

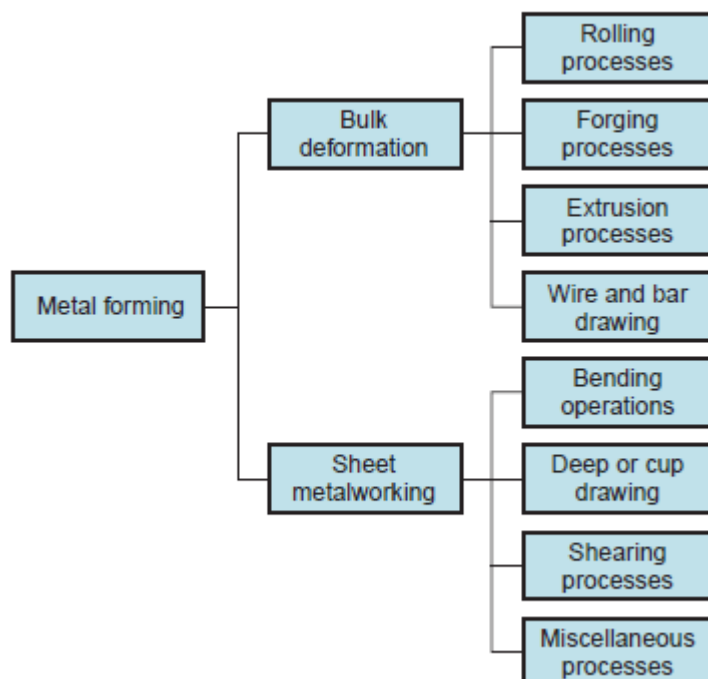
Metal forming:

Includes a large group of manufacturing processes in which plastic deformation is used to change the shape of metal work pieces. Deformation results from the use of a tool, usually called a die in metal forming, which applies stresses that exceed the yield strength of the metal.

Metal forming processes can be classified into two basic categories:

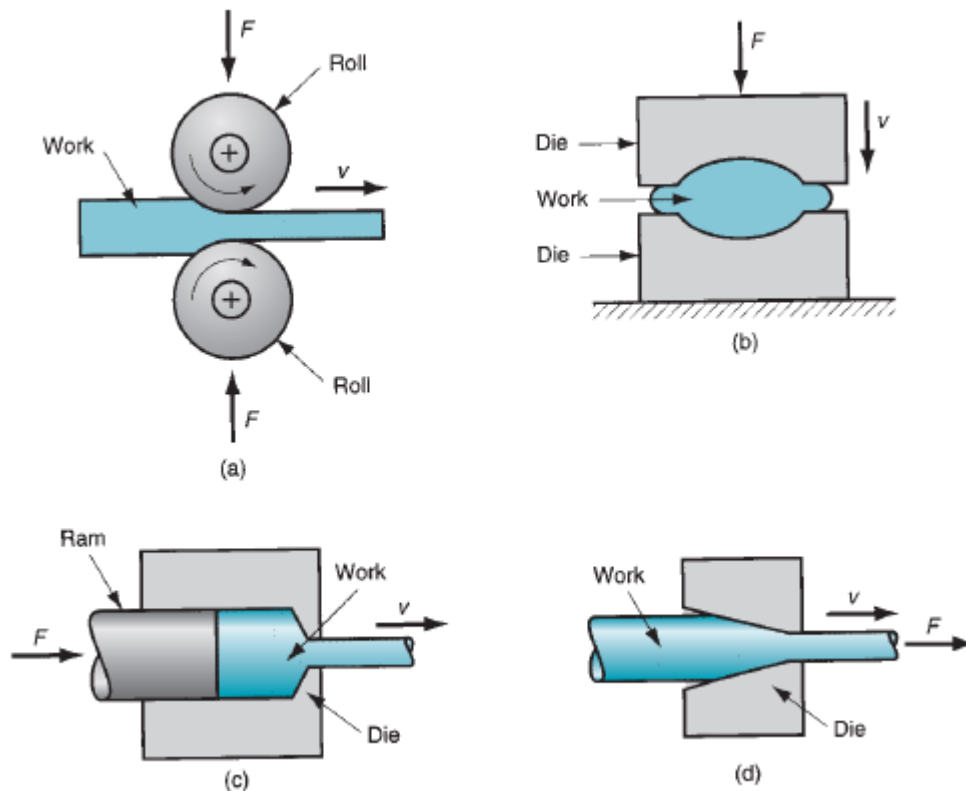
1-bulk deformation processes

2-sheet metalworking



Bulk Deformation Processes

Bulk deformation processes are generally characterized by significant deformations and massive shape changes, and the surface area-to-volume of the work is relatively small. The term bulk describes the work parts that have this low area to- volume ratio. Starting work shapes for these processes include cylindrical billets and rectangular bars



Rolling (A): This is a compressive deformation process in which the thickness of a slab or plate is reduced by two opposing cylindrical tools called rolls. The rolls rotate so as to draw the work into the gap between them and squeeze it.

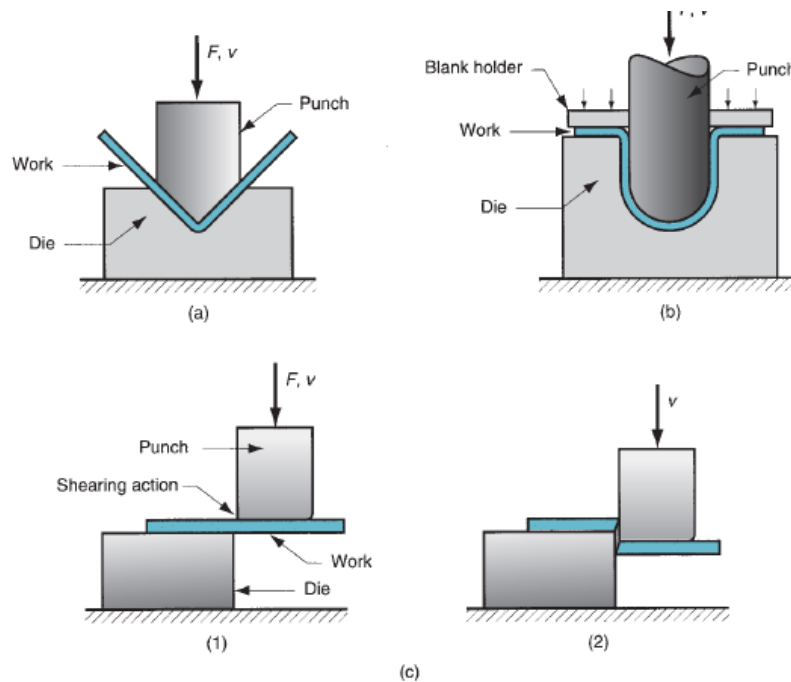
Forging (B): In forging, a work piece is compressed between two opposing dies, so that the die shapes are imparted to the work. Forging is traditionally a hot working process, but many types of forging are performed cold.

Extrusion(C) : This is a compression process in which the work metal is forced to flow through a die opening, thereby taking the shape of the opening as its own cross section.

Drawing(D): In this forming process, the diameter of a round wire or bar is reduced by pulling it through a die opening.

Sheet Metalworking Sheet :

Metalworking processes are forming and cutting operations performed on metal sheets, strips, and coils. The surface area-to-volume ratio of the starting metal is high; thus, this ratio is a useful means to distinguish bulk deformation from sheet metal processes. Press working is the term often applied to sheet metal operations because the machines used to perform these operations are presses (presses of various types are also used in other manufacturing processes). A part produced in a sheet metal operation is often called a stamping. Sheet metal operations are always performed as cold working processes and are usually accomplished using a set of tools called a punch and die. The punch is the positive portion and the die is the negative portion of the tool set. The basic sheet metal operations are sketched in Figure and are defined as follows:



Bending(A) : Bending involves straining of a metal sheet or plate to take an angle along a (usually) straight axis.

Drawing (B): In sheet metalworking, drawing refers to the forming of a flat metal sheet into a hollow or concave shape, such as a cup, by stretching the metal. A blankholder is used to hold down the blank while the punch pushes into the sheet metal, as shown in Figure 18.3(b). To distinguish this operation from bar and wire drawing, the terms cup drawing or deep drawing are often used.

Shearing(C): This process seems somewhat out-of-place in a list of deformation processes, because it involves cutting rather than forming. A shearing operation cuts the work using a punch and die, as in Figure 18.3(c). Although it is not a forming process, it is included here because it is a necessary and very common operation in sheet metalworking.