

Plastics

Organic (carbon-containing) compounds are also used in the manufacture of **plastics**.

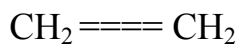
Synthetic fibres, plastics and rubbers are mostly, polymers. This means they have been made by linking up large numbers of smaller molecules (monomers) into very long chains, sheets or solid networks. They may contain many thousands of carbon atoms.

The monomers are linked (by means of a suitable catalyst) in a process called polymerisation. Organic peroxides (highly explosive) are often used as catalysts.

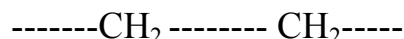
The nature of the final product depends on what monomer was used. Plastics can be "tailor-made" for specific purposes. Other materials are mixed into them to improve their properties or make them cheaper.

An example of polymerisation:

(1) Ethene (monomer)



(2) The double bond breaks



(3).....and links up with others to form a long chain polymer:
~~-----CH₂-----CH₂-----CH₂-----CH₂-----CH₂-----CH₂-----~~

The Effect of Heat on Plastics

The effect of heat depends on the type of plastic.

- a. **Thermoplastic** materials (usually long molecular chains), soften or melt on heating, often at temperatures as low as 100°C. (E.g.) P.V.C., polystyrene. Polythene, perspex.
- b- **Thermosetting** plastics do not soften on heating. They set hard in a 3-dimensional network of cross-linked molecules (like concrete). (e.g.) Bakelite, melamine, polyurethane, cured epoxy resins etc.

Hazards of Burning Plastics

Most types of plastics are fire hazards, even though they vary in their flammability.

1. Production of toxic and corrosive gases

Carbon monoxide CO is produced by most burning plastics, due to their high carbon content. Other gases produced depend on the make up of the plastic.

If the plastic contains nitrogen, it will often appear as nitrogen dioxide (NO_2) and hydrogen cyanide (HCN) in the fire gases.

Polyurethane forms produce appreciable amounts of both HCN and CO (both toxic).

P.V.C. and other chlorine-containing plastics give off hydrogen chloride (HCl) gas (toxic and corrosive).

Fluorine-containing polymers such as P.T.F.E. and teflon. While almost non-combustible will give off toxic fluoro-compounds if over heated.

2. The evolution of large quantities of (usually black) smoke

3- Production of burning tars and droplets

As thermoplastics melt on heating, they may form burning droplets which cause further spread of fire.

Further information

The manufacture of plastics is hazardous because:

1. Polymerisation process may be exothermic. The trapped heat may cause polyurethane blocks to catch **fire**.
2. Catalysts include organic peroxides - highly explosive.
3. Flammable solvents are used.
4. Finely divided plastic dust may be produced.
5. The monomers and intermediates are often flammable and toxic and may polymerise accidentally, giving off large amounts of heat.

Summary

- Plastics are organic compounds.
- They are made by linking short molecules (monomers) to form long chains or networks (polymers).
- The nature of the polymer will depend on the monomer used.
- Plastics may soften on heating (thermoplastic) or harden (thermosetting).
- Burning plastics are hazardous because they produce toxic gases, large quantities of smoke, burning tars and droplets,