Bicarbonate flooding of homogeneous and heterogeneous cores from a carbonaceous petroleum reservoir - DTU Orbit (05/05/2019)

Bicarbonate flooding of homogeneous and heterogeneous cores from a carbonaceous petroleum reservoir

Two extensive core flooding experiments along with supplementary tests were conducted to investigate the effect of bicarbonate as a potential determining ion for improved oil recovery from Danish North Sea reservoir chalk samples. Different sequences of brines were injected to see the impact on tertiary oil recovery. The core flooding experiments were conducted using two kinds of core plugs, homogeneous and heterogeneous (fractured). As injection of bicarbonate solutions leads to increase in pressure drop across the homogeneous core plug during injection, it was inferred that permeability reduction may be caused by fines production. The same flooding scenario was repeated for a fractured core plug. The difference in recovery from homogeneous and heterogeneous core plugs was observed: a significantly higher additional recovery was obtained for the heterogeneous core plug. This effect cannot be explained just by changing the chemical interactions between oil and rock surface. Adding bicarbonate to the injection brine changed the equilibrium and caused the sulfate ion in seawater to precipitate. Mixing injection brine with seawater from secondary injection caused the fines migration in the porous space, while high pH of bicarbonate solutions causes emulsification. In the accompanying crude oil/bicarbonate brine contact tests, formation of dynamically stable emulsions was observed. It was hypothesized that the fines migration and emulsification are causes for the microscopic flow diversion to the oil saturated regions and additional recovery from the heterogeneous rocks.

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