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1. THE SCIENCE OF RHEOLOGY

Rheology. Literally, rheology means the study of flow, but the scope of rheology has become much broader than this. It has come to include almost every aspect of the study of the deformation of matter under the influence of imposed stress; it is the study of the internal response of materials to forces.

Between the extremes of simplicity of the newtonian fluid and the complexity of solid materials of great interest. It is fair to say that considerable interest in synthetic polymeric materials has given the greatest impetus to the rapid growth of the science of rheology. One should not forget, however, the advances which have resulted from the intellectual challenge of producing realistic mathematical descriptions of the response of complex materials.

Several broad, qualitative categories of response can be described. If a small stress is suddenly exerted on a solid, a deformation will begin to occur. The material will continue to deform until molecular (internal) stresses are established which just balance the external stresses. The word "deformation" usually means the equilibrium deformation which is established when the internal and external stresses are in balance. Most solids exhibit some degree of elastic response, in which there is complete recovery of deformation upon removal of the deforming stresses. The simplest such body is the hookean elastic solid, for which the deformation is directly proportional to the applied stress. But elastic response may also be exhibited by non-hookean materials, for which the deformation is not directly related to the applied stress.

Not all materials reach an equilibrium deformation. In a fluid, if an external stress is exerted, deformation occurs, and continues to occur indefinitely until the stress is removed. A fluid response is one in which there is no resistance to deformation. But internal frictional forces retard the rate of deformation, and an equilibrium can be established in which the