Yield Strength

Internally, *elastic deformation* is seen as small displacements of atoms from their equilibrium positions, with the atoms returning to those positions when forces are removed. *Plastic deformation* is understood to be internal shear deformation, with atoms or molecules sliding over each other. The displaced material settles into new equilibrium positions. The deformation is permanent.

Except for elastomers (rubber-like materials), elastic deformation is usually limited to a few tenths of a percent of strain. Plastic deformation, in contrast, is often several tens of a percent. During deformation of ductile materials, the initial deformation is completely elastic. At a stress level designated as the *yield stress*, plastic deformation begins and is added to the elastic strain. The numerical value of the yield stress is not a precise value like density or melting temperature. The yield stress value depends upon the history of previous plastic deformation and heat treatment, as well as chemical composition.

Materials engineers often use the words *stress* and *strength* interchangeably. We commonly report experimental measurements as *stresses*, but we refer to a *strength* when a particular stress is tabulated as a handbook value.