Study the Performance of LSWACO₂ EOR technique on Oil Recovery Improvement in Sandstones

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Abstract

Low salinity water is an emerging EOR method that based on wettability alteration toward a favorable state for residual oil saturation, while WAG is a proved EOR process that enhances oil recovery by controlling mobility of both water and gas. Therefore, combining the two EOR process as low salinity water-alternating CO₂ EOR injection (LSWACO₂) can further improve oil recovery by promoting the synergy of the mechanisms underlying these two methods.

Coreflood, contact angle, interfacial tension (IFT), and CO₂ solubility in oil and brine were conducted to investigate the viability and performance of LSWACO₂ in sandstone reservoirs. A favorable wettability alteration along with IFT reduction, and mobility control are the mechanisms that contribute to residual oil mobilization efficiencies during LSWACO₂ EOR process. In addition, LSWACO₂ coreflooding experiments result in a significant incremental oil recovery.

Three smart water were tested in our research to examined the impact of changing cationic composition on oil recovery. The solutions are 5000 ppm NaCl (SW1), 5000 ppm MgCl₂ (SW2), and 5000 ppm KCl (SW3). Amongst the three solutions, SW1 yields the highest incremental oil recovery and highest IFT reduction. In addition, it results in a favorable wettability alteration toward more water-wet state.

In all cases, introducing CO₂ to the brine/oil system shows a great advantages in term of enhancing wettability modification, promoting IFT reduction, and controlling the displacement front of the injected fluid through mobility control.