



Standard Terminology of Rheological Properties of Gelled Rocket Propellants¹

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1. Scope

1.1 These definitions² cover the flow properties of gelled propellants of interest to the aerospace industry.

2. Terminology

2.1 Definitions:

apparent viscosity (of a non-Newtonian fluid)—the viscosity of a Newtonian fluid that produces the same reading in the same apparatus under identical conditions.

Discussion—Avoidance of this artificial term is recommended.

classification of fluids:

Class I—Newtonian Fluid—a fluid that exhibits a direct proportionality between shear stress and shear rate in the region of laminar flow.

Discussion—The shear rate is independent of the time of application of shear stress.

Class II—Non-Newtonian Shear-Thinning Fluid—a fluid in which the shear stress is not directly proportional to the shear rate and in which the shear stress-shear rate ratio decreases as the shear stress increases.

(a) *Type A—Plastic Fluid*—a Class II fluid that exhibits a change in shear rate directly proportional to the change in shear stress above the yield stress.

(b) *Type B—Pseudoplastic Fluid*—a Class II fluid that exhibits a shear stress-shear rate ratio that is independent of the duration of application of shear stress.

(c) *Type C—Thixotropic Fluid*—a Class II fluid that exhibits time-dependent, reversible changes of the shear stress-shear rate ratio.

Discussion—The ratio decreases asymptotically with duration of shear.

Class III—Non-Newtonian Shear-Thickening Fluid—a fluid in which the shear stress is not directly proportional to the shear rates, and in which the shear stress-shear rate ratio increases as the shear stress increases.

(a) *Type A—Dilatant Fluid*—a Class III fluid that exhibits a shear stress-shear rate ratio that is independent of the duration of application of shear stress.

(b) *Type B—Rheopectic Fluid*—A Class III fluid that exhibits time-dependent, reversible changes of the shear stress-shear rate ratio.

Discussion—The ratio increases asymptotically with duration of shear.

emulsion—a two-phase liquid system in which small droplets of one liquid (the internal phase) are immiscible in, and are dispersed uniformly throughout, a second, continuous liquid phase (the external phase).

gel—a liquid containing a colloidal structural network that forms a continuous matrix and completely pervades the liquid phase.

Discussion—A gel deforms elastically upon application of shear forces less than the yield stress. At shear forces above the yield stress, the flow properties are principally determined by the gel matrix.

viscosity—the ratio of shear stress to shear rate. For non-Newtonian fluids, it is preferable to report shear stress and shear rate.

Discussion—If the viscosity of such a fluid is reported, the shear rate must be specified.

yield stress—the maximum shear stress that can be applied without causing permanent deformation.

3. Keywords

3.1 terminology, Dilatant fluid; terminology, Newtonian fluid; terminology, Non-Newtonian fluid; terminology, plastic fluid; terminology, propellants; terminology, Rheopectic fluid; terminology, Thixotropic fluid; terminology, yield stress

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² These definitions are identical in substance with the JANNAP definitions, "A Glossary of Rheological Terms," Part I of "Heterogeneous Propellant Characterization," Liquid Propellant Test Methods, March 1967, published by the Chemical Propulsion Information Agency, Johns Hopkins University, Applied Physics Laboratory, Johns Hopkins Rd., Laurel, MD 20707.

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