silicon are hydrocarbon.
- In this rubber carbon is replaced by silicon and oxygen, in polymer chain.
- 3. They have poor mechanical strength.
- They are expensive but their temp tolerance 200°c makes them very useful.
- 5.This can be improved by replacing some of the hydrogen atoms by fluorine but it increases cost.
 6.It is used in adhesives.

Uses: seal, gaskets, electrical engineering, medical, etc.

