

Manufacturing Presentation (Group 9)



Moulding of Thermosets

Group 9:

| Sujal Singh | Divyanshi Panchal | Priyanshu Raj |
| Chitransh Koshta | Prashant Pulkit |

Submitted to:

Mr. Rajendra Prasad

Enrollment Numbers:

0{41-45}19051723

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Thermosets

- 1 **Plastics** which are set under the application of **heat** and/or **pressure**.
- 2 Thermosets harden when they are heated, if heated further they will breakdown chemically and lose their properties.
- 3 The process is **not reversible**, hence thermosets can not be recycled.
- 4 They consist of **3D network structures** based on strong covalent bonds to form rigid solids & linear molecular chains are connected by weak secondary bonds.

Thermosets

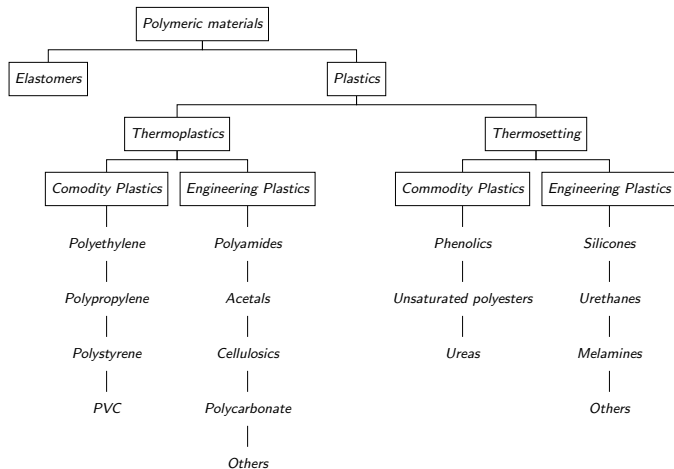


Figure 1: Classification of the different polymeric materials

Thermosets

- **Epoxies**

- ▶ **Characteristics:** Excellent combination of mechanical properties and corrosion resistance, dimensionally stable, good adhesion, relatively inexpensive, good electrical properties.
- ▶ **Applications:** Electrical mouldings, sinks, adhesives, protective coatings, used with fiberglass laminates.

- **Phenolic**

- ▶ **Characteristics:** Excellent thermal stability to over 150°C, may be compounded with a large number of resins, fillers, etc., inexpensive.
- ▶ **Applications:** Motor Housing, telephones, auto distributors, electrical fixtures.

- **Polyester (PET or PETE)**

- ▶ **Characteristics:** One of the toughest of plastic films, excellent fatigue and tear strength, and resistance to humidity acids, greases, oils and solvents.
- ▶ **Applications:** Magnetic recording tapes, clothing, automotive tire cords, beverage containers.

Moulding Process

- This process is used mostly for thermo-setting polymers.
- In compression moulding, the raw material is placed inside the mould in semi-solid (i.e., as granules, or a single piece called a plug). The mould is heated and closed using pressure, and the plastic flows to fill the cavity.
- If the part shape is more complex, transfer moulding may be used. Here, the charge are placed in a heated cylinder till they are soft, a hole at the bottom of the cylinder is connected to the die cavity by a sprue.
- A plunger pushes the semi-solid plastic into the die through the sprue, using high pressure.

Compression Moulding

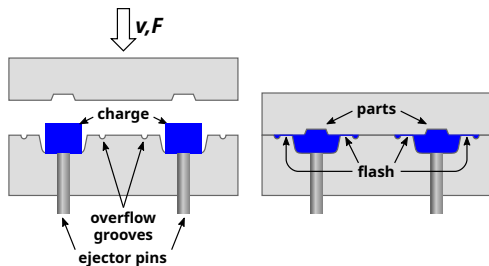


Figure 2: Compression Moulding

- A compression mould is made of two halves with one each being connected to the platens of the press.
- The mould is electrically heated to maintain the required temperature.
- Material is placed in the mould, and it is closed with a hydraulic cylinder, or toggle clamp.

Compression Moulding

- The pressure maintained on the material is of the order of 14 to 40 MPa of moulding area.
- As the material comes in contact with the heated mould surface, it softens and fills the entire cavity and at the same time intimates the chemical reaction which cures the part.
- Cure time is determined by the thickest cross-section, mould temperature, material type and grade.
- The most widely used plastic is phenol-formaldehyde, commonly known as '**Bakelite**'.

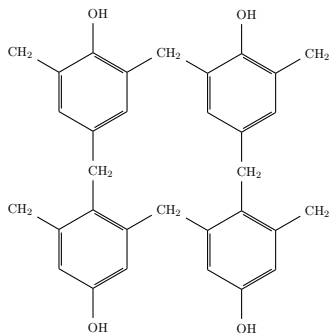


Figure 3: Bakelite

Transfer Moulding

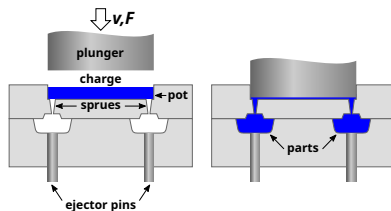


Figure 4: Transfer Moulding

- Transfer moulding is a manufacturing process where casting material is forced into a mould.
- This is similar to compression moulding but the main difference is that in compression the mould is enclosed whereas in transfer the mould is open to the fill plunger resulting in higher dimensional tolerances.
- Thermoset polymer and epoxy resins are some materials which are used in transfer moulding.

Transfer Moulding

Process:

- The pre-heated, uncured compound is placed in the transfer pot.
- The mould is closed up and under hydraulic pressure, the moulding compound is forced through a small hole into the cavity.
- The mould is held closed while the moulding compound is cured (thermosets) or cooled (thermoplastics).
- The mould is then split to free the product, with the help of ejector pins.
- Any flash or sprue material is trimmed off.

References

- Manufacturing Technology: Foundry, Forming and Welding – P N Rao
- [Wikipedia](#)

The End

Thank You.