Basic Workshop

أساسيات الورش

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Plastic Deformation Process

- Casting  (Liquid state)
- Forging  (solid state)
- Rolling  (solid state)
- Deep Drawing  (solid state)
- Extrusion  (solid state)
- Wire Drawing  (solid state)

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Hand Forging is the oldest type of metal working process and has influenced the formation of other materials through the age. Smith forging was formerly the process envisioned when we think of the blacksmith wielding a hammer against a piece of hot metal placed upon a rigid anvil.

The modern process is the same except that the crafts-person uses a mechanical hammer and manipulators to move heavy pieces. Smith forging is done with a flat hammer and a flat anvil.
Upset Forging

- The upset forging is done in either the hot or cold state.
- The object is formed by deforming the material, which is usually cylindrical-shaped, into a formed cavity similar to drop forging.

Drop Forging

- Is similar to smith forging done except that shaped on both the hammer and anvil are normally utilized.
- Drop forging uses successive dies to first roughly form product, provide a semi-finished form to the product, and then to form and blank or trim the flashing from the formed object.
- The dies used in the drop forging must be made from extremely strong and tough materials in order to withstand the impact loads and temperature of the process.
There are two types of drop forging:

1. **Open-die drop forging**
2. **Closed-die drop forging**

- In open-die forging, a hammer strikes and deforms the workpiece, which is placed on a stationary anvil. The dies are usually flat in shape, but some have a specially shaped surface for specialized operations. For example, a die may have a round, concave, or convex surface or be a tool to form holes or be a cut-off tool.

- In some cases, open-die forging may be employed to rough-shape ingots to prepare them for subsequent operations. Open-die may also orient the grain to increase strength in the required direction.
Open-Die Drop Forging

In this type of forging, the metal is never completely enclosed or confined on all sides. The common “upsetting” operation done on a hammer can also be considered as an example of open die forging with two flat dies.

- Cogging operation on a rectangular bar.
- Reducing diameter of a bar by open-die forging.
- Thickness of a ring being reduced.

Impression Die Forging

In impression die forging, the work piece is pressed between the dies. As the metal spreads to fill up the cavities sunk in the dies, the requisite shape is formed between the closing dies. Some material which is forced out of the dies, is called “flash”.

Schematic illustrations of stages in impression-die forging. *the formation of a flash, or excess material that subsequently has to be trimmed off.*
Closed Die Forging

- Closed die forging is very similar to impression forging, but in true closed die forging, the amount of material initially taken is very carefully controlled, so that no flash is formed.
- Otherwise, the process is similar to impression die forging. It is a technique which is suitable for mass production.

Forging Defects

Stages in internal defect formation in a forging because of an oversized billet.

Stages in lap formation in a part during forging, due to buckling of the web.

Web thickness should be increased to avoid this problem.