

Drilling Fluids Viscosity Analysis

Viscosity testing of drilling and fracturing fluids is imperative for optimizing oil and gas well drilling. Sensitive, low-shear rate viscosity (LSRV) measurements predict how fluids will behave under low-shear conditions, critical for efficient solids transport downhole. The Brookfield LVDV2T Viscometer, with its ability to measure LSRV, is the instrument of choice for verifying the performance of costly drilling and fracturing fluids in the field.

Background:

- Low-shear rate viscosity is essential for drilling fluids as it determines the fluid's capacity to transport solids in extreme downhole conditions.
- Field measurements enable real-time adjustments, ensuring that fluids perform optimally in maintaining wellbore stability and carrying drill cuttings to the surface.



Equipment:

- Viscometer: Brookfield LVDV2T
- Spindles: LV-1 cylindrical spindle or Small Sample Adapter with SC4-18 spindle

Settings:

- Low Shear Rate Range: 0.01 to 0.1 rpm (shear rate below 0.1 sec^{-1})
- Higher Shear Rates: 1.0 to 6.0 rpm (shear rates up to 10 sec^{-1}); optional high-speed tests up to 200 rpm for higher shear rates if needed

Procedure:

1. Select either the LV-1 cylindrical spindle or the SC4-18 spindle, depending on sample type and field conditions.
2. Begin testing at a low rotational speed (0.01-0.1 rpm) to capture the viscosity at very low shear rates.
3. Increase speed to a moderate level (1.0-6.0 rpm) to assess viscosity changes across shear rates.
4. Optional: Run tests at 200 rpm for higher shear rates if the viscosity range allows.

Observations:

- Figure 1: Viscosity data for three fracturing fluids at varying shear rates (e.g., 5.11 sec^{-1} and 0.06 sec^{-1}).
 - At low shear rates, Fluid B demonstrates significantly higher viscosity than Fluids A and C, indicating better performance for particle suspension.
 - At higher shear rates, all fluids show similar viscosity, but the low-shear performance is critical for downhole effectiveness.

Shear Rate	Fluid A (cP)	Fluid B (cP)	Fluid C (cP)
5.11 sec^{-1}	800	780	900
	1,400	27,000	2,500

Figure 1

Results:

- Fluid A: Shows moderate viscosity across all shear rates, suitable for standard applications.
- Fluid B: Exhibits high viscosity at low shear rates, ideal for challenging downhole conditions where particle suspension is crucial.
- Fluid C: Lower viscosity at low shear rates, less effective for heavy solids transport.

Discussion:

The LV DV2T Viscometer provides accurate low-shear rate measurements, essential for predicting fluid behavior in downhole conditions. Fluids with higher low-shear viscosity, like Fluid B, are preferred in applications requiring particle suspension, enhancing wellbore stability and drilling efficiency.