19CH201 ENGINEERING CHEMISTRY

UNIT-4 HIGH POLYMERS

INJECTION MOULDING is a manufacturing process for producing parts by injecting molten material into a mould, or mold. Injection moulding can be performed with a host of materials mainly including metals (for which the process is called die-casting), glasses, elastomers, confections, and most commonly thermoplastic and thermosetting polymers. Material for the part is fed into a heated barrel, mixed (using a helical shaped screw), and injected into a mould cavity, where it cools and hardens to the configuration of the cavity. After a product is designed, usually by an industrial designer or an engineer, moulds are made by a mould-maker (or toolmaker) from metal, usually either steel or aluminium, and precision-machined to form the features of the desired part. Injection moulding is widely used for manufacturing a variety of parts, from the smallest components to entire body panels of cars. Advances in 3D printing technology, using photopolymers that do not melt during the injection moulding of some lower temperature thermoplastics, can be used for some simple injection moulds.

Parts to be injection moulded must be very carefully designed to facilitate the moulding process; the material used for the part, the desired shape and features of the part, the material of the mould, and the properties of the moulding machine must all be taken into account. The versatility of injection moulding is facilitated by this breadth of design considerations and possibilities.

APPLICATION OF INJECTION MOLDING

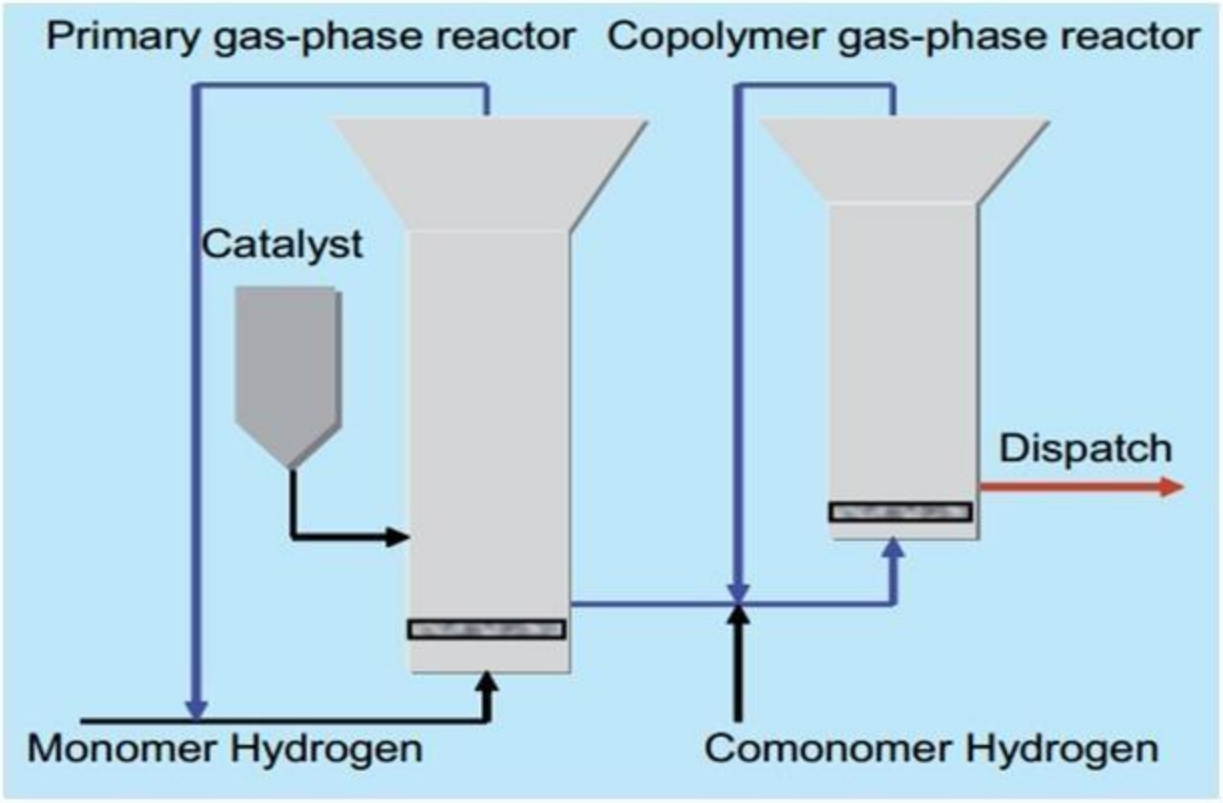
Injection moulding is used to create many things such as wire spools, packaging, bottle caps, automotive parts and components, toys, pocket combs, some musical instruments (and parts of them), one-piece chairs and small tables, storage containers, mechanical parts (including gears), and most other plastic products available today. Injection moulding is the most common modern

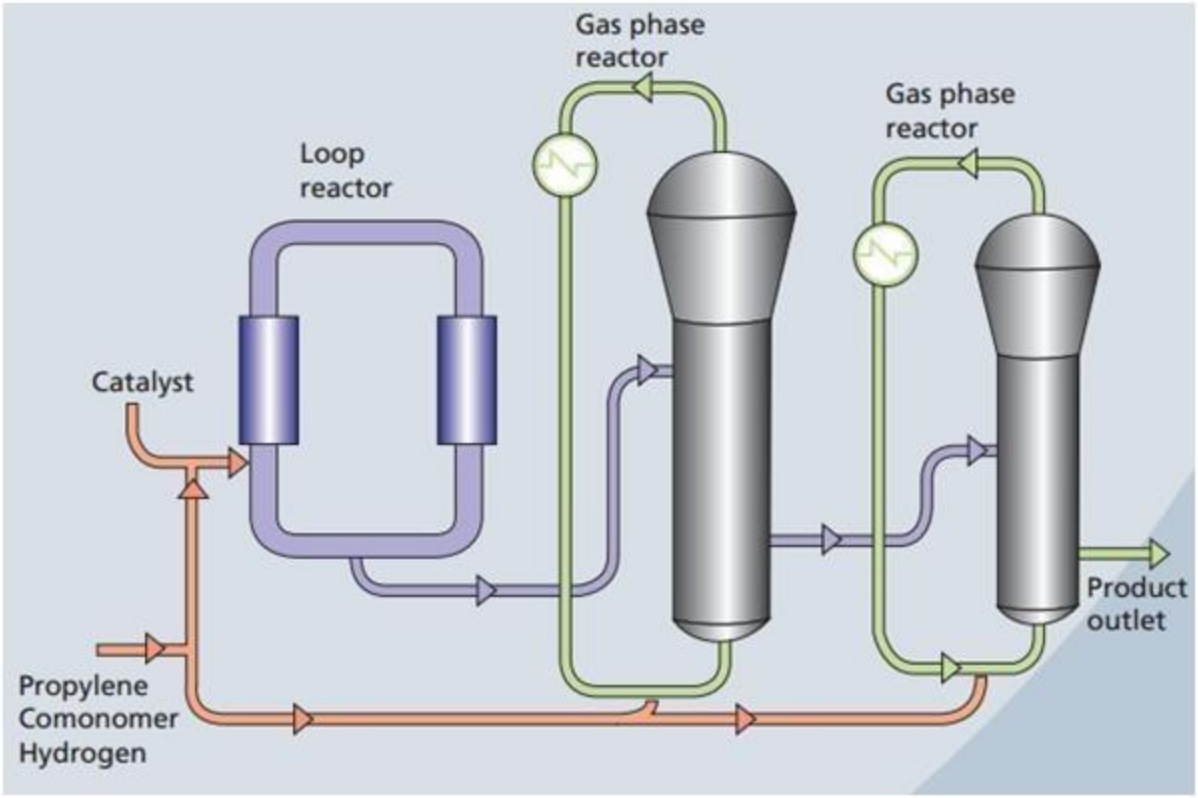
method of manufacturing plastic parts; it is ideal for producing high volumes of the same object.

FABRICATION PROCESS

Polypropylene is currently one of the fastest growing polymers. Much of this growth is attributed to polypropylene's ability to displace conventional materials (wood, glass, metal) and other thermoplastics at lower
cost. Polypropylene (PP) is a tough, rigid plastic and produced in a variety of molecular weights and crystallinities.
Polypropylene is made from the polymerization of propylene gas in the presence of a catalyst system, usually Ziegler-Natta or metallocene catalyst. Polymerization conditions (temperature, pressure and reactant concentrations) are set by the polymer grade to be produced.

Various production processes exist with some general similarities. They are taking place either in a gas-phase (fluidized bed or stirred reactor) or a liquid-phase process (slurry or solution). An example of flow diagram corresponding to each of the two types of processes is illustrated in figure 1 bellow. The gas-phase polymerization is economical and flexible and can accommodate a large variety of catalysts. It is the most common technology in modern polypropylene production plants. Relevant technologies are Novolen®, Unipol® (gas-phase processes), Borstar® and Spheripol® (liquid-phase processes).


Primary gas-phase reactor
Copolymer gas-phase reactor
Catalyst
Dispatch
Monomer Hydrogen
Comonomer Hydrogen


Gas phase
reactor
Gas phase
reactor
Loop
reactor
Catalyst
Product
outlet
Propylene
Comonomer
Hydrogen