

Forging

- It is a metal forming process usually at high temperature to get desired shape and size by using compressive force (hammer blows) or continuous squeezing action (Hydraulic press)with or without dies.
- forging alter the grain structure is elongated in the direction of deformation.

Types of forging

- Metals can be forged must possess plasticity, ductility, malleability.
- Types of forging:
 - 1. smithing or hand forging
 - 2. Drop forging
 - 3. press forging
 - 4. Machine or upset forging.

smithing

- Operations: upsetting
- Drawing down
- Setting
- Swaging
- Punching & drafting
- Bending
- Cutting
- Welding

smithing

- Heating devices: hearth, tuyere, hood, chimney
- Tools: anvil, swage block, hammers, tongs
- Chisels, flatters, fullers, swages, set hammer punches, drifts.
- Cheap method and suitable for less quantities.
- Skilled and experienced blacksmith.

Drop forging

- Closed die **drop forging** is a steel shaping **process** whereby a heated steel billet is placed on a lower die mould block, while an overhead, die-equipped ram hammer drives or “drops” down, forcing the metal to fill the contours of the two die blocks.
- Open die
- Closed die with or without flash

- Operations in drop forging
- Fuller
- Edger
- Bender
- Blocker
- Finisher
- Flash gutter

Press forging

- the forming process of placing metal between two dies by applying mechanical or hydraulic pressure.
- The key difference between impact forging and press forging is that in the former method a sudden impact force is applied on the die, while the latter exerts a gradually increasing pressure on the die.

- The operation is completed in a single squeezing action, saves the time.
- The capacity of presses ranging from 500 to 9000 tons and the number of working strokes per minute can be high as 40 or even 50. Means 40 to 50 parts produced per minute.
- Both, hydraulic presses and mechanical presses are employed for press forging operation. The mechanical presses are used for light work while the hydraulic presses are employed for heavy work.

Upset forging

- **Upset forging** increases the diameter of the work piece by compressing its length.
- A few examples of common parts produced using the **upset forging** process are engine valves, couplings, bolts, screws, and other fasteners
- Punch, stationary die, movable die, stop
- Length of bar less than 3 times of diameter

- This forging process is ideal for longer shapes where only end of a part needs to be forged.
- The mechanical press used to manufacture these components operates on a horizontal plane.

- Advantages:
- More uniform structure & directional characteristics
- Minimum cavity & blow holes
- High mechanical strength & toughness
- Smooth surface, closer dimensions with less machining
- Economy in mass production

- Disadvantages:
- Size is limited
- Not suitable for complicate shapes
- High tooling cost
- Oxidation of metal
- Not economic for small quantities

defects

- Cold shuts – discontinuity-incorrect position & design
- Surface crack- excessive work at low temperature
- Flash line crack- low flash thickness
- Internal cracks-proper design of die
- Poor impressions
- Mismatched forging.