# EXTRUSION AND TYPES

## Introduction:

Extrusion is a metal working process in which cross section of metal is reduced by forcing the metal through a die orifice under high pressure.
It is used to produce cylindrical bars, tubes and sections of any regular or irregular types. Forces required to extrude a metal are quite high and hence hot extrusion is most widely done as deformation resistance of metal is low at high temperature. However, cold extrusion is also performed for soft metals like Aluminum, lead etc.

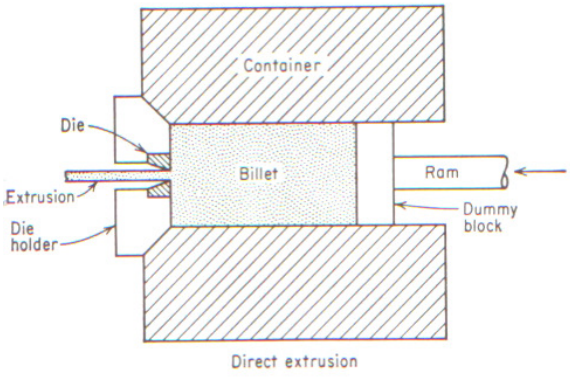
Difficult to form metals like stainless steels, nickel based alloys and high temperature metals can also be extruded.

History; Originally the principle of extrusion was applied to make lead pipe and lead sheathing of electrical cables.

## Types of Extrusion

### 1) Direct Extrusion

In this process, the metal billet is placed in a container and compressed and extruded through the die by a ram.



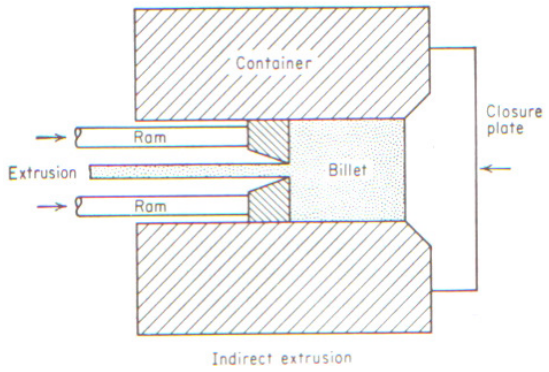

Some features of direct extrusion:

- Both the ram and extrusion move in the same direction.
- A dummy block or pressure plate is in contact with the billet and ram.

- The relative motion between billet and container wall develops high friction. Hence power required is relatively high.
- Brittle metals like Tungsten, Titanium alloys are difficult to extrude because they fracture during the process. Fractures occur because of rapid growth of micro cracks due to tensile stresses.

## 2) Indirect Extrusion

A hollow ram compresses metal through a die in a direction opposite to ram motion. Either the ram is moved against a stationery billet or the billet (hence container) is made to move against stationery ram.



Indirect extrusion

Some features of indirect extrusion:

- There is no relative motion between the billet and the wall of the container.
- Hence friction is lower and power required is relatively less.
- Limitation; Due to hollow ram, the load that can be applied is limited and only small sections can be extruded.

## 3) Tube extrusion

A mandrel is attached to the end of the ram as shown, which produces a hollow tube. The clearance between the mandrel and die wall determines the thickness of the tube

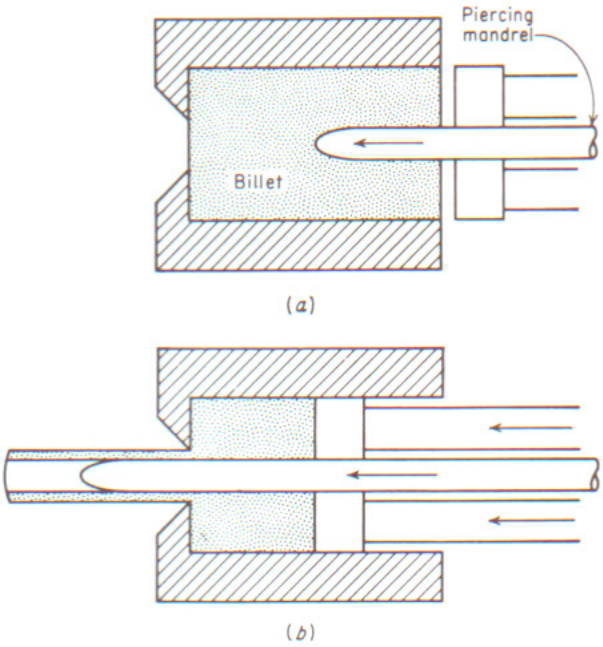



Fig.Tube Extrusion

To begin with, either a hollow billet is taken or a solid billet is first pierced through and then extruded.

## 4) Impact Extrusion

In this process a punch moves into the die and squeezes metal around the die cavity. It may have either direct or indirect extrusion arrangement.

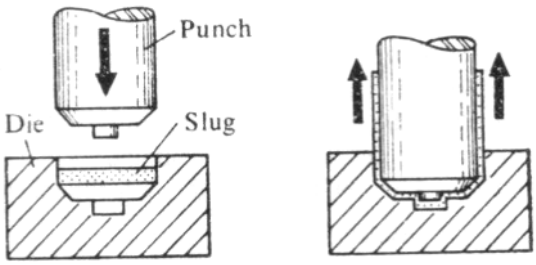



Fig. Impact Extrusion

It is useful to produce short lengths of hollow shapes like collapsible tooth paste tubes and thin walled cans.

It is usually a cold working process, but the high speed of deformation develops heating. The process is limited to soft metals like lead, tin, aluminum, copper.

## 5) Hydrostatic Extrusion

In this process the space between the ram plate and billet is filled with water. Hence billet is subjected to uniform hydrostatic pressure.

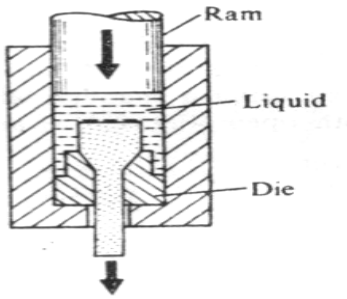



Fig. Hydrostatic Extrusion

Also, there is no direct contact between wall of container and work piece. Hence there is no container-billet friction. As a result, the curve of extrusion pressure v/s ram travel is nearly flat. Therefore, large length to diameter ratios are possible. eg coils of wire.

Advantages:

i) Lubrication is very effective.
ii) Extruded product has good surface finish and dimensional accuracy.
iii) It is possible to use dies with very low semi cone angle ( about 20 degrees) because friction is less.
iv) This reduces extrusion pressure and improves homogeneity of deformation.
v) Redundant deformation is minimized.

Limitations:

i) Hot working is not possible.
ii) Leakages of liquid are frequent due to high pressures involved ( upto 1.7GPa)
iii) Liquid used should not solidify at high pressure.
iv) Extrusion ratios possible ; 20:1 for mild steel, 200:1 for aluminum.

Source : http://elearningatria.files.wordpress.com/2013/10/mp3_unit6_extrusion_final.pdf