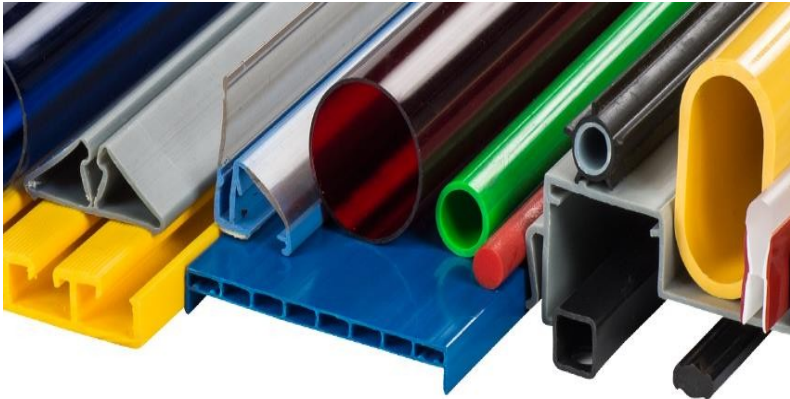


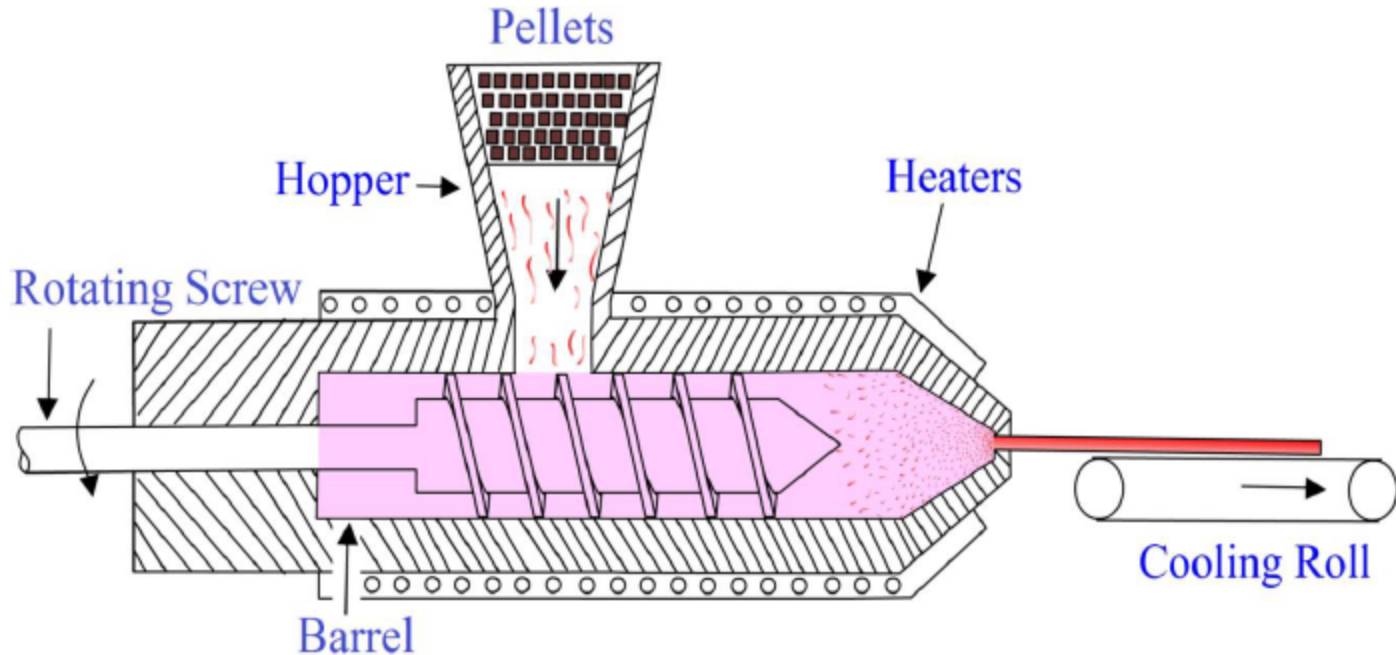
Extrusion



Extrusion

- Extrusion is a high volume manufacturing process.
- Plastic material is melted with the application of heat and extruded through die into a desired shape.
- A cylindrical rotating screw is placed inside the barrel which forces out molten plastic material through a die.

Extrusion Process Set-up



Extrusion Process

- Plastic material in the form of pellets or granules is gravity fed from a top mounted hopper into the barrel of the extruder.
- Additives such as colorants and ultraviolet inhibitors can be mixed in the hopper.

Extrusion Process Cont..

- Plastic material enters through the feed throat and comes into contact with the rotating screw.
- The rotating screw pushes the plastic beads forward into the barrel which is heated by using the heating elements up to melting temperature of the plastic.

Extrusion Process

Cont.

- The plastic material is completely melted in the melting zone.
- A thermostat is used to maintain the inside temperature of the barrel.
- The overheating of plastics should be minimized which may cause degradation in the material properties.
- A cooling fan or water cooling system is used to maintain the temperature of the barrel during the process.

Extrusion Process Cont..

- At the front of the barrel, the molten plastic leaves the screw and travels through a screen pack to remove any contaminants in the molten plastic.
- The screens are reinforced by a breaker plate. The breaker plate assembly also serves to create back pressure in the barrel.

Extrusion Process Cont..

- The back pressure gives uniform melting and proper mixing of the molten plastic material into the barrel.
- After passing through the breaker plate, molten plastic enters into die.

Extrusion Process

Cont..

- An uneven flow of molten plastic would produce unwanted stresses in the plastic product.
- These stresses can cause warping after solidification of molten plastic.
- Plastics are very good thermal insulators and therefore it is very difficult to cool quickly.
- The cooling of plastic product is achieved by pulling through a set of cooling rolls (water or air cooling).

Extrusion Process Animation

Source:

https://www.youtube.com/watch?v=qn16JtE_vLc

Process Parameters

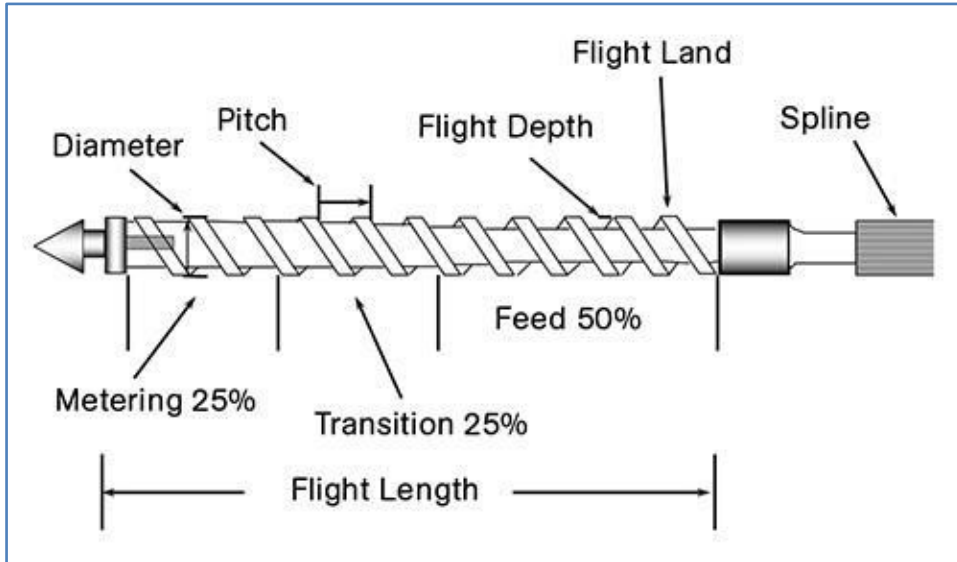
- Melting temperature of plastic
- Speed of the screw
- Extrusion pressure required
- Types of die used
- Cooling medium

Screw Design

The rotating screw has three different functions:

- 1) Feeding mechanism.
- 2) Uniform melting and mixing of plastic.
- 3) Generates the pressure to push the molten material through die.

Screw Design



- Different zones in a screw length:

- 1) Feed zone
- 2) Melting zone
- 3) Metering zone

Materials Used

Different types of plastic material that can be used in extrusion process are:

Polyethylene, Polypropylene (PP), Acrylic, Nylon (Polyamides), Polystyrene, Polyvinyl Chloride (PVC), Acrylonitrile Butadiene Styrene (ABS) and Polycarbonate.

Applications

The extrusion process is used for manufacturing:

Rods, plates and tubes, wire and cable coating, hose liners, hose mandrels, filaments, sheets, multilayer film, medical packaging and food packaging, etc.

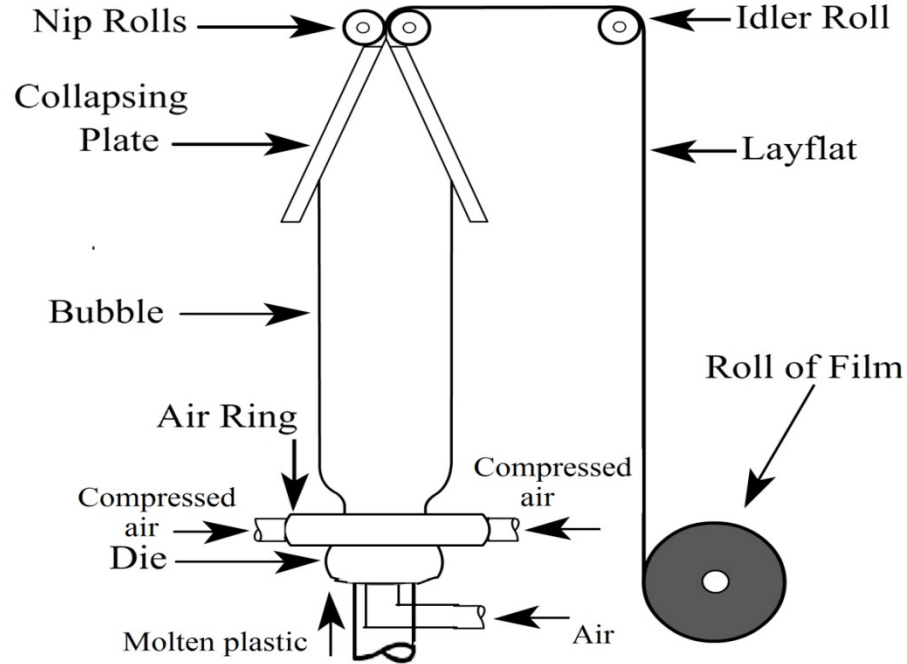
Advantages

- High production volume
- Relatively low cost as compared with other molding process
- Design flexibility
- Short lead times
- Coating of wire can be done
- Continuous part can be produced

Limitations

- Limited complexity of parts
- Uniform cross section can only be produced

Blown Film Extrusion



Blown Film Extrusion Cont..

- The die is like a vertical cylinder with a circular profile.
- The molten plastic is pulled upwards (up to 4 to 20 meters) from the die by a pair of nip rollers.
- The compressed air is used to inflate the tube around the die.
- In the centre of the die there is an air inlet from which compressed air can be forced into the centre of the circular profile and hence tube creating a bubble.
- The extruded circular cross section may be increased 2-3 times of the die diameter.

Blown Film Extrusion Cont..

- The bubbles are collapsed with the help of collapsing plate.
- The nip rolls flatten the bubble into a double layer of film (called lay-flat)
- The wall thickness of the film can be controlled by changing the speed of the nip rollers.
- The lay-flat can be spooled in the form of roll or cut into desired shapes.
- Bottom side of the lay-flat is sealed with the application of heat, and cut across further up to form opening; hence it can be used to make a plastic bag.

Blown Film Extrusion Animation

Source:

https://www.youtube.com/watch?v=qn16JtE_vLc