



**SRI AKILANDESWARI WOMEN'S COLLEGE,
WANDIWASH**

POLYMER CHEMISTRY

Class : II PG CHEMISTRY

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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:

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

properties of polymers

Disadvantages:

1. Dimensional instability.
2. Many are flammable.
3. Some are attacked or dissolved by certain chemicals.
4. Many take a long time to degrade when disposed.
5. 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 worn out articles can be effectively used again.

❑ **Properties :**

• **Advantages**

1. Softens and liquefies on heating and hardens up to cooling.
2. Retains shape after manufacture.
3. Suitable for recycling.
4. Can be reshaped by heat.
5. It may melt before passing to a gaseous state.
6. Allow plastic deformation when it is heated.
7. They are soluble in certain solvents.
8. 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:

- I. **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.
2. Excellent resistance to corrosion .
3. It is tough & Flexible.
4. It has high electrical resistivity.
5. It has low density.
6. It is easily moulded and machined.
7. It is comparatively cheap and find wide range of applications.
8. It has low coefficient of friction.
9. 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 (P V C)

PROPERTIES :

It is from **vinyls** group($\text{CH}_2=\text{CH}$)derived from ethylene.

1. It has resistance to water and alkalies.
2. It has excellent dielectric properties.
3. They absorb low moisture.
4. 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:**

1. It is from **vinyl** group plastic which is most widely used **polymethyl methacrylate(PMMA)**
2. It is tougher and lighter than glass and easily moulded into desired shapes.
3. It transmit 90% daylight.
4. It has low abrasion resistance. So PPMA lenses scratch easily.
5. It is good electrical insulator.
6. It has high resistance to weathering and sunlight.

Uses : sanitary wares, bath rooms and sinks.



- **THERMO PLASTIC MATERIALS :**

- 4. ABS(Acrylonitrile Butadiene Styrene) :**

- PROPERTIES:**

1. It is copolymer of **Acrylonitrile, Butadiene & Styrene.**
2. They has outstanding strength and toughness.
3. They are hard and rigid.
4. They has good impact resistance.
5. 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: polytetrafluoroethylene)/flurocarbon :**

- **PROPERTIES:**

1. Low coefficient of friction
2. Resistance to chemical attack
3. It has high temperature capability
4. Non Wetting
5. Dielectric Properties
6. 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.
2. Undergoes chemical changes during manufacture.
3. Cannot be melted and reshaped.
4. Little potential for recycling.

- **Examples and uses:**

1. **Polyester** fibreglass systems: sheet molding compounds and bulk molding compounds)
2. **Bakelite**, a phenol-formaldehyde resin used in electrical insulators and plastic ware
3. **Urea-formaldehyde** foam used in plywood, particleboard and medium-density fiber board
4. **Melamine** resin used on worktop surfaces
5. **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 :

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

☐ Applications:

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



• THERMOSETTING PLASTIC MATERIALS

2. Phenolics/Phenol-formaldehyde (bakelite) :

PROPERTIES :

1. The cheapest.
2. Bakelite is unaffected by water.
3. It has chemical resistance.
4. Heavy solid plastic material.
5. It has good electric insulation.
6. It has excellent thermal stability up to 250°C
7. Heat resistant.

Uses : Bottle caps, plastic automobile parts, bonding plywood and chip board, glues, laminates with other materials , electrical parts etc.

BAKELITE



3. Polyesters :

□ PROPERTIES:

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

Polyesters



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

4.Epoxies:

□ Properties:

1. They have adhesion property.
2. Resin and hardener.
3. They have excellent chemical resistance.
4. They are relatively expensive.
5. 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:

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

□ Types

1. Butadiene rubber(BR)
2. Styrene butadiene rubber(SBR)
3. Acrylonitrile butadiene rubber(NBR)
4. Butyl rubber
5. Silicon rubber(SIL)

1.Acrylonitrile Butadiene Rubber :

❑ PROPERTIES:

1. Trade name of this rubber is 'Buna N' or 'Nitrile'
2. This are co-polymer of Acrylonitrile , butadiene.
3. Nitrile is relatively expensive.
4. It is used for sealing applications(gaskets)
5. 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 , conveyer belts cable sheathing, washing machine parts etc.

2.Silicon Rubber(SIL):

❑ PROPERTIES:

1. Silicon are hydrocarbon.
2. In this rubber carbon is replaced by silicon and oxygen , in polymer chain.
3. They have poor mechanical strength.
4. 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.

SIL

