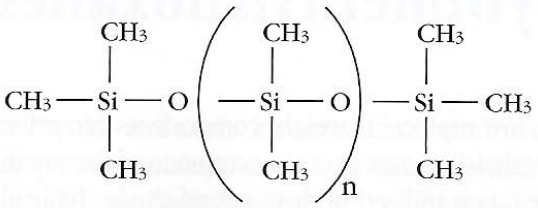
Rheological Behavior Under Shear

At shear rates commonly encountered ($\leq 10^4 s^{-1}$) polydimethylsiloxanes behave, at viscosities up to 1,000 cSt., 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 1,000 cSt., this ratio is only constant for velocity gradients below a certain value. Beyond this value, becoming lower as the product becomes more viscous—the ratio 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, and 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 for polydimethylsiloxanes (where change of rheological behavior occurs) as well as apparent viscosity measured at velocity gradient equal to 10,000 s^{-1}.



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

Apparent viscosity as a function of velocity gradient