Reduce Formation and Proppant Pack Damage with Self-Suspending Proppant Transport Technology

THIS PROPPANT BRIEF DISCUSSES:

- A shear-stable, hydrogel polymer ensures uniform proppant distribution in frac fluid.
- The polymer breaks cleanly and flows back easily to reduce downhole damage.
- This cleaner downhole condition increases formation retained permeability and proppant pack regain conductivity.

Self-suspending proppant increased cumulative production > 20% after 10 months.

The shear-stable, hydrogel polymer—wrapped around a standard-mesh sand grain or ceramic proppant—is the engineered wisdom of self-suspending proppant transport technology (Figure 1). By just adding to water, the polymer rapidly swells around each proppant grain, for effective suspension and transport in low-viscosity fluid; unlike proppant in slickwater and gel-based fluids. Additional chemicals are unnecessary to facilitate proppant transport.

This stacking effect hinders settling and eliminates duning as with traditional fluids.

A completely stacked fluid column allows proppant to travel farther and remain higher in the fracture for an increased propped fracture surface area. Once in the fractures, the polymer breaks cleanly and flows back easily with substantially reduced downhole damage.

This cleaner, residue free system, increases formation retained permeability and proppant pack regain conductivity, allowing operators to increase hydrocarbon production at lower cost per BOE.

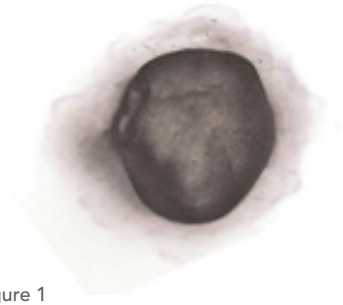

Figure 1
This magnified self-suspending proppant image shows the hydrated polymer wrapped around a Northern White sand grain. This attachment of polymer to proppant enables shear stability during blending, pumping, and transport. Stim-Lab confirmed the technology is at least shear stable up to 9,600 sec-1 for more than 20 minutes with nominal change in viscosity.

ROBUST HYDROGEL POLYMER

The robust hydrogel resists swelling in humidity while tolerating high shear forces during fracing; it remains attached to the proppant grain until chemically broken. The technology is unaffected by cold water unlike gel-based frac fluids that require temperature as high as 80° F and a prehydration unit to reach the desired viscosity. This technology can help operators mitigate up to $500,000 per well to heat water in the winter.

The shear stable hydrogel also functions as a fluid leakoff control agent, further enabling completion design flexibility. The robust, versatile technology allows operators to select the ideal proppant, fluid volume, pump rate and proppant concentration without sacrifice to well performance in favor of operating efficiency.

A CLEAN BREAK PROTECTS WELL INTEGRITY

Fairmount Santrol R&D verified complete polymer breaking with ammonium persulfate and magnesium peroxide, among others, by testing the fluid viscosity and settled bed volume. After breaking the polymer and upon fluid flowback, fluid additive residue was eliminated. This is the ideal condition after fluid flowback unlike what happens all too often with traditional guar-gel residue remaining downhole.

TECHNOLOGY RETAINS FORMATION PERMEABILITY AND FRACTURE CONDUCTIVITY

Stim-Lab confirmed self-suspending proppant technology maintains downhole integrity without damage to the formation and proppant pack that limits hydrocarbon flow. As far as the formation, a Stim-Lab test showed 100% retained permeability for self-suspending proppant while the conventional fluids could not match this result. Retained permeability for slickwater, linear gel, and crosslinked gel decreased 13%, 6%, and 14%, respectively.

Concerning the proppant pack, another Stim-Lab test recorded complete regain conductivity for self-suspending proppant and slickwater, but the guar-based fluids regain conductivity was 50% to 60%. Well damage is reduced with self-suspending proppant; the result of residue free polymer remaining attached to the proppant during frac treatments.

REDUCED COST PER BOE

There are better results in field trials also. A Niobara formation operator compared three self-suspending proppant wells against three other wells completed with a high viscosity friction reducer based fluid system, both using only 40/70 northern white sand. The self-suspending proppant wells improved production more than 20% in the first 10 months.

In the Escondido formation, self-suspending proppant as a 46% tail-in boosted 60-day initial production in 1 well by more than 55%. A higher proppant concentration enabled significantly better effective fracture half-lengths. The operator improved fracturing efficiency by decreasing pumping time 25%, fluid additives 15%, and water consumption 10%. The operator completed the offset well with 20/40, 40/70, and 100-mesh Northern White sand in slickwater.

CONCLUSION

Self-suspending proppant transport technology is a new method for completing wells. The shear-stable, hydrogel polymer's clean break and flowback are laboratory tested and field-proven. Operators are now reducing cost per BOE with greater efficiency while considerably reducing the formation and proppant pack damage caused by slickwater and gel-based fluids.

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