

FiberPAC

Proppant washout control technology

APPLICATIONS

- Cased hole water injector wells completed with STIMPAC* fracturing and gravel-packing service
- Land and offshore, including deepwater wells

BENEFITS

- Maintains injectivity through life of well by protecting gravel-pack integrity under high-flow-rate and cyclical stress and temperature conditions

FEATURES

- Works with any type of proppant, borate crosslinked fluids, and fluids containing a viscoelastic surfactant (VES)
- Uses standard fiber-feeding equipment
- Immobilizes the proppant by forming an interconnected network of fibers
- Does not plug sand control equipment or screens
- Provides a tailored formulation with gravel-pack strength and permeability determined by fiber concentration

In frac-packed cased hole water injectors, continuous injection can displace gravel from the screen-casing annulus into the fractures, especially when water is injected above fracture pressure. The resulting voids in the annulus can be filled by an influx of formation sand during shut-in, reducing injectivity when operations resume.

FiberPAC* proppant washout control technology is a fiber-based solution that prevents the gravel washout and subsequent loss of injectivity. The fibers have a sticky external coating that activates with temperature, forming a bonded fiber network and locking the gravel in place.

Compatible with existing equipment, proppants, and fluids

FiberPAC technology is added to proppant on the fly with standard fiber-feeding equipment during the STIMPAC fracturing and gravel-packing service. Concentrations are typically 0.5% to 1.8% by weight of proppant (BWOP), depending on the planned water injection velocity. This technology can be used with any type of proppant. It is compatible with borate crosslinked fracturing fluids as well as certain formulations of ClearPAC* polymer-free gravel-pack fluids.

Following the frac-pack treatment, as the wellbore temperature returns to bottomhole static conditions exceeding 158 degF [70 degC], the outer sheaths of the fibers bond together to create an interconnected network supporting the proppant pack in the screen-casing annulus, perforations, and fractures.



Sample of 20/40 ceramic proppant with 1.2% BWOP activated FiberPAC technology.



Interconnected network of fibers providing stability in the sample (magnified view).

Able to withstand high velocities and stress cycles

The screen-casing annulus and the perforations are under low stress during FiberPAC technology activation and during water injection. However, flow velocity in the perforations can be very high during injection. This is the most critical area where washout can initiate, and the fiber concentration is designed to provide gravel-pack stability in this low-stress, high-velocity environment.

The proppant pack in the fracture zone is exposed to closure stress. During water injection, the stress on the pack reduces to near zero because the injection pressure usually balances the closure stress, but the stress is reapplied at every shut-in event. Flexible FiberPAC technology can withstand these stress cycles. Other products, such as curable resin-coated proppant, do not provide flexibility and can therefore crush and mobilize once injection is resumed.

Proven performance in deep water

A deepwater injector well offshore West Africa successfully used FiberPAC technology to maintain injectivity. Since completion of the well, more than 7,000,000 bbl of water and approximately 6 tonUS of 5-um-sized solid particles have been injected. Injectivity is comparable to that of conventional frac-packed water injector wells despite the addition of fibers to the gravel pack, and it has successfully resisted deterioration over time.

FiberPAC Technology Specifications

Operating temperature	158 to 230 degF [70 to 110 degC]
Water injection rate	Up to 30,000 bbl/d
Proppant type	All proppant types
Regained permeability	More than 30–50% of fiber-free pack
Stability in seawater	Qualified stable at 200 degF [93 degC] for 90 days
Cyclic loading resistance	Qualified resistant to 20 cycles

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