

METAL FORMING

Metal forming is also known as mechanical working of metals. Metal forming operations are frequently desirable either to produce a new shape or to improve the properties of the metal.

Shaping in the solid state may be divided into non-cutting shaping such as forging, rolling, pressing, etc., and cutting shaping such as the machining operations performed on various machine tools.

RECRYSTALLISATION TEMPERATURE

If the temperature is sufficiently high, the growth of new grains is accelerated and continuous till the metal comprises fully of only the new grains. This process of formation of new grains is known as recrystallization and is said to be complete when the metal structure consists of entirely new grains. That temperature at which recrystallization is completed is known as the recrystallization temperature of the metal.

Comparison between Hot working and Cold working

S.No.	Hot working	Cold working
1	Hot working is done at a temperature above the recrystallization temperature and below the melting point.	Cold working is done at a temperature below the recrystallization temperature.
2	Refinement of the crystal occurs.	Refinement of the crystal will not occur.
3	Crack propagation will be less.	More crack propagation will be seen.
4	Internal residual stresses are not produced.	Internal residual stresses are not produced.
5	It improves value of elongation.	It decreases value of elongation.
6	Surface finish is poor due to oxidation.	Surface finish is good.
7	It is difficult to control the dimension because of contraction.	It is easy to control the dimension within the tolerance limit.
8	Due to re-crystallisation and recovery no or very negligible hardening of metal takes place	Since this is done below re-crystallisation temperature the metal gets work hardened.
9	Less stress is required for deformation.	More stress is required for deformation.
10	Heavy oxidation of metal occurs during working.	No oxidation of metal occurs during working.

Classification of metal forming processes

The classification of hot working processes is given as under.

1. Rolling
2. Forging
3. Extrusion
4. Drawing

FORGING PROCESS

Forging is an oldest shaping process used for the producing small articles for which accuracy in size is not so important. The parts are shaped by heating them in an open fire or hearth by the blacksmith and shaping them through applying compressive forces using hammers.

Thus forging is defined as the plastic deformation of metals at elevated temperatures into a predetermined size or shape using compressive forces exerted through some means of hand hammers, small power hammers, die, press or upsetting machine.

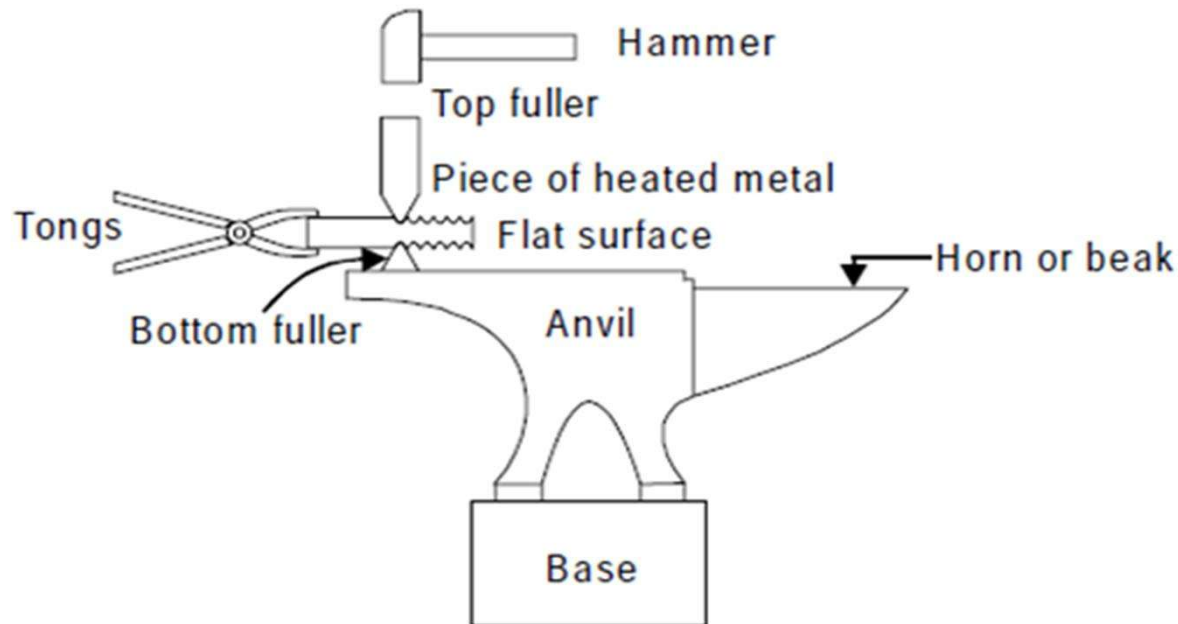
Advantages of forging

- Forged parts possess high ductility and offers great resistance to impact and fatigue loads.
- Forging refines the structure of the metal.
- It results in considerable saving in time, labor and material as compared to the production of similar item by cutting from a solid stock and then shaping it.
- Forging distorts the previously created unidirectional fiber.
- The reasonable degree of accuracy may be obtained in forging operation.
- The forged parts can be easily welded.

FORGING METHODS

(i) Hand forging

Hand forging is performed in the black smithy shop. The job is heated at the forging temperature in hearth and it is then brought on anvil using tong. It is then forged using hand hammers and other hand forging tools for imparting specific shape.



(ii) Power Forging

Hand hammer blows impact will not be always sufficient enough to affect the proper plastic flow in a medium sized or heavy forging. It also causes fatigue to the hammer man. To have heavy impact or blow for more plastic deformation, power hammer are generally employed.

These hammers are operated by compressed air, steam, oil pressure, spring and gravity.