

FUNDAMENTALS OF METAL FORMING

Metal Forming

- Large group of manufacturing processes in which plastic deformation is used to change the shape of metal workpieces
- The tool, usually called a die, applies stresses that exceed yield strength of metal
- The metal takes a shape determined by the geometry of the die

Stresses in Metal Forming

- Stresses to plastically deform the metal are usually **compressive**
Examples: forging, rolling, extrusion
- However, some forming processes:
 - Stretch the metal (**tensile** stresses)
 - Others bend the metal (tensile and compressive)
 - Still others apply **shear** stresses

*Tensile - capable of being stretched or extended; ductile.
 *Shear stress - exists when two parts of a material tend to slide across each other in any typical plane of shear upon application of force parallel to that plane.

Material Properties in Metal Forming

Desirable material properties:

- **Low yield strength and high ductility**

*Yield strength refers to an indication of maximum stress that can be developed in a material without causing plastic deformation.

These properties are affected by temperature:

Ductility increases and yield strength decreases when work temperature is raised

Other factors:

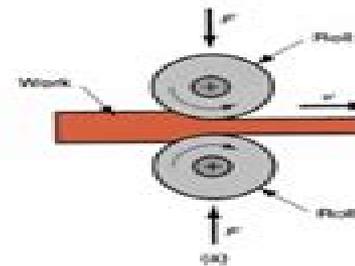
Strain rate and friction

Bulk Deformation Processes

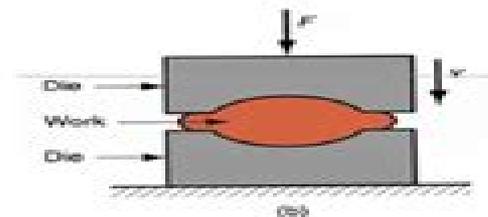
- Characterized by significant deformations and massive shape changes
- "Bulk" refers to workparts with relatively low surface area-to-volume ratios
- Starting work shapes include cylindrical billets and rectangular bars

BASIC PROCESSES BULK DEFORMATION

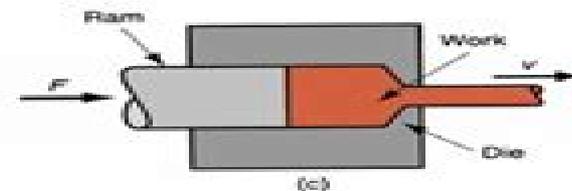
A. Rolling



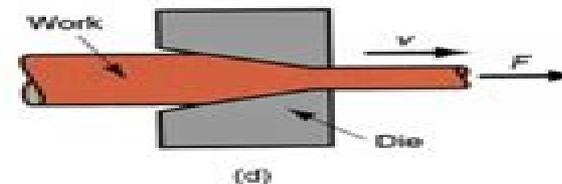
B. Forging



C. Extrusion



D. Drawing



Handbook Of Metal Forming Processes

Rosina Ehmman



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