MORE COMMON POLYMERS

This mobile revision pdf is based on detailed work found in the MATERIALS section.
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Tap the blue button to view common polymers covered by this Revision PDF

MORE COMMON POLYMERS

1. HOW POLYMERS ARE MANUFACTURED

2. THERMOPLASTIC ELASTOMERS

3. NYLON (POLYAMIDE)

4. POLYURETHANE AND FOAM RUBBER

DOWNLOAD THE "MATERIALS - WOODS - METALS – PLASTICS" FOR COMMON THERMOPLASTICS AND THERMOSETTING POLYMERS

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PLASTICS, FUELS AND CHEMICALS FROM CRUDE OIL

Oil refineries 'refine' oil in massive quantities, to produce the fuels we need. However, some of the raw materials we need to manufacture plastics, are also extracted from oil at the refinery. When crude oil is refined, four percent ends up as raw materials for the production of plastics

Oil is refined through a process called distillation. To the plastics industry, **Naphtha** is the most important fraction distilled from crude oil. It is used in the production of a range of plastics.

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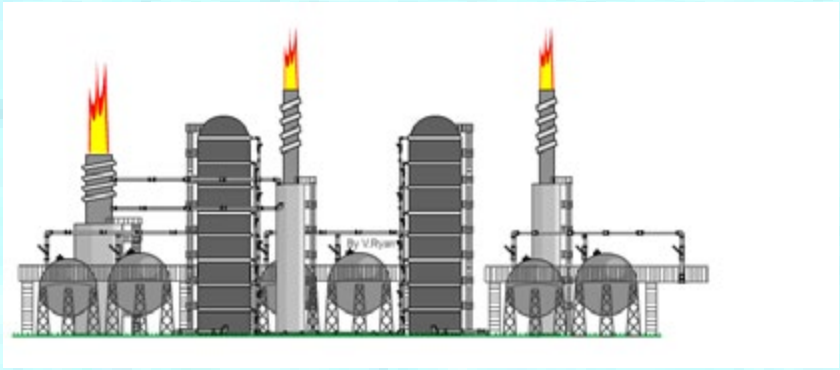

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DISTILLATION

The distillation process takes place at an oil refinery in a distillation 'Tower'. Crude oil is heated to over 370 degrees Celsius and it vaporises, rising up the tower, condensing at different levels. NAPHTHA is important to the plastics industry.

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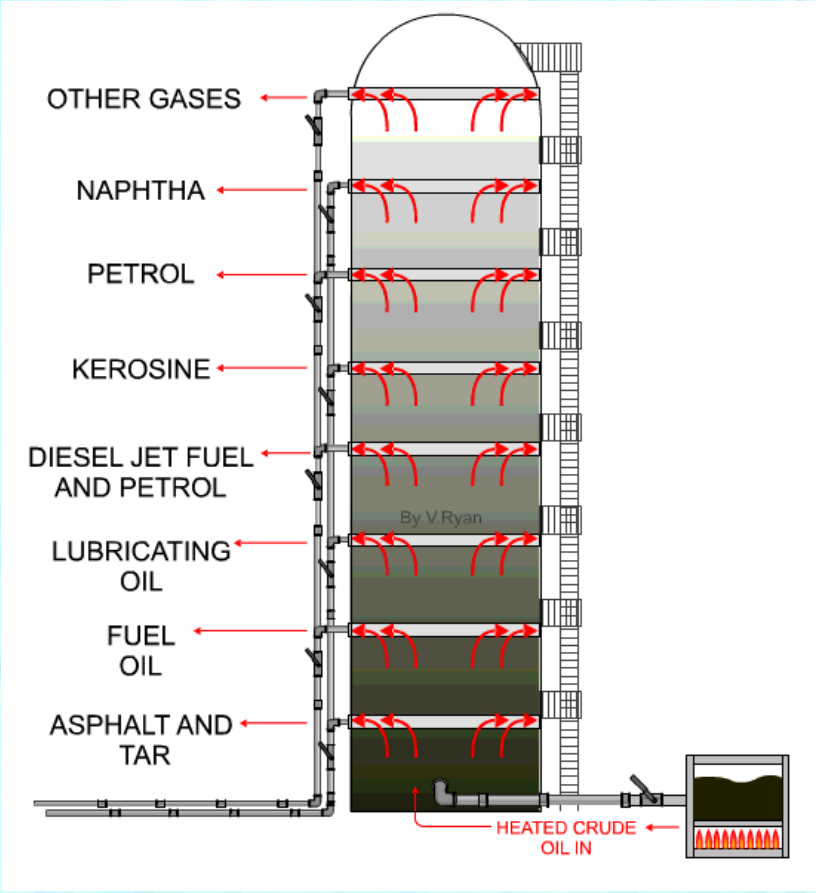

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POLYMERS FROM NAPHTHA

Naphtha is used to manufacture a range of polymers / plastics.

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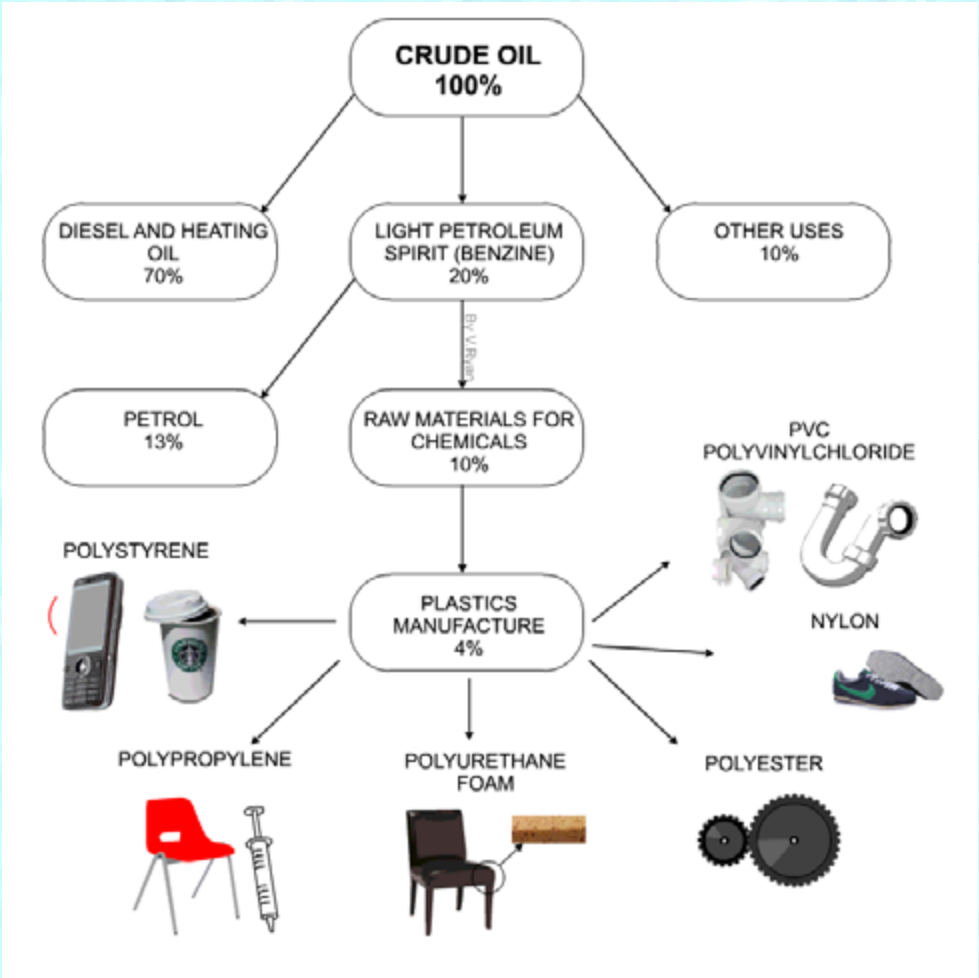

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THERMOPLASTIC ELASTOMERS (TPE)

These are a combination of thermoplastics and elastomers. Although classed as polymers, they act like a thermoset rubber. In simple terms, they are a mix of polymers and rubber giving them a combination of the physical properties, attributed to thermoplastics and rubber (elastomers). This can include combining flexibility (rubber) with toughness (thermoplastics). TPEs can be processed using the same techniques associated with thermoplastics, including injection moulding and blow moulding.
Five types of TPEs are named below.

Tap the image for more information


ARNTINEL


HYTREL


KRATON


RITEFLEX


STYROFLEX

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PROPERTIES OF TPEs

They have good tensile strength and are tear resistance.
They resist chemicals and ink / paint adhere well to them.
They have good properties of flexibility and resistance to compression. After bending, they will return close to their original shape / form.
They can be reprocessed / recycled by raising the temperature above melting point. They can be reformed during the melting process, unlike many other forms of plastics. They can be extruded, blow moulded and injection moulded. They can be remoulded if the temperature is raised until the TPE becomes soft and pliable.

Tap BOTH link buttons for more information

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ONE PRACTICAL APPLICATION OF TPEs

TPEs are a collection of Thermoplastic Elestomers. They a combination of thermoplastics and elastomers.

The most suitable for the manufacture of a TV remote control is styroflex. Although classed as polymers, they act like a thermoset rubber. In simple terms, they are a mix of polymers and rubber giving them a combination of the physical properties, attributed to thermoplastics and rubber (elastomers). This can include a combining flexibility (rubber) with toughness (thermoplastics).

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NYLON (POLYAMIDE)

In 1935 a team of chemists at DuPont, led by Wallace Carothers, developed nylon66. Commercial applications followed quickly, first with the introduction of nylon bristle toothbrushes in 1938, by DuPont. Nylon fibres arranged as a textile material appeared in the 1940s, as sort after 'nylon' stockings. Over the following decades, nylon changed the world of clothing and fashion. It became popular as a textile material during the Second World War, when silk was scarce. Solid nylon also gained in popularity, often replacing metals such as brass in some practical applications.

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PROPERTIES OF NYLON

Nylon is an excellent insulator, preventing electricity flowing through it. For this reason it is often found inside electrical products, as parts that help to provide insulation. It has really good mechanical properties, as it is strong, durable and tough, with very little 'give'. It produces very little friction and can be used as a material for plain bearings, as it does not need lubrication.

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NYLON PRODUCTS

Tap the image for more information
On nylon products

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HOW IS NYLON MANUFACTURED?

Nylon fibre is produced when equal volumes of a diamine acid and a dicarboxylic acid are carefully and slowly poured together. One is oil based (diamine) and floats on the top of the other, water based chemical dicarboxylic. A delicate film forms where the two chemicals meet (called the 'interface'). This is called a 'condensation reaction'. The film can be removed using tweezers and as it is removed a new boundary between the chemicals forms and process continues, forming long chains of nylon.

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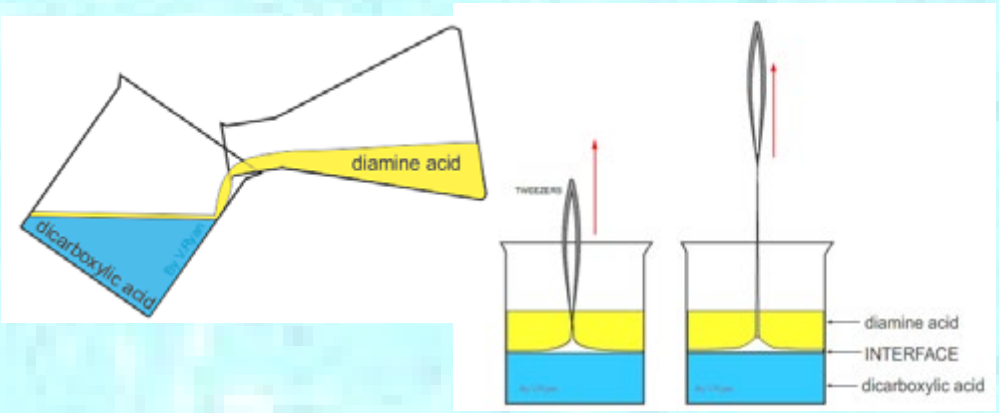

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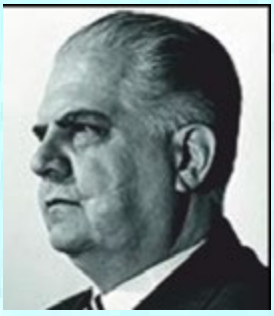
POLYURETHANE AND FOAM RUBBER

In the 1930s, Germany lead the world in the development of chemicals and plastics. In1937, Otto Bayer mixed two chemicals, polyol (an alcohol) and isocyanate (sometimes called isonitrile or carbylamine). The two chemicals formed a solid plastic. The resulting plastic was polyurethane (PUR), a new plastic. However, occasionally when the process was repeated, something different happened. Sometimes the chemicals were contaminated with water and when mixed, a significantly different reaction took place. The chemicals 'fizzed' with bubbles and the polyurethane expanded. The resulting plastic is now called foam rubber.

Tap the image of Otto Bayer for detailed information



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MANUFACTURING POLYURETHANE AND FOAM RUBBER

Polyurethane and foam rubber are virtually the same chemically. Polyurethane is a solid plastic (solid resin) and foam rubber is light, soft and flexible. They have different material properties, all due to the addition of water during the manufacturing process.

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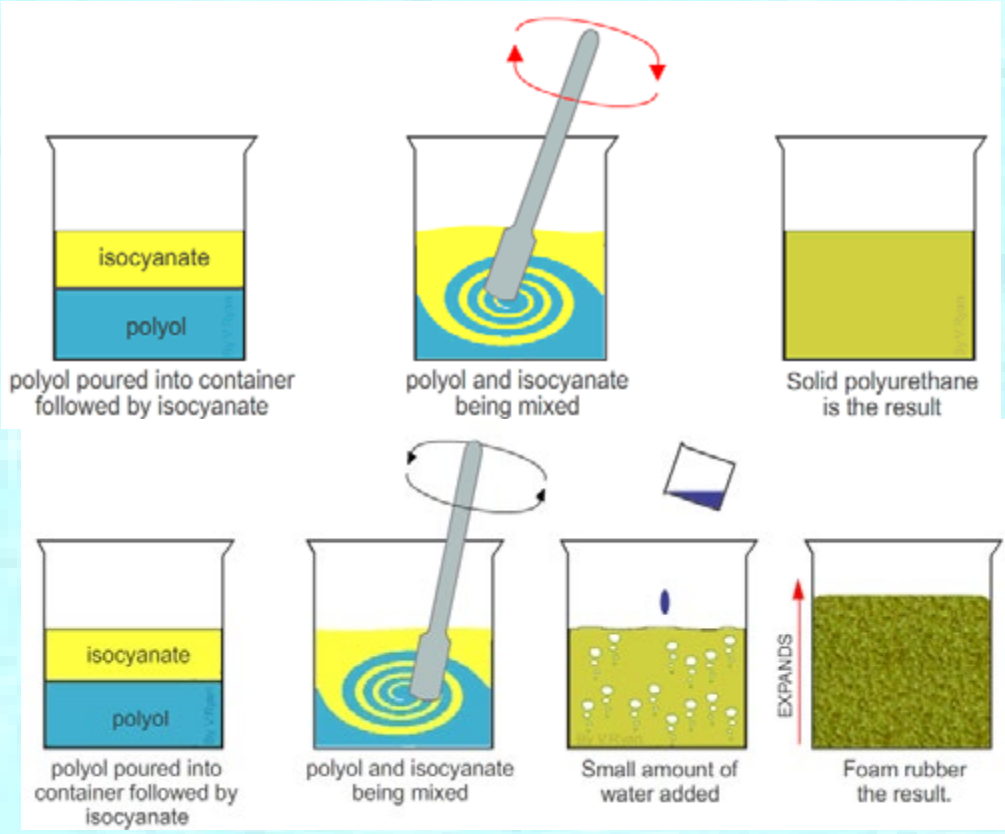

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PROPERTIES OF POLYURETHANE

Polyurethanes can be either thermoplastics or thermosetting. Polyurethane can be cast and injection moulded, as it is a resin. It is long lasting and out performs many other materials in harsh environments. It performs well in high temperatures, although can be damaged / attacked by most solvents. It has low heat transfer / conductivity, consequently a good insulator. Polyurethane has high resistance to abrasion. It can be manufactured in a range of colours.

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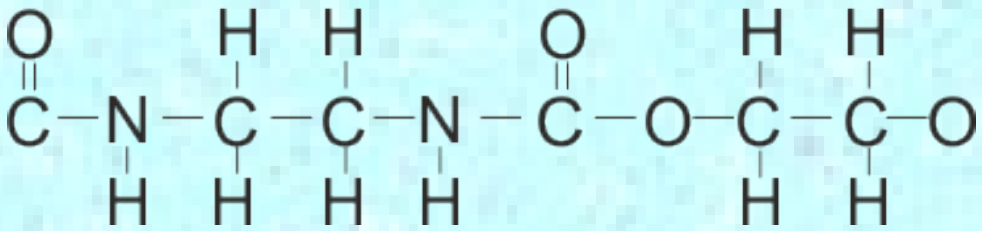
POLYURETHANE - FORMULA



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PROPERTIES OF FOAM RUBBER

Foam Rubber is lightweight and flexible. It can be manufactured as a very light foam ideal of cushions or as a dense rigid material ideal for the trays. It is used to manufacture a range of comfy and rigid products. It resists impacts and is often used as protective packaging inserts. An excellent acoustic insulator, as it absorbs sound. It resists temperatures of up to 200 degrees and consequently can be used to reduce sound from car engines. It performs well in high temperatures, although can be damaged / attacked by most solvents. It has low heat transfer / conductivity, consequently a good insulator.

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POLYURETHANE PRODUCTS

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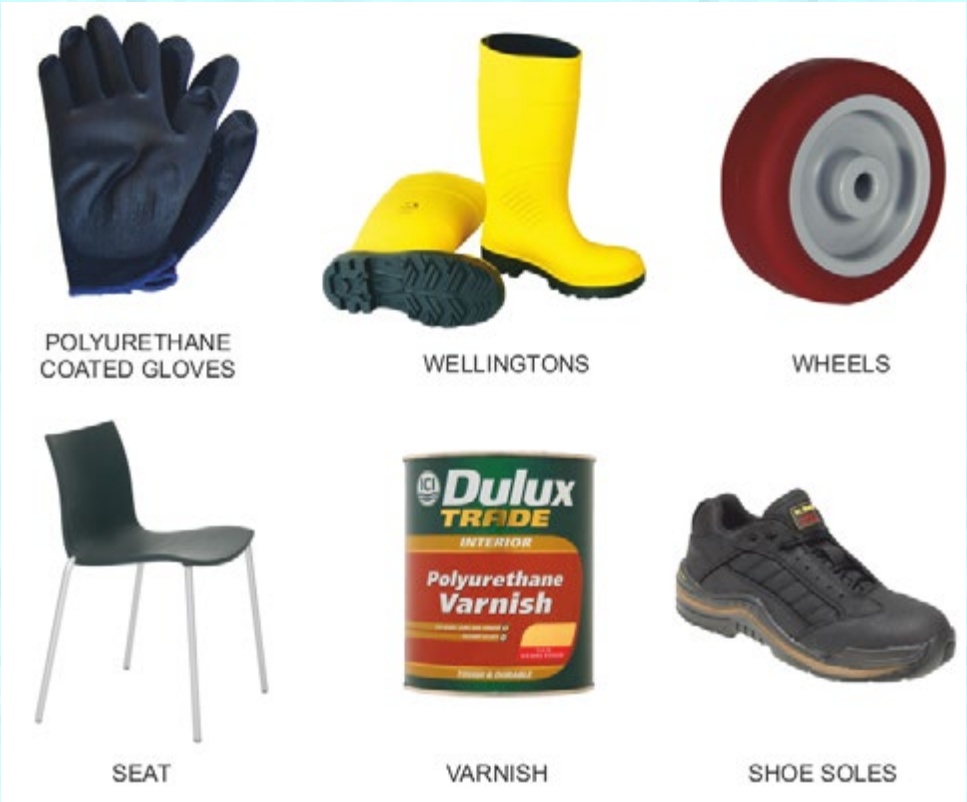

WELLINGTONS, SEATS, VARNISH, SHOE SOLES, WHEELS

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FOAM RUBBER PRODUCTS

Tap the image for more information

PIPE INSULATION – CUSHIONS / PADDING, PROTECTIVE PACKAGING, PILLOWS, SOFT TOYS

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