

Extrusion moulding

Everyday examples of extrusion can be seen when toothpaste is squeezed out of a tube, icing is pushed out of an icing bag and "Playdo" shapes are made. Extrusion moulding of plastics is used to make any long shape that has a constant cross section. Pipes, gutters, window sections and decorative trims can all be made using the process.

Thermoplastics such as PVC (polyvinylchloride), LDPE (low-density polyethylene, or polythene), HDPE (high density polyethylene) and PP (polypropylene) can all be extruded. Thermoplastics are pliable when they are heated but form a rigid shape once cooled.

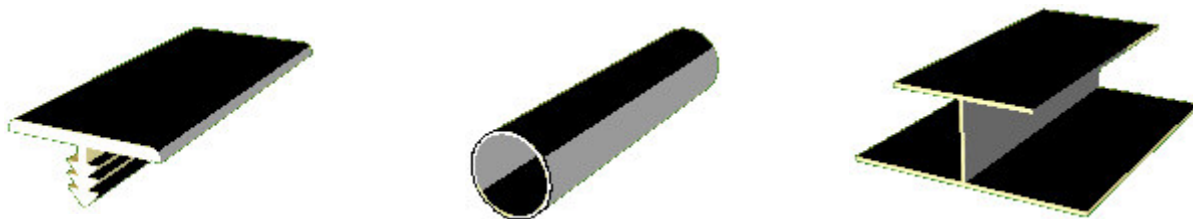
Perhaps most common plastic extruded is PVC. Hard, "unplasticised" PVC (PVC-u) can be used in pipes for water, sewage and gas. They may be drilled, joined or cut to give the final product. A PVC-u window frame consists of extruded sections that are joined to make the shape of the frame. Soft, "plasticised" PVC can be used for flexible bags and tubing such as in a blood transfusion, or in more common applications such as garden hoses.

The extrusion process begins with the plastic polymer in a granule or powder form. A funnel, or hopper, feeds this into the heating chamber of the extruder. The polymer melts as it is heated to temperatures typically above 200°C. Once molten, a screw-mechanism pushes the melted polymer through the shaped "die head" which forms the plastic into shape. As it leaves the extruder, the plastic is cooled by water or air to give the final form. Flexible products, like tubing, may be coiled whilst rigid plastics, such as window-frame sections, will be cut to length.

Common examples are:

- Insulated coating for wires and cables.
- Monofilament: for rope, bristles and synthetic textile fibres.
- Flat plastic sheets for signs, refrigerator interiors, glazing and lighting applications.
- Pipes and tubing used for hoses, water, gas, sewers and drains.
- Window and door frames are made up of unplasticised PVC which has a cross section designed to contain air gaps or chambers to give the necessary thermal and sound insulation.

Examples of extruded sections



Classroom contexts

These questions may provoke some discussion, or suggest further activities, within the classroom. Scroll down below the curriculum links for some suggested answers.

- Not all plastic objects are made in the same way. Which common ones cannot be made by extrusion moulding.
- What other materials can be used to make pipes, window frames and guttering?
- Thermoplastics melt at very high temperatures. What materials melt at much lower temperatures?
- PVC can be used to make hard or soft pipes. When are soft pipes useful and when are hard pipes useful.

Links to the Primary Science National Curriculum

Key stage 2

Sc3 - 1a
(Materials) To compare everyday materials and objects on the basis of their material properties.

Sc3 - 2b
(Materials) To describe changes that occur when materials are heated or cooled.

Not all plastic objects are made in the same way. Which common ones cannot be made by extrusion moulding.

Extrusion moulding is good for making shapes that have a constant cross-section. Look at the examples above. Other forms of moulding are used to make plastic items that are irregular. For example, a plastic lemonade bottle is made by a process called "blow moulding". Examples of other irregular plastic items are television casings, food trays, mobile telephone covers and disposable plastic cups.

What other materials can be used to make pipes, window frames and guttering?

Traditional materials for pipes includes lead, steel, copper and cast iron. Guttering can be made out of steel or even cast iron in older houses. Window frames are also made from wood.

Thermoplastics melt at very high temperatures. What materials melt at much lower temperatures?

Common examples include ice ("solid water"), chocolate, margarine and butter.

PVC can be used to make hard or soft pipes. When are soft pipes useful and when are hard pipes useful?

Utilities pipes (gas, water and sewage) are buried in the ground and need to be able to withstand the weight of soil without getting crushed. Plumbing and central heating pipes also need to be able to withstand any areas where they may be exposed to being squashed. These pipes are unplasticised and rigid.

"Soft" pipes are more suitable for applications where a degree of flexibility is required. Tubes used in medical applications and flexible hoses contain plasticisers which allow them to be pliable.