

# Engineered Fracturing Fluids

Technology to optimize BroadBand unconventional reservoir completion services

## APPLICATIONS

- New openhole or cased hole completions
- Refracturing operations
- Hydraulic fracturing operations in shale, dirty carbonate, tight sand, and coalbed methane reservoirs with surface and bottomhole temperatures between 21 and 350 degF [–6 and 177 degC]

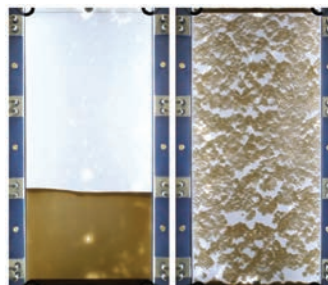
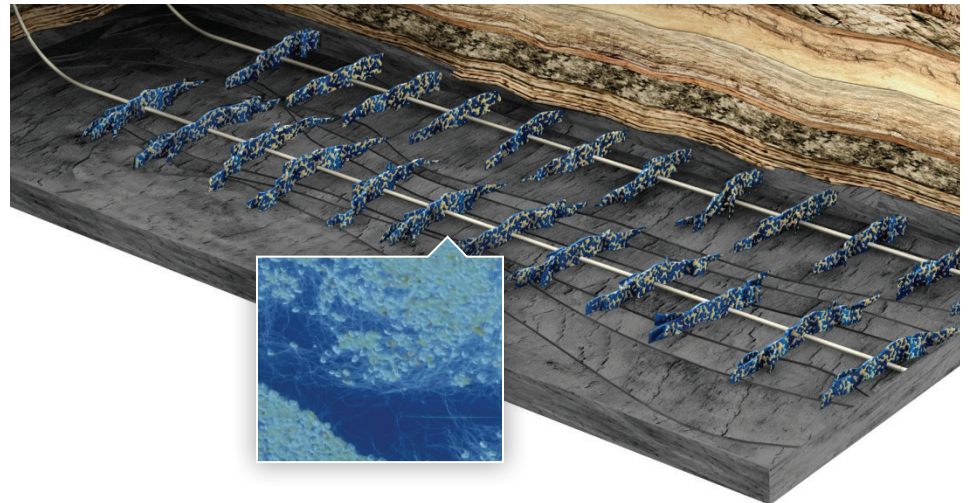
## BENEFITS

- Improves flexibility to design treatments that balance technical, economic, and operational goals
- Reduces freshwater, proppant, and equipment requirements compared with conventional fluid systems
- Minimizes environmental footprint with selection of engineered additives
- Simplifies operations by reducing screenout risks

## FEATURES

- Fluid systems designed to optimize BroadBand\* unconventional reservoir completion services
- Enhanced proppant transport and placement in complex fracture networks

BroadBand services maximize well productivity while helping to accommodate operator strategies for economics, efficiency, logistics, and risk. With a comprehensive portfolio of engineered fracturing fluids, Schlumberger has the flexibility to deliver effective stimulation treatments regardless of water quality, proppant volume, or location constraints.



▲ Comprising a blend of proprietary fibers and rheology-controlled fluids, Schlumberger composite fluids promote effective proppant transport and placement through the formation of highly conductive channels.

◀ During laboratory testing, 8-ft × 4-ft × 0.1-in test panels show that conventional fracturing fluids (left) leave large fractured areas without proppant, indicated by the clear zone on top of the proppant. These areas eventually close and do not contribute to production. Engineered composite fluids (right) prop open each fracture throughout its height and length.

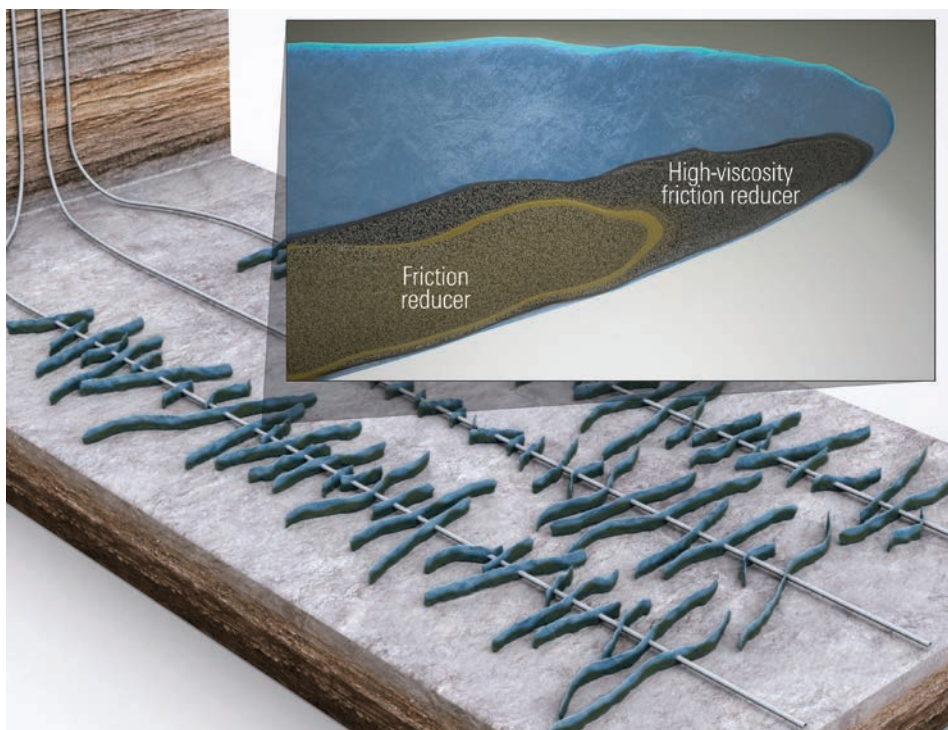
## Composite fracturing fluids for reservoir contact

Composite fracturing fluids integrate proprietary fibers, additives, and proppant to maximize proppant transport and posttreatment proppant pack conductivity. Compared with conventional fracturing fluids, the composite fracturing fluids transport proppant more effectively through the tortuous paths of a complex fracture network, increasing the effective, propped fracture area.

BroadBand service designs typically use short sweeps of clean composite fracturing fluids to reduce the risk of screenouts and proppant flowback. After pumping ceases, the degradable fibers help suspend the proppant and maintain a heterogeneous distribution until formation closure. When the fluid breaks and fibers degrade, they leave a robust, highly conductive fracture that maximizes oil and gas production and recovery.

Composite fracturing fluids can be designed to optimize any Schlumberger base fluid, including standard slickwater, viscous slickwater, linear gel, viscoelastic gel, and crosslinked gel.

# Engineered Fracturing Fluids



Visualization of sand settling under dynamic flow conditions indicates that a viscous slickwater fluid transports proppant more efficiently compared with a conventional friction reducer as evident.

## Standard slickwater fluids for efficiency and flexibility

Standard slickwater fluids combine available water with minimal additives to simplify operations, achieve economic goals, and maximize reservoir contact. High-molecular-weight polymers are used to reduce fluid friction, enabling efficient but effective BroadBand service designs that transport proppant with high pump rates rather than the viscosity mechanism of conventional guar linear gel and crosslinked systems. Engineered polymer breakers optimize cleanup, improving proppant pack conductivity.

A broad slickwater technology portfolio gives Schlumberger the unique flexibility to accommodate mix water variations and reservoir and surface conditions that challenge conventional slickwater systems.

## Viscous slickwater fluids for maximum propped conductivity

Viscous slickwater fluids combine the simplicity and cleanup of conventional slickwater with the proppant transport benefits of a more viscous hybrid linear or crosslinked gel system. As with conventional slickwater fluids, engineered breaker systems minimize formation and proppant pack damage, further improving their performance as compared with conventional guar-based fluid systems.

With viscosity as high as 100 cP and minimal fluid friction, viscous slickwater fluids enhance proppant-carrying capacity. As a result, engineers can design BroadBand services with aggressive pumping schedules and sand concentrations as high as 5 to 6 lbm/galUS. This reduces total water volume requirements and related costs—without compromising on engineering and production performance.

The viscous slickwater portfolio now offers a high-salinity, high-viscosity friction reducer (HVFR). This fluid provides more flexibility and extends the use of viscous slickwater to diverse water sources up to 300,000 total dissolved solids content. Produced water can be reused with no negative effects on the fluid or production performance. With lower freshwater requirements, flowback water handling, and disposal costs, the high-salinity HVFR is a cost-effective and more sustainable solution for high-volume hydraulic fracturing needs.

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