

JOB ROLE – AUTOMOTIVE SERVICE TECHNICIAN

Sector: Automotive
(Qualification Pack Code : **ASC/Q01402**)



PSS Central Institute of Vocational Education
Shyamla Hills, Bhopal – 462013, Madhya Pradesh, India

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UNIT 3 : Materials for construction of automotive components

Session 2: Basic Manufacturing Processes

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Session Objectives

1. The student will be able to explain importance of materials.
2. Able to identify different materials used in automobile vehicle.

Introduction

Manufacturing is a production operation in which raw material of some kind is taken as input and processed into a finished product . A product is an object that has been manufactured suitably for use in specific applications .

Products are manufactured with the help of various production processes which are broadly classified into the following

1. Casting
2. Forming
3. Joining
4. Machining

Casting

Casting is one of the most ancient processes of manufacturing metallic components. Also with few exceptions it is the first step of manufacturing metallic components. Metal casting process begins by creating a mould, which is the 'reverse' shape of the part we need. The mould is made from a refractory material, for example, sand. The metal is heated in an furnace until it melts, and the molten metal is poured into the mould cavity..



Casting process

The Basic steps of casting

1. Melting the metal.
2. Pouring it into a previously made mould or cavity which conforms to the shape of the desired component.
3. Allowing the molten metal to cool and solidify in the mould.
4. Removing the solidified component from the mould, cleaning it and subjecting it to further treatment, if necessary.

Applications of casting process

- (a) Automobile engine blocks, cylinder blocks, wheels of automobile
- (b) Airplane engines, pistons' and piston rings,
- (c) Machine tool beds and frames, mill rolls,
- (d) Water supply and sewer pipes, sanitary fittings, door handles, locks, the outer casing or housing for motors, pumps and agricultural parts etc. It is also used in the toy industry to make parts, e.g. toy cars, planes etc.

Machining

Machining is a manufacturing term encompassing a broad range of technologies and techniques. It can be roughly defined as the process of removing material from a workpiece using power-driven machine tools to shape it into an intended design. Most metal components and parts require some form of machining during the manufacturing process. Other materials, such as plastics, rubbers, and paper goods, are also commonly fabricated through machining processes. An unfinished workpiece requiring machining will need to have some material cut away to create a finished product. A finished product would be a work piece that meets the specifications set out for that work piece by engineering drawings or blueprints.

Machining operations

The three principal machining processes are classified as turning, drilling and milling. Other operations falling into miscellaneous categories include shaping, planing, boring, broaching and sawing.

- Turning operations are operations that rotate the workpiece as the primary method of moving metal against the cutting tool. Lathes are the principal machine tool used in turning.

- Milling operations are operations in which the cutting tool rotates to bring cutting edges to bear against the workpiece. Milling machines are the principal machine tool used in milling.

Machining operations

- Drilling operations are operations in which holes are produced or refined by bringing a rotating cutter with cutting edges at the lower extremity into contact with the workpiece. Drilling operations are done primarily in drill machine but sometimes on lathes or milling machines.
- Grinding operations apply a rotating wheel to achieve a fine finish or to make light cuts on a workpiece. Grinding machines such as bench grinder or pedestal grinder are used for the operation.

Some machine tools



Drilling Machine



Lathe Machine



Drilling Machine



Grinding Machine

Machine tools

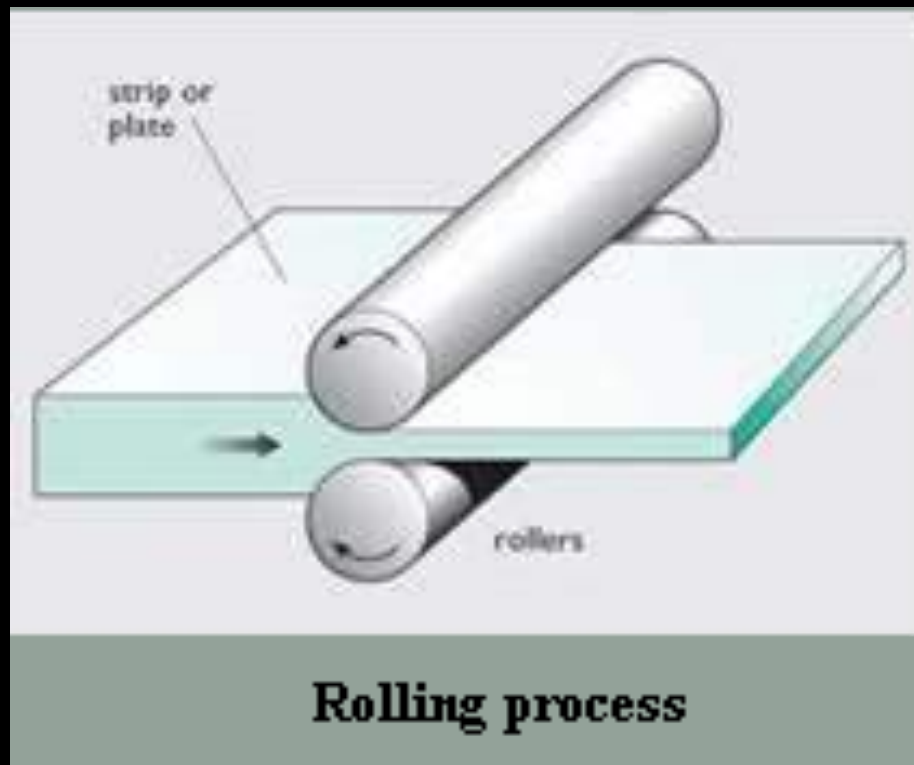
Forming

Forming is a broad term covering many different manufacturing processes. In general you may think of forming as any process that changes the shape of given raw stock without changing its phase (i.e. without melting it). In general, these processes involve beating with a hammer, squeezing, bending, pulling/pushing a given raw stock through a hole, etc. No matter where you are standing, you can probably see some object that is made by a forming process. Some examples include: aluminum/steel frame of doors and windows, coins, springs, elevator doors, cables and wires, almost all sheet-metal, etc.

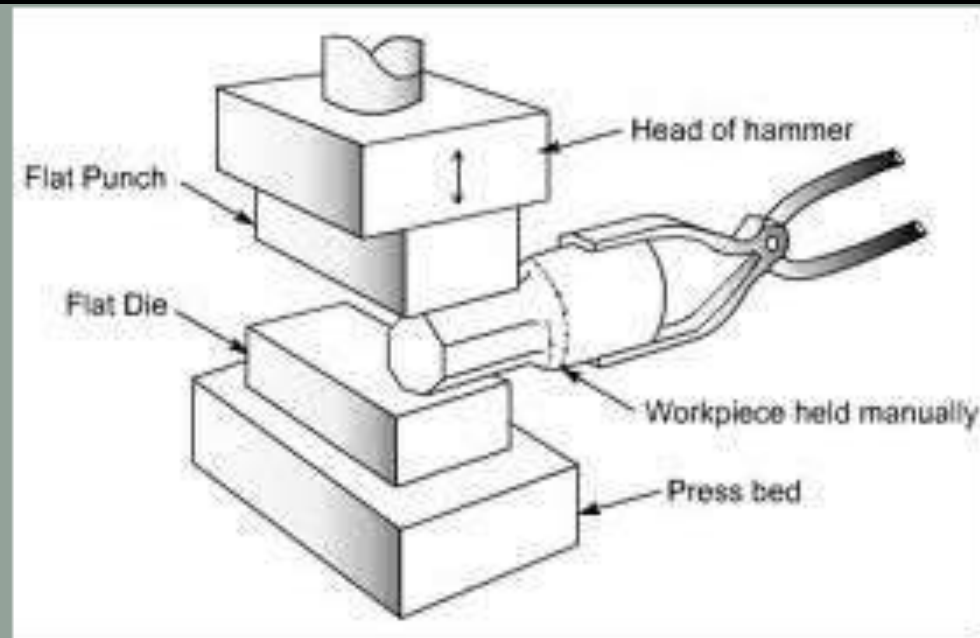
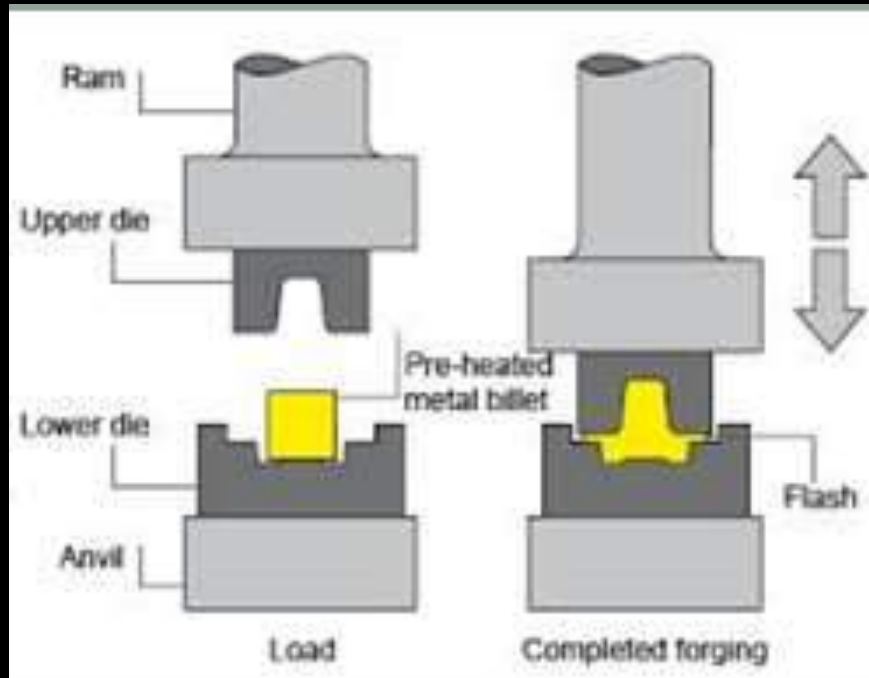
Rolling

Rolling is a metal forming process that deforms the work by the use of rolls. Rolling processes include flat rolling, shape rolling, ring rolling, thread rolling, gear rolling, and the production of seamless tube and pipe by rotary tube piercing or roll piercing. The material to be rolled is drawn by means of friction into the two revolving roll gap. The compressive forces applied by the rolls reduce the thickness of the material or changes its cross sectional area. The geometry of the product depend on the contour of the roll gap. All the sections of steels such as channel, I-section, channel section, angle sections, flat iron, sheets etc; are produced by rolling process and many of them are used in making of vehicle chassis and body.

Different types of sections of aluminium, many of them are used in body building of vehicles are also made by the process. A simple flat rolling process



Forging: Forging is characteristic in the use of dies to compress and shape a work piece.



Forging process

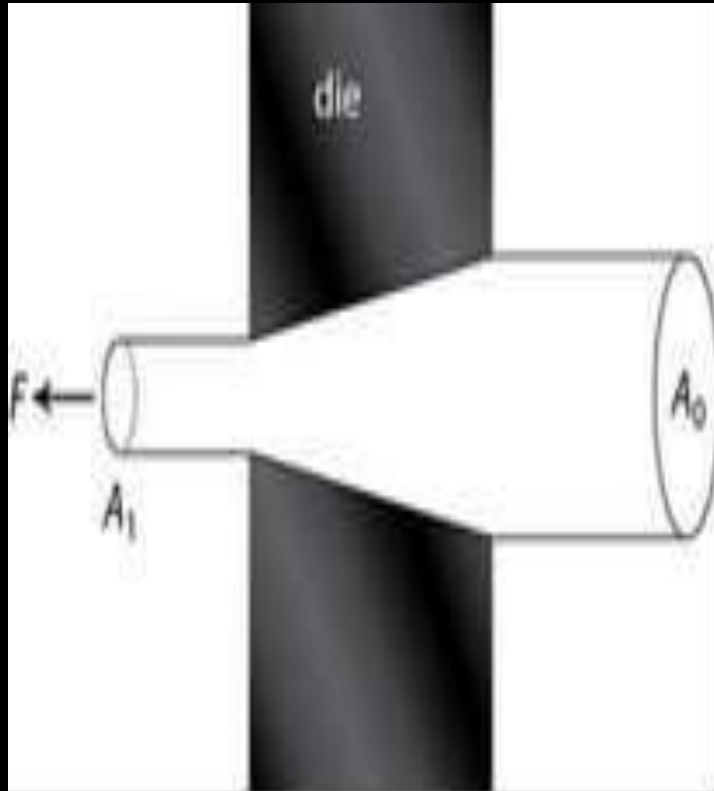
Forging: Forging is characteristic in the use of dies to compress and shape a work piece. The die may be flat or may contain an impression of certain geometry. Forging is basically involves plastic deformation of material between two dies to achieve desired configuration. Depending upon complexity of the part forging is carried out as open die forging and closed die forging. In open die forging, the metal is compressed by repeated blows by a mechanical hammer and shape is manipulated manually. In closed die forging, the desired configuration is obtained by squeezing the work piece between two shaped between two shaped and closed dies.

Extrusion: Extrusion involves forming by forcing metal through a die opening, producing work of variable length and constant cross section. The cross-sections that can be produced vary from solid round, rectangular, to L shapes, T shapes, tubes and many other different types. The simple example of extrusion is squeezing paste from the tooth paste tube. In extrusion, the material is compressed in a chamber and the deformed material is forced to flow through the die. The die opening corresponds to the cross section of the required product. It is basically a hot working process; however, for softer materials cold extrusion is also performed. Typical parts produced by extrusions are trim parts used in automotive and construction applications, window frame members, railings, aircraft structural parts.

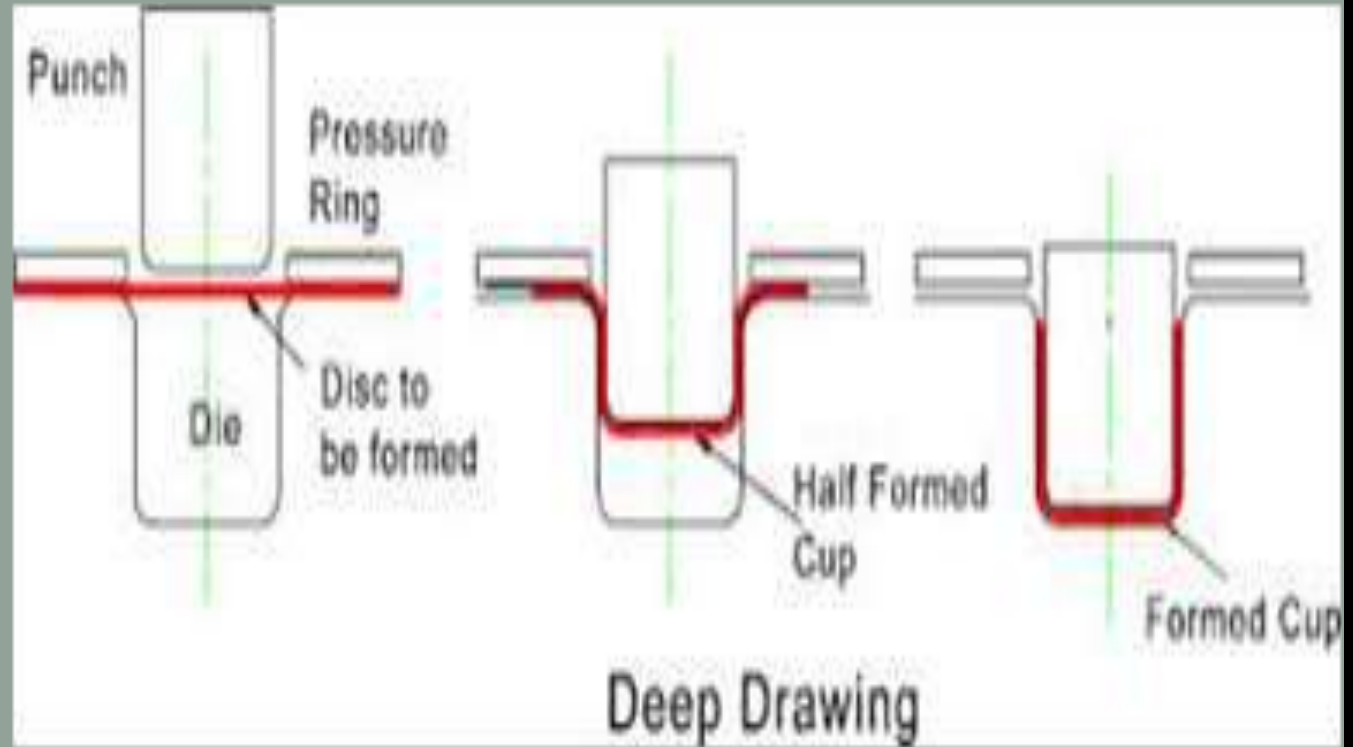
Extrusion: It is basically a hot working process; however, for softer materials cold extrusion is also performed. Typical parts produced by extrusions are trim parts used in automotive and construction applications, window frame members, railings, aircraft structural parts.

Drawing: drawing is similar to extrusion, in that a length of metal is made to flow through a die opening and forming is done over its cross section. The difference between drawing and extrusion is the application of force to the work piece. In extrusion the work is pushed through the die opening, in drawing the work is pulled through the die opening. Large quantities of wires, rods, tubes and other sections are produced by drawing process which is basically a cold working process. In this process the material is pulled through a die in order to reduce it to the desired shape and size.

Drawing:



Drawing



Drawing process

Joining Processes

Almost all products are assemblies of a large number of components. Some of the components or sub-assemblies can move with respect to each other, others are physically fixed together, with no relative motion possible. Both types of joints are important in manufacturing, and there are many ways of achieving such joints. The process and methods used for joining depend on the type of joint, the required strength, the materials of the components being joined, the geometry of the components, and cost issues. Below are some of the common methods of joining.

Welding

It is a fabrication process that joins materials, usually metals or thermoplastics, by causing coalescence. This is often done by melting the workpieces and adding a filler material to form a pool of molten material that cools to become a strong joint, but sometimes pressure is used in conjunction with heat, or by itself, to produce the weld.

Many different energy sources can be used for welding, including a gas flame, an electric arc, a laser, an electron beam, friction, and ultrasound.

Riveting

It is one of the most ancient metalwork joining processes. It is used in industry and construction works. A rivet is essentially a two-headed and unthreaded bolt which holds two other pieces of metal together. Holes are drilled or punched through the two pieces of metal to be joined. The holes being aligned, a rivet is passed through the holes and permanent heads are formed onto the ends of the rivet utilizing hammers and forming dies (by either cold working or hot working). Rivets are commonly purchased with one head already formed. When it is necessary to remove rivets, one of the rivet's heads is sheared off with a cold chisel. The rivet is then driven out with a hammer and punch.

Summary

In this session you have learnt about, Manufacturing is a production operation in which raw material of some kind is taken as input and processed into a finished product.

A product is an object that has been manufactured suitably for use in specific applications. Products are manufactured with the help of various production processes which are broadly classified into the following:

1. Casting
2. Forming
3. Joining
4. Machining

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