

## CHAPTER 17

### Fundamentals of Metal Forming

#### Review Questions

1. Plasticity is the ability of a solid to flow, plastically deform, without deterioration of its properties. The mathematical description of plastic deformation stresses and strains, and the relations between them is known as the theory of plasticity.
2. Deformation processes shape metal in the solid state through the rearrangement rather than the removal of material. Unfortunately, large forces are required, and the machinery and tooling can be quite expensive. Large quantities may be necessary to justify the capital expenditure.
3. Large production quantities are often necessary to justify the use of metal deformation processes because the large forces require costly machinery and tooling.
4. Independent variables are those aspects of a process over which the engineer has direct control. They are generally selected or specified when setting up the process.
5. The specification of tool and die geometry is an area of major significance in process design. Since the tooling will produce and control the metal flow, the very success or failure of a process often depends upon good tool geometry.
6. It is not uncommon for friction to account for more than

50% of the power supplied to a deformation process. Product quality is often related to friction, and changes in lubrication can alter the material flow and resulting material properties. Production rates, tool design, tool wear, and process optimization all depend upon friction and lubrication. In addition, lubricants often act as coolants, thermal barriers, corrosion inhibitors, and parting compounds .

7. Lubricants, and metal working lubricants in particular, can act as coolants, thermal barriers and corrosion inhibitors. Often lubricants are formulated to include or enhance these functions in addition to their use in reducing friction.

8. If the speed of a metal forming operation is altered, several changes can occur. Many materials are speed-sensitive and will behave differently at different speeds. Ductility may vary, and many materials appear stronger when deformed at faster speeds. In addition, faster speeds promote lubrication efficiency and reduce the amount of time for heat transfer and cooling.

9. Dependent variables are aspects of a process determined by the process itself as a consequence of the values selected for the independent variables.

10. It is important to be able to predict the forces or powers required to perform a specific forming process, for only by having this knowledge can the engineer specify or select the equipment for the process, select appropriate tool or die materials, compare various die designs or deformation methods, and ultimately optimize the process.