FORMING PROCESSES

- These are solid state manufacturing processes involving minimum amount of material wastage and faster production.
- In a forming process, metal may be heated to a temperature which is slightly below the solidus temperature and then a large force is applied such that the material flows and takes the desired shape.
- The desired shape is controlled by means of a set of tools called dies which may be completely or partially closed during manufacturing.
- These processes are normally used for large-scale production rates.
- These are generally economical and in many cases improve the mechanical properties too.

FORMING PROCESSES

Some of the metal forming processes are as follows:

- Rolling
- Drop Forging
- Press Forging
- Upset Forging
- Extrusion
- Wire Drawing
- Sheet Metal Operations

HOT WORKING AND COLD WORKING

- The metal-working processes are traditionally divided into **hot working and cold-working processes**. The division is on the basis of the amount of heating applied to the metal before applying the mechanical force.

- Those processes, working above the **recrystallisation temperature**, are termed as hot-working processes whereas those below are termed as cold-working processes.

- Under the action of heat and the force, when the atoms reach a certain higher energy level, the new crystals start forming which is termed as recrystallisation. Recrystallisation temperature as defined by American Society of Metals is "**the approximate minimum temperature at which complete recrystallisation of a coldworked metal occurs within a specified time**".

- The recrystallisation temperature generally varies between **one third to one half the melting point** of most of the metals. The recrystallization temperature also depends on the amount of cold work a material has already received. Higher the cold work, lower would be the recrystallisation temperature.

HOT WORKING AND COLD WORKING

- **Advantage of Hot Working**: As the material is above the recrystallisation temperature, any amount of working can be imparted since there is no strain-hardening taking place.

- **Limitations of Hot Working**:
  1) Higher temperatures of metal give rise to scaling of the surface and as a result, the surface finish obtained is poor.
  2) Because of the thermal expansion of metals, the dimensional accuracy in hot working is difficult to achieve since it is difficult to control the temperature of work pieces.
  3) Handling and maintaining of hot metal is difficult and troublesome.

- **Advantage of Cold Working**: Cold working increases the strength and hardness of the material due to strain hardening which would be beneficial in some situations.

- **Limitation of Cold Working**: Since the material has higher yield strength at lower temperatures, the amount of deformation that can be given to is limited by the capability of the presses or hammers used.

FORGING

- Forging is the operation where the metal is heated and then a force is applied to manipulate the metal in such a way that the required final shape is obtained.

- Forging is generally a hot-working operation though cold forging is used sometimes.

- Two types of operations are used in forging in order to arrive at the final object configuration. They are

Drawing Out

- This is the operation in which the metal gets elongated with a reduction in the cross-sectional area. For this purpose, the force is to be applied in a direction, perpendicular to the length axis.