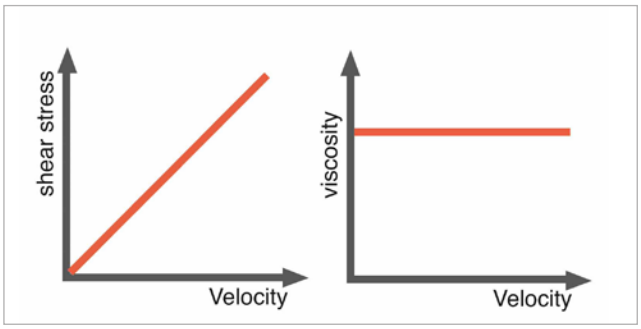
# Introduction

Viscosity is a measure of the resistance of a fluid to deform under shear stress. It is commonly perceived as flow behaviour or resistance to pouring. Viscosity describes a fluids internal resistance to flow and may be thought of as a measure of fluid friction.

Viscosity at final plays a key role in th processing stage!

For certain liquids viscosity is a material constant that only depends on temperature and pressure. This group of materials is termed Newtonian liquids.

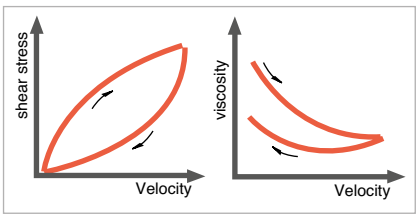



Newtonian

Liquids which do not follow this proportional ratio are called non-Newtonian.

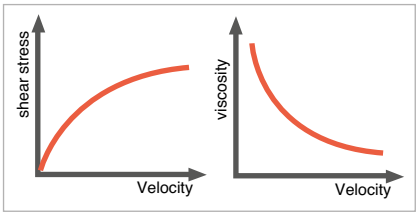
In practice, time-dependent viscosity is called thixotropy. If a liquid is sheared at a constant velocity gradient, viscosity will slowly decrease. As soon as the shear forces are removed, viscosity will recover and return to the initial value.

Thixotropy




The viscosity of pseudoplastic materials will decrease with an increasing shear rate (shear thinning).

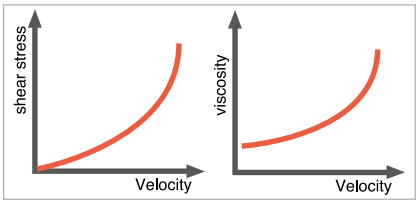
Pseudoplastic (Shear-Thinning)




## VISCOSITY

The viscosity of dilatant products, however, will increase when shear forces are applied.

Dilatant
(Shear-Thickening)




This behavior is known as “shear thickening”. When shear forces are applied, the liquid becomes more viscous.

## Viscosity Measurement

In the paint industry a number of measurement methods, from simple flow cup to computer controlled rotation viscometers, have been established for the determination of viscosity.
BYK-Gardner offers a complete line of viscosity measurement instrumentation.

## Bubble Viscometers

The Alphabetical Comparison Method uses 4 sets of lettered reference tubes, A5 through Z10, of known viscosity to cover a viscosity range from 0.005 to 1,000 stokes.

The Direct Time Method uses a single 3-line timer tube for determining the “bubble seconds” required for an air bubble to travel a known vertical distance through a bore of known diameter. These “bubble seconds” may then be converted to stokes.

Both methods are subject to variations traceable to the following variables:

| | | | |
|---|---|---|---|
| Temperature: | ± 1° C | = | 10% error |
| Vertical Control | ± 5° C slant | = | 10% error |
| Tube I.D. Control | ± 0.1 mm | = | 2% error |

## Dip Cups

These cups are designed for quick and approximate determination of efflux times for paints and similar fluids at paint manufacturers and paint user sites.

## Flow Cups

For many applications it is not necessary to know the absolute viscosity of a paint system. A parameter permitting a relative classification and estimation is often sufficient. The efflux time, measured in seconds, has proven to be a practical measure. It is determined using flow cups of various designs following the appropriate international / national standards. These cups hold a defined volume of liquid which flows through an orifice. The reproducibility of such measurements depends on
– The accuracy of the size of the cup
– A constant temperature during measurement
– The Newtonian flow behaviour of the liquid

## Rotational Viscometers

Various rotational viscometers are in use for the determination of the viscosity of non-Newtonian liquids. These types of material exhibit different viscosities depending on the applied shear rate. BYK-Gardner offers a complete line of viscometers for any application: Stormer Viscometer, Cone and Plate Viscometer as well as Brookfield Viscometers with different cylinders, tubes and other measuring accessories.