

SYNTHETIC MATERIALS IN INDUSTRY



7.1 : Synthetic Polymers

Synthetic Rubber

- ✓ Are elastic synthetic polymers
- ✓ Specially made for specific purposes
- ✓ General characteristic:
 - resistant to heat, water and oil
 - able to withstand bad weather
 - non-reactive to chemical substances (acid, alkaline, organic solution)
 - air-tight
 - good heat and electric insulator



Synthetic Rubber

✓ examples of use:

| Products | Reasons |
|--|---|
|  Balloons, gloves, raincoats | Elastic and water resistant |
| Fan belts, gaskets and hoses | Elastic, strong, resistant to oil and heat |
|  Teats of baby bottles | Clear, easy to clean, odourless and not sticky |

✓ comparison between natural rubber and synthetic rubber:

Natural Rubber

Similarities

Synthetic Rubber

Both are polymers

Both can be vulcanized

Both are good heat and electric insulator

Differences

Sticky when heated

Reacts with acid, alkali,
organic solution

Yes/high

Yes/high

Yes/high

High

high

Heat resistance

Chemical resistance

Ability to absorb vibration

Ability to absorb sound

Ability to absorb pressure

Flexibility

Elasticity

Not sticky when heated

Doesn't react with acid,
alkali, organic solution

No/low

No/low

No/low

No

No

Synthetic Fibres

- ✓ Are textiles such as nylon, polyester, rayon, acetate and acrylic
- ✓ These textiles are used to make clothes, curtains and carpets and furniture upholstery
- ✓ They are better than some natural fibres (from plants and animals) because they are stronger and crease-resistant.



SYNTHETIC MATERIALS IN INDUSTRY



7.2 : Plastics

Plastics

- ✓ Are synthetic polymers
- ✓ Have wide variety depend on their properties
- ✓ General characteristics:
 - cheaper compared to metals, woods or glass
 - flexible
 - easily moulded into different shapes
 - strong and light
 - good insulators of heat and electricity
 - resistant to chemicals
 - resistant to attack of microorganism, therefore non-biodegradable



✓ Examples of the common types of plastics:

| Types of plastics | Characteristics | Examples |
|----------------------------------|--|--|
| Polyvinylchloride | Tough, flexible, cheap to produce, easy to print on | Credit cards, IC |
| Polystyrene | Can either be foam or rigid. Clean, lightweight, water resistant | Food container (foam), plastic toys (rigid) |
| Polythene | Comes in two types: low density and high density | Low density : straws High density : wash basins |
| Polyamide | Also known as nylon | Bristle of toothbrush |
| Polyethylene terephthalate (PET) | Strong recyclable plastic | Bottles of carbonated drinks |
| Polyurethane | Strong and lightweight | Wheels of skateboard |

- ✓ Plastics can be divided into two main groups according to their thermal properties :
 - i. Thermoplastics and
 - ii. Thermosetts/thermosetting plastics (*thermo = heat*)
- ✓ Comparison of thermoplastics and thermosetting plastics:

| Thermoplastics | Thermosetting plastics |
|------------------|------------------------|
| Soft when heated | Blister when heated |
| Can be remoulded | Cannot be remoulded |
| Recyclable | Non-recyclable |
| Unbreakable | Breakable |
| <u>Examples</u> | <u>Examples</u> |

Disposal of Polymers



- ✓ Synthetic polymers are non-biodegradable
- ✓ Synthetic polymers cannot be decomposed in landfills
- ✓ So, we need to reduce the amount of this wastes. How to do?
 - through recycling and reuse
 - using degradable synthetic polymers
[classified into biodegradable (can be decomposed by microorganisms) and photodegradable (decomposed rapidly when exposed to bright light)].
- ✓ Most synthetic polymers are made from petroleum. Will produce lot of heat when burnt. This energy can be converted into electricity. This process is known as **incineration with energy recovery**.