

Extrusion Process

Basic working principle of extrusion: Extrusion is the process in which the metal is forced to flow through a shaped opening or die, so that metal will take the shape of the opening. The operation of extrusion is similar to squeezing of the tooth paste tube as a result the tooth paste comes out in the shape of the opening. The heated metal is placed in the cylinder and pressure is applied by ram, while keeping a dummy block in between. The metal is forced to pass through the die/ orifice opening.

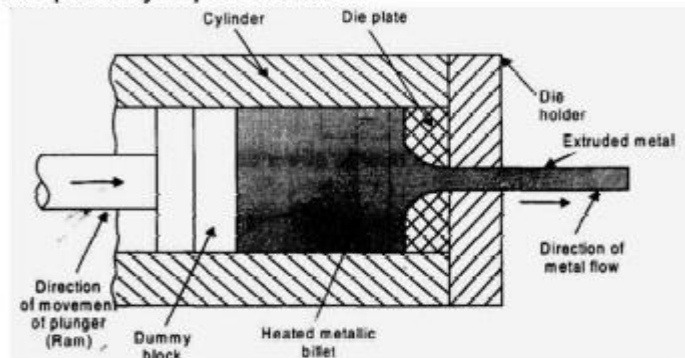
Extruded Shapes/Applications: (Examples of extruded products)

- a. Rods, tubes, splined shafts, structural sections and bars of different cross sections.
- b. Almost any length can be produced but with constant cross section only.
- c. tubes such as shaving cream, tooth paste by impact extrusion.

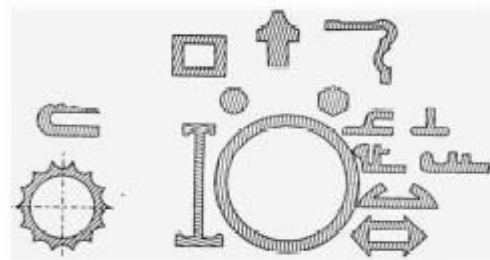
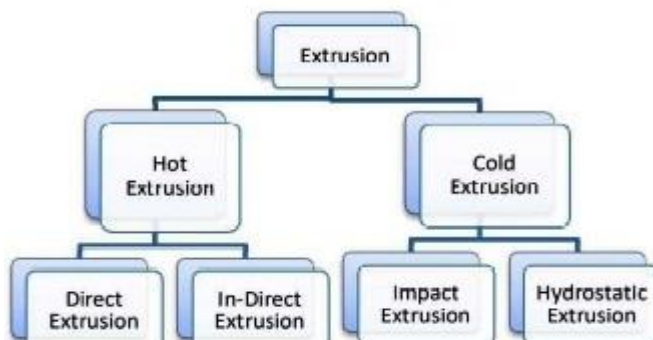
(1) Direct extrusion OR forward extrusion: If the direction of extruded product is same as the direction of force application then the extrusion is called as **direct extrusion**.

Direct Extrusion

The different cross sections which can be produced with extrusion process are shown as:

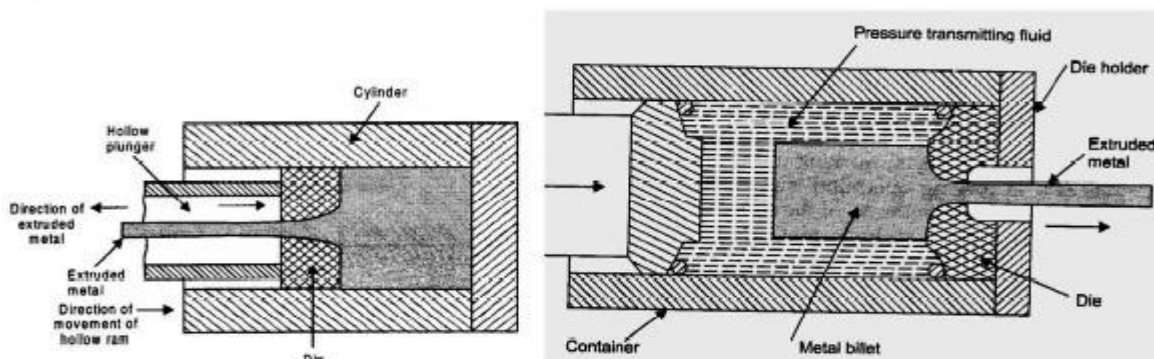


Classification Extrusion can be classified as:



Examples of extruded products

(2) In-Direct extrusion OR backward extrusion: If the direction of extruded product is opposite to the direction of force application then the extrusion is called as **In-Direct extrusion** as shown in figure:

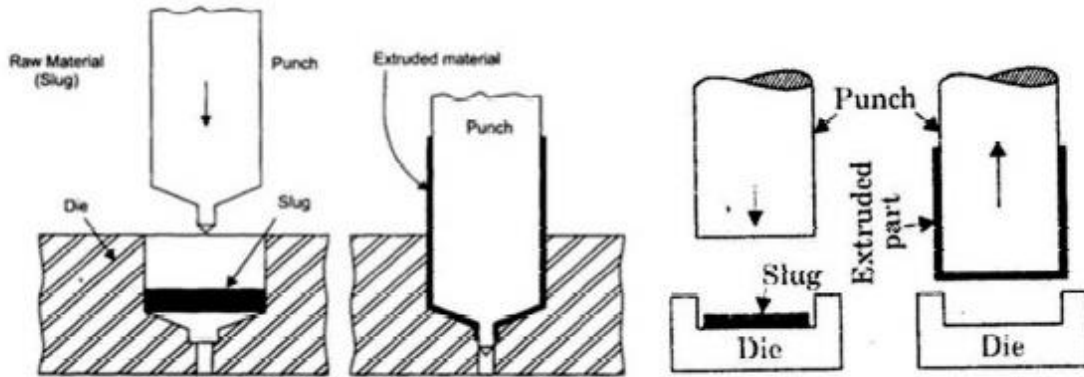


In-Direct extrusion

Hydrostatic Extrusion

(3) Hydrostatic extrusion: In this type of extrusion the force is applied indirectly using a liquid medium and force is uniformly applied because of presence of fluid/liquid. The difficult to extrude materials can be extruded by this method and the process is schematically shown in the figure.

(4) **Impact extrusion:** Impact extrusion is most suitable for producing collapsible tubes of soft materials, aluminum and copper etc. This may be tooth paste tubes and cans etc. The impact extrusion is performed using a punch and die as shown in the figure. The material is placed in the die and punch is struck from top with high pressure and speed, the metal flows up and forms cup shape over the punch which is removed from the punch using the compressed air.



Figures showing the process of impact extrusion for tooth paste tube and cup shape

Comparative merits and demerits of different types of extrusion

| Direct extrusion | In-Direct extrusion | Impact extrusion | Hydrostatic extrusion |
|-------------------------------------|--------------------------------------|--------------------------------------|--|
| Problem of friction is dominant | Problem of friction is eliminated | High speeds are involved | No Problem of friction |
| High force is required | Less force is required | Applicable to soft materials only | Difficult to extrude materials may be worked |
| Lubricants are required | Ram gets weakened | | Additional Lubricant is not required |
| Brittle material cannot be extruded | Brittle materials cannot be extruded | Brittle materials cannot be extruded | Brittle materials may be extruded |

References:

1. 'Manufacturing Technology by P.N. Rao, Tata McGraw Hill, New Delhi
2. 'Production Technology' by R K Jain, Laxmi Publisher
3. Ghosh A. and Mallik A. K., Manufacturing Science, EWP Pvt. Ltd
4. <http://nptel.ac.in/courses/112107144/12>