Schlumberger

Single-Phase Retarded Acid

Improved reservoir contact

APPLICATIONS

- Acid fracturing and matrix stimulation in carbonate formations
- Bullhead treatments and coiled tubing (single and dual injection)
- Limestone, dolomite, and chalk formations
- Cased hole and openhole completions

BENEFITS

- Slows reaction rate for deeper reservoir stimulation
- Reduces surface equipment requirements because of low friction pressures
- Limits environmental footprint compared with services using emulsified acid system

FEATURES

- Single phase for easier mixing on the fly
- High dissolution capacity compared with unmodified hydrochloric acid (HCl)
- Tunable acid reaction rate
- Temperature range from 100 to 325 degF [38 to 162 degC]

Single-phase retarded acid extends reservoir contact compared with conventional hydrochloric acid. The low reaction rate of the acid allows it to travel deep into the reservoir before completely spending. The use of hydrochloric acid as the reactive component gives the fluid a high dissolution capacity. The acid-retarding component is completely water soluble; therefore, the resulting single-phase fluid can accommodate friction reducers, enabling higher pumping rates.

In matrix acidizing, the single-phase retarded acid creates longer wormholes in comparison with stimulation services using the same volume of unmodified hydrochloric acid.

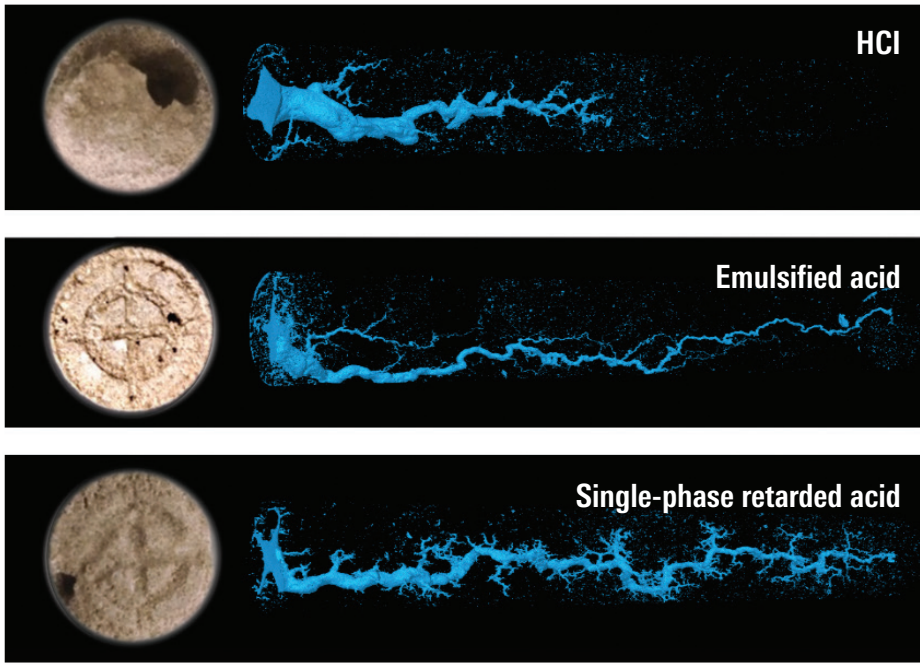
In acid fracturing, the single-phase retarded acid's low friction pressure enables high-rate pumping. In addition, when used in OpenPath Reach* extended-contact stimulation services, the system's low viscosity favors viscous fingering in designs that include a high-viscosity pad fluid.

Laboratory testing

The acid was evaluated for acid retardation in core flow and rotating disk experiments. The core flow experiments showed that the system achieved similar wormhole penetration rates to emulsified acids across most injection rates up to 275 degF [135 degC]. Proton diffusion in the acid was up to 10 times lower in comparison with unmodified HCl. Corrosion experiments determined that standard Schlumberger corrosion inhibitors can be used with the system.

Acid strength

This acid is prepared by mixing the retarding package with 28% HCl that contains the desired amount of corrosion inhibitor. The final fluid has acid strength equivalent to 15% HCl.



The performance of the single-phase retarded acid is similar to that of an emulsified acid and much better than HCl in core flow experiments at 275 degF [135 degC] in 8-mD Indiana limestone cores with equal amount of acid injected into the cores at equal rates. The wormhole from HCl penetrates only half of the core, while the wormholes from the single-phase retarded acid and the emulsified acid extend the entire length.

*Mark of Schlumberger.

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