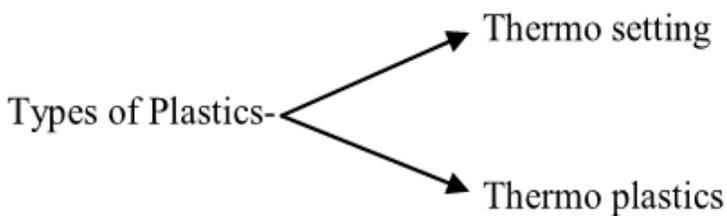


## PLASTICS

### PROPERTIES OF PLASTICS:

1. Light weight
2. Corrosion resistant
3. Electric resistance
4. Low thermal conductivity
5. Variety of optical properties
6. Formability
7. Surface finish
8. Comparatively lower cost



### THERMOSETTING

1. Once set or cured they cannot be melted and shaped again.
2. They are made of thermosetting resins.
3. A cross-linked material is thermo set
4. Thermosets possess better properties such as improved resistance to heat, less creep, better chemical resistance, etc.
5. These require a more complex process to produce a part, rod, sheet, or tube.
6. Typical plastics of the thermosetting family are epoxies, polyurethanes, and urea formaldehyde.

### THERMOPLASTIC

1. Soften by heat, retain chemical composition.
2. Are capable of repeated softening by heating and hardening on cooling.
3. The linear materials are thermoplastic.
4. They have less resistance to heat and chemicals and high creep, like in nylons.
5. Different shapes can be produced easily.
6. Typical of the thermoplastic family are based on polyethylene, polypropylene, polyvinyl chloride, etc.

## PROCESSING OF PLASTICS:

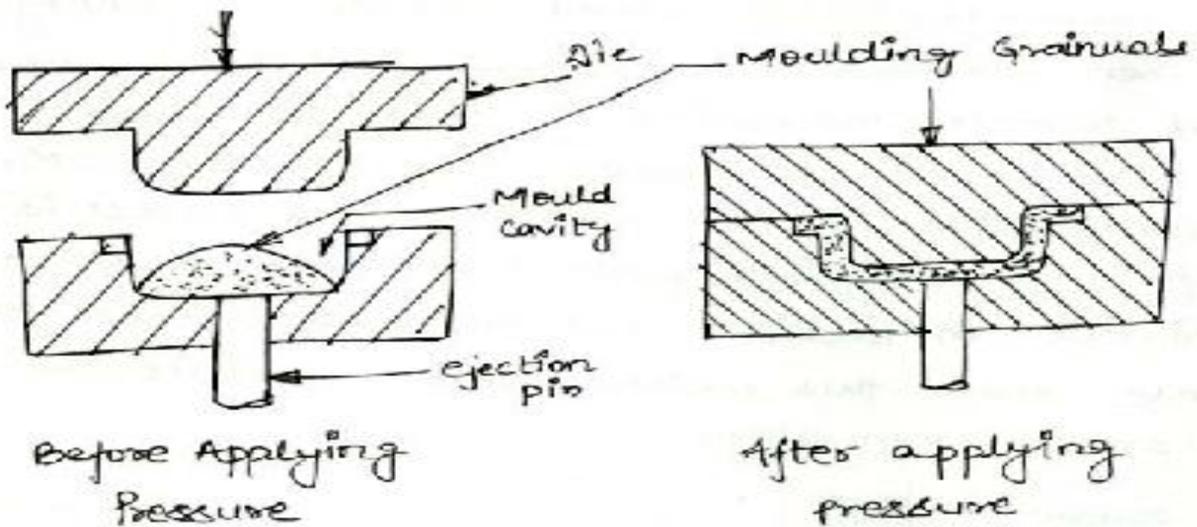
### 1. Moulding processes

- a. Compression moulding
- b. Transfer moulding
- c. Injection moulding
- d. Blow moulding

### 2. Extrusion

### 3. Casting

#### 1) a) COMPRESSING MOULDING:

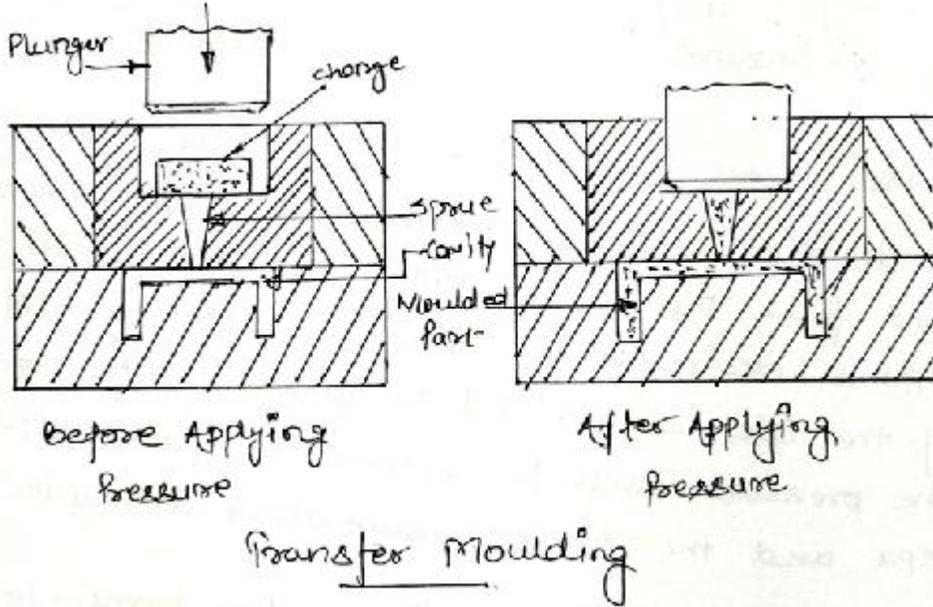


Compression moulding is the process in which the powder or granular form of thermosetting material can be moulded.

The process is shown in figure. The upper half of the die compresses the material which melts and fills the die cavity. The part solidifies into a desired shape then the upper half of the die is removed to take out the part. The pressure used to compress is around 0.7-55 MPa and the temp is somewhere around 120-200<sup>o</sup> c

**Application-** Electrical switches fuse boxes, electrical equipment, microwave containers etc.

## b) TRANSFER MOULDING:



Transfer moulding (also known as gate moulding or extrusion moulding) is a form of compression moulding. In this method, the moulding powder (charge) is heated to the plastic stage and then forced into a mould with a plunger. After the thermoplastic is cured inside the cavity, it is then removed. The difference between compression and transfer moulding is that the curing time for the TM is usually less than the CM. The loading time is also shorter. This process is usually preferred for producing parts that have a large variation in section, but the cost of the die and sprue makes this method more expensive than compression moulding.

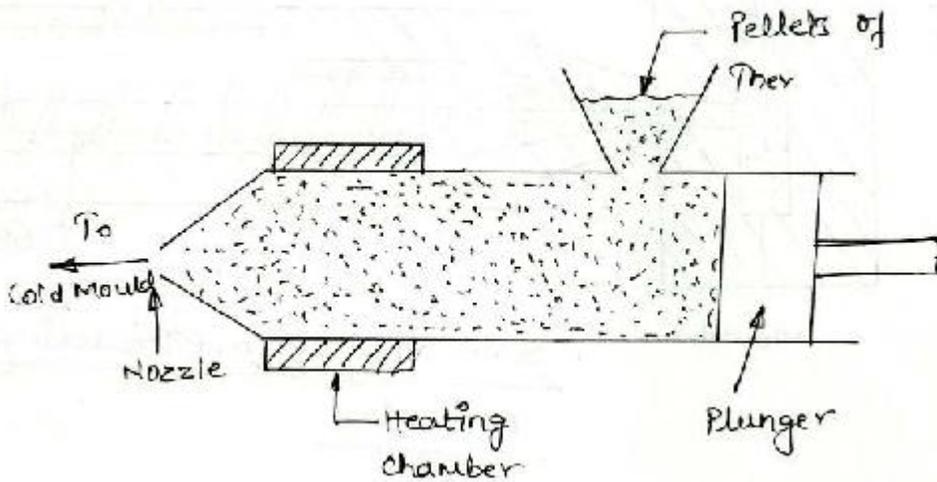
### Advantages:

- This process provides relatively close tolerances and fairly uniform density.
- High production rate.
- Medium tooling cost.

### Limitations:

- The transfer moulds are complex and more costly to build.
- Loss of material as scrap.

### c) INJECTION MOULDING:



This process is very commonly used for thermoplastics.

The pellets of thermoplastics are first compressed in the pressure chamber and then pushed into heating chamber. The melted material in the flowing state is then forced with pressure through a nozzle into a cold mould having cavity of desired shape plastics articles of intricate shapes can be formed in these cavity moulds. The following methods are used to inject the molten plastic into the mould-

- Screw injection moulding
- Plunger injection moulding
- Two stage injection moulding

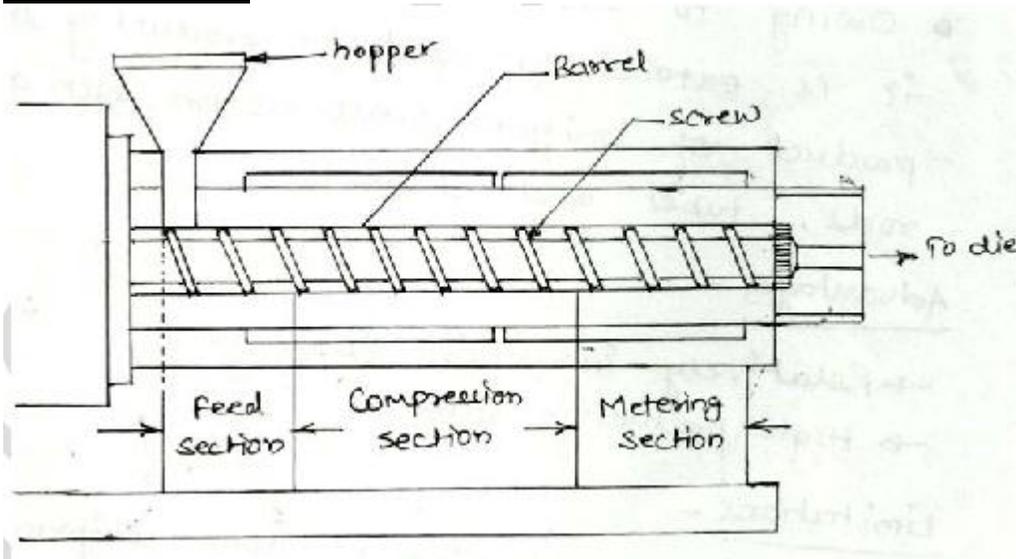
#### Advantages:

- It gives a good surface finish.
- It is used for very complex moulding.
- Economically for mass production.

#### Applications:

- CD cases, mobile phones safety helmets.
- Television cabinets, telephone headsets etc.

### 2) EXTRUSION:-



Extrusion is like squeezing toothpaste out of its tube this continuous process is used for the production of semi finished goods such as tube and pipes. They are turned semi finished because they may be further processed.

### **Working**

1. The powdered raw material, usually thermoplastic, is fed into a hopper and carried along by a screw conveyor through the heating chamber
2. The material is leaving the die rests on a moving conveyor and is cooled by air or water spray to retain the shape of die opening.
3. Owing to continuous nature of process it is extensively used for producing long product of uniform cross-section such as rods, tubes and channels.

### **Advantages-**

- Relatively inexpensive cooling
- High production rate.

### **Limitations-**

- Suitable for forming of long uniform sections
- High production volume is required
- Dimensions accuracy is not very good.

### **WELDING OF PLASTICS:-**

Mechanical fast, and adhesives cannot employed to form joint b/w engineering plastics Mechanical fasteners do not provide leak tight joint and the adhesives take too long time to cure. Welding can be used to produce joints with mechanical properties that approach those of parent mechanical properties that approach those of parent material Welding is confined to thermoplastic polymers because these materials can be resorted by heat . The heat required for welding thermoplastic. Polymers is less than that required for metals. Plastic welding process can be divided into two groups.

(1) Process involving mechanical movement like ultrasonic welding friction and vibration welding

(2) Process involving external heating like hot plate welding hot gas welding resistive welding etc.

### PROCESS INVOLVING MECHANICAL MOVEMENT:-

#### a) ULTRASONIC WELDING:

This types of welding requires he conversion of low frequency electrical power to high frequency mechanical vibrations that are applied to thermoplastic components. When the plastic melts, the components are joints in a fusion bond. The tools for this purpose are quite expensive so large volume production runs are preferred.

#### Applications:

Valves and filters used in medical equipment, automotive components etc.

#### Advantages :

- Ultrasonic welds can also be mode in dissimilar parts.
- Lap and tee spot joints are made best of all.
- Neither edge preparation nor filler material is needed.

#### b) FRICION WELDING:

- Rotatory member brought up to speed
- Rotator member advances into contact under axial load.
- Rotator contact pressure maintained or increase for specified period to product weld.

#### Description –

\_The friction welding of thermo plastics is also known as spin welding one of the component is fixed and other is rotated with a controlled angular velocity when the pars are pressed together frictional heat is causes the plastic to melt and weld is created on cooling.

#### Advantages

- High weld quality.
- Simplicity of the process.
- It is suitable for applications in which at least one of the components is circular.

#### c) VIBRATION WELDING:

This process is also called linear friction welding. Two thermoplastics parts are rubbed together under pressure and at a suitable frequency and amplitude until enough heat is generated to melt the polymer after vibration are stopped the parts are aligned and the molten polymer is allowed to solidify creating the weld. Thos process is similar to spin welding except the motion is liner rather than rotation the process is rapid and quick.

#### Advantages-

Ability to weld large complex liner joints at high production rates. This process has found its applications in the automobile and domestic industry.

## **Process Involving External heating:-**

### **a. Hot plate Welding :-**

It is the simplest of the mass production techniques to joint plastics a heated plate is clamped b/w the surface are brought together again under controlled pressure for a specified period. The fused surfaces are allowed to cool to form a joint the welding tool or heaters to prevent the plastics sticking to it .Temp are generally 180-230°c process is commonly used to weld the built ends of the plastic pipes used in gas or water distribution, sewage etc. **Applications:** Vacuum cleaner housing components of washing machine automotive parts such as indicator light etc.

**Draw back:** It is slow process

### **b. Hot gas welding :-**

This is similar to oxy-acetylene welding of metals. The only difference is that oxy –acetylene flame is replaced by a stream of hot gas compressed air  $N_2$ , H or  $CO_2$  is heated by an electrical coils as it passed through a welding is a fabrication process for thermoplastic materials.

#### **Applications:-**

Chemical storage vessel, repair of plastic moulding such as bumpers  $N_2$  is used for oxygen sensitive plastic such as polyethylene. Compressed air is popular since it gives satisfactory result for many purposes and is cheap.

**Advantage:-** Large complex fabrication can be constructed.

## **NEW METHODS:-**

### **Laser Welding:**

This is suitable for joining both sheet film and moulded thermoplastics. It used a laser to melt the plastic in the joint region. The laser generates an intense beam of radiation which is focused on to the material to be joint laser welding is a high volume production process with the advantage of creating no vibration and is specially effective in the welding of thermoplastics films in a lap joint .

**Application:-** Food packaging , Medical devices.

**Thank you**

**Question session**

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