Rhealogical Behavior of Silicone Fluids under Shear

At Shear rates commonly encountered (<10^4 S^{-1}), polydimethylsiloxanes behave at viscosities up to 1,000cSt like Newtonian fluids. Viscosity is constant and independent of the velocity gradient. Apparent viscosity is identical with viscosity extrapolated to zero velocity gradient.

For oils of a higher viscosity than 1,000cSt, this ratio is only constant for velocity gradients below a certain value. Beyond this value, becoming lower as the product becomes more viscous – the ration is no longer constant; apparent viscosity falls below real viscosity (extrapolated for a zero velocity gradient) and the behavior is then known as "pseudoplastic". This change is perfectly reversible as behavior again becomes Newtonian when the velocity gradient falls once more below the critical value. Viscosity returns to its initial level even after intense shearing of long duration.

As a guide, the table indicates the critical velocity gradients of polydimethylsiloxanes (where change of rhealogical behavior occurs) as well as apparent viscosity measured at velocity gradient equal to 10,000s-1.

Fluid	Critical velocity gradient (s^{-1})	Apparent viscosity for a velocity gradient of 10,000s^{-1}
1,000cSt	2,500	850cSt
12,500cSt	200	4,700cSt
30,000cSt	150	6,000cSt
100,000	30	8,200cSt

Essentially, silicone fluids show excellent shear stability and retain their original viscosity characteristics, as they are not affected by mechanical working. The apparent lowering in viscosity at high shear rates is a transitory effect as dimethl fluids return to their original viscosity one the shear is stopped.