

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

**Topic**

# *Plastics*

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# *Plastics*

“The material which have the ability to change their shapes upon heating are called plastics.” Plastics is material consisting of any of a wide range of synthetic or semi-synthetic organic compounds that are malleable and so can be molded into solid objects.

Plastics are typically organic polymers of high molecular mass and often contain other substances. They are synthetic, mostly derived from petrochemicals. Due to large number of consumption of petrochemical reserves and their cause of global warming, bio-plastics are made substantially from renewable plant materials such as cellulose and starch.



## **Additional chemicals:**

Plastics contain other organic and inorganic compounds blended in. The amount of additives ranges from zero percentage (for polymers used to wrap foods) to more than 50% (for certain electronic applications). The content of additives is 20% by weight of the polymers. Fillers improve performance or reduce production cost. Typically fillers are mineral in origin, e.g., chalk

## *History*

- In 1600 BC, Mesoamericans used natural rubber for balls, bands, and figurines.
- Early plastics were bio-derived materials such as egg and blood proteins, which are organic polymers.

- In the 1800s, the development of plastics accelerated with Charles Goodyear's discovery of vulcanization as a route to thermoset materials derived from natural rubber.
- Polyvinyl chloride (PVC) first created in 1872 but commercially produced in the late 1920s.
- In the early 1900s, Bakelite, the first fully synthetic thermosetting plastic was reported by Belgian chemist Leo Baekeland.
- Polystyrene (PS), first produced by BASF in the 1930s.

# ***PROPERTIES OF PLASTICS***

- Less brittle than glass, hence can be made transparent and smooth.
- Corrosion resistance
- Low electrical and thermal conductivity, insulator.
- Easily formed into complex shapes, can be formed, casted and joined.
- Wide choice of appearance, colors and transparencies.
- Light weight but posses good strength and rigidity.
- Low moisture absorption.
- Heat resistance.

# *TYPES OF PLASTICS*

1. Thermoplastics
2. Thermosetting plastics



## *Thermoplastics:*

Thermoplastics are the plastics that do not undergo chemical change in their composition when heated and can be molded again and again.

### *Examples:*

Polyethylene, polypropylene, polystyrene, polyvinyl chloride and polytetrafluoroethylene (PTFE). Typically they have a molecular weight between 20,000 to 50,000 amu. Most plastics contain organic polymers. The vast majority of these polymers are based on chains of carbon atoms alone or with oxygen, sulphur, or nitrogen as well. The backbone is that part of the chain on the main path linking a large number of repeat units together.



## *Thermosetting plastics:*

Thermoset can melt and take shape once; after they have solidified, they stay solid. In the thermosetting process a chemical reaction occurs that is irreversible.

### *Examples:*

Bakelite, polyesters, polyurethane, Melamine Formaldehyde, Urea Formaldehyde and epoxy resins. The vulcanization of rubber is a thermosetting process. Before heating with sulphur, the polyisoprene is a tacky, slightly runny material, but after vulcanization the product is rigid and non-tacky. Many adhesives (glues) are thermosetting plastics. A good example is 'Araldite' which is an epoxy resin that hardens when a second chemical is added (a catalyst). It will bond most materials including woods and metals as well as some plastics.

# *Manufacturing of Plastics*

- *The production of plastics can be roughly divided into four categories:*
  1. Acquiring the raw materials or monomers.
  2. Synthesizing the basic polymer.
  3. Compounding the polymer into a material that can be used for fabrication.
  4. Molding or shaping the plastic into its final form.

# *Advantages of plastics:*

- Light in weight
- Easily molded and have excellent finishing
- They possess very good strength and toughness
- Possess good shock absorption capacity
- Have low thermal expansion of coefficient and possess good thermal and electrical insulating property
- Strong, good and cheap to produce
- Ordureless
- Use for building, construction, electronic, packaging and transportation industry
- Use to reduce soil and wind erosion

# *Disadvantages of using plastics*

- Low strength
- Low useful temperature range (up to 600 degree F)
- Less dimensional stability over period of time (creep effect)
- Aging effect, hardens and become brittle over time
- Sensitive to environment, moisture and chemicals
- Poor machinability
- Causes cancer
- It is a recycle process, but is very costly



***Thank you***