

Newtonian vs. Non-Newtonian Fluids

Why "Newtonian"?



Sir Isaac Newton was the first to create a scientific formula defining viscosity.

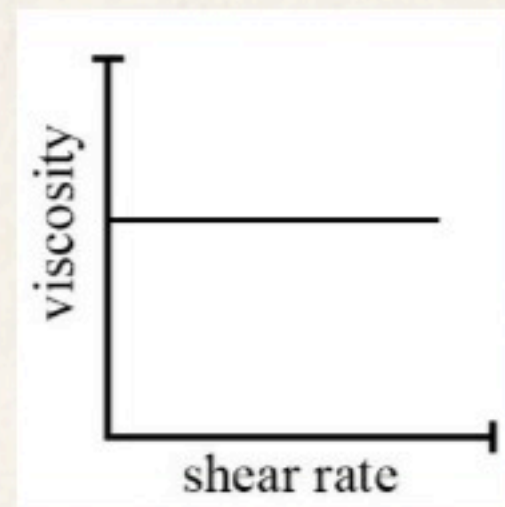
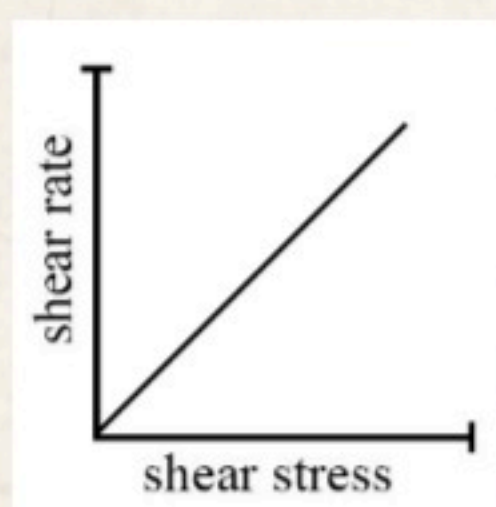
He knew that the viscosity of all fluids changed depending on the temperature of the sample.



But he also thought that viscosity was independent of shear rate - that, at a given temperature, increasing or decreasing the shear rate would not change the viscosity of a fluid.

Some fluids do behave this way.

We call these fluids "Newtonian".



Most fluids, however, have a viscosity that varies with the shear rate.

These are "Non-Newtonian" fluids.



There are Five Types of Non-Newtonian Fluids

Time Independent

Pseudoplastic (shear-thinning): viscosity decreases with an increased shear rate.



Dilatant (shear-thickening): viscosity increases with an increased shear rate.

Plastic: the fluid will behave as a solid under static conditions, requiring that a certain amount of force be applied before any flow is induced.



Time Dependent

Thixotropic: At a constant shear rate, viscosity decreases with time.

Rheopectic: At a constant shear rate, viscosity increases with time.



Special Note: Fluids can exhibit the characteristics of more than one of these types (i.e. paint, which is both pseudoplastic and thixotropic). However, they will not be both pseudoplastic and dilatant or both thixotropic and rheopectic.