# Unparalleled Viscosity Accuracy Based on the 1st Principle

Achieving accurate and reliable viscosity measurements begins with a fundamental approach. VROC technology is based on the 1st principle of viscosity, which is viscosity equals shear stress divided by shear rate:

$$\text{Shear Viscosity} = \frac{\text{Shear Stress}}{\text{Shear Rate}} = \frac{\sigma}{\dot{\gamma}}$$

To obtain measurements based on this foundational principle, precise control over the shear rate is critical. This is where VROC technology excels. VROC allows you to precisely control the flow rate of your sample through a microfluidic channel. Simultaneously, integrated MEMS pressure sensors accurately detect the resulting pressure drop along the channel, which is used to calculate the shear stress.
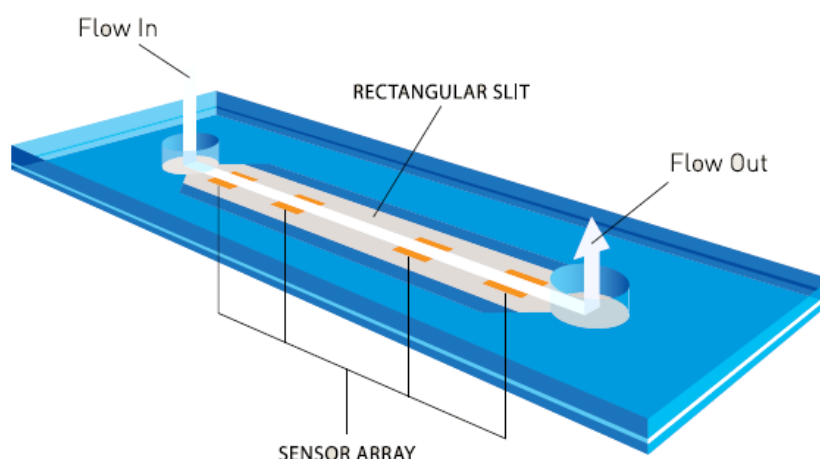
This direct and precise control of flow rate translates directly into precise control of the shear rate experienced by the sample. This is essential for accurate viscosity determination for all fluid types:

- For Newtonian fluids, no corrections are needed.
- For non-Newtonian fluids, precise shear rate control is possible with application of the Weissenberg-Rabinowitsch-Mooney (WRM) correction using measurements at multiple shear rates.
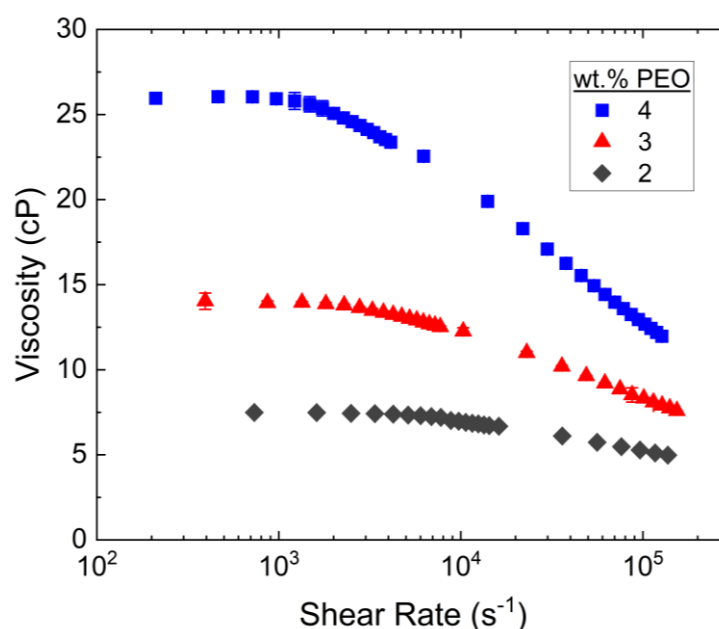
This fundamental approach ensures VROC instruments deliver viscosity results with high accuracy (±2%) and repeatability (0.5% RSD) across a wide range of viscosities and shear rates.

Example: The plot below demonstrates VROC's capability in characterizing complex fluids. It shows the viscosity vs. shear rate (after WRM correction) for three concentrations of 200 kDa PEO in water, measured using an m-VROC II equipped with B05 and E02 chips. These samples clearly exhibit shear thinning behavior captured over a wide shear rate range (~200 – 150,000 s^{-1}), providing critical data for understanding material performance under diverse conditions.