

A flow curve is a graphical representation of how a fluid's viscosity changes as a function of shear rate or shear stress. It's a fundamental tool in rheology, the study of how fluids deform and flow. A flow curve plots the relationship between shear stress and shear rate (or sometimes, viscosity versus shear rate).

- It shows how a fluid's resistance to flow changes as the applied force increases.
- This can reveal important properties like whether a fluid is Newtonian (viscosity remains constant regardless of shear rate) or non-Newtonian (viscosity changes with shear rate).
- Different shapes of flow curves correspond to different fluid behaviors, such as shear-thinning (viscosity decreases with increasing shear rate), shear-thickening (viscosity increases with increasing shear rate), or those with a yield stress.

How it's used:

- **Fluid characterization:**

Flow curves help classify fluids and understand their behavior under various conditions.

- **Process optimization:**

Knowing the flow curve of a fluid is crucial for designing and optimizing processes like pumping, mixing, and extrusion.

- **Product development:**

It can guide product formulation, ensuring that a product behaves as desired during use (e.g., ease of spreading for toothpaste, good flow for paints).

- **Quality control:**

Flow curves can be used to monitor the quality of fluids and detect any changes in their properties over time.

Examples:

- **Newtonian fluids:**

Have a straight-line flow curve, indicating constant viscosity.

- **Shear-thinning fluids (e.g., ketchup, paint):**

Show a curve that flattens as shear rate increases, meaning they become less viscous under high shear rates.

- **Shear-thickening fluids (e.g., some slurries):**

Show a curve that steepens as shear rate increases, meaning they become more viscous under high shear rates.

- **Fluids with yield stress (e.g., some gels, pastes):**

Have a curve that's initially flat, indicating they require a certain amount of force (yield stress) before they start to flow.

In summary:

Flow curves are a vital tool in rheology for characterizing fluids, understanding their behavior, and optimizing processes involving fluid flow

