TWO-PHASE FLOW IN POROUS MEDIA: INFLUENCE OF PH ON WETTABILITY

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Abstract Wettability is an important factor in petroleum engineering due to its effect on fluid flow and distribution in reservoir rocks. The preferential wetting of the rock surfaces by either oil or water was demonstrated to mainly depend on the short range forces applied on the liquid films (essentially electrostatic, Van der Waals and structural interactions). As a consequence, it has been shown that both brine pH and salinity could control crude oil adhesion on given mineral surfaces.
Laboratory experimental studies performed at different scales of observation are reported on the wetting behaviour of oil-brine-glass systems.

Surface-scale experiments: Adhesion tests of a crude oil were performed on a glass surface as a function of pH. For this system, adhesion was found to occur only for pH values below 5.8.

Pore-scale experiments: Experiments were performed on a single column of glass spheres packed in a square-cross-section glass tube. This model was aimed at the observation of oil trapping and two-phase flow behaviour within the pore volume. Experiments were performed for different values of brine pH.

Porous medium model experiments: Two-phase flow experiments (crude oil displaced by water) were performed in a

porous medium consisting of calibrated glass beads packed in a square-cross section glass tube. This was aimed at studying the influence of brine pH on the oil recovery processes.

At high values of the brine pH, most of the oil is displaced before water breakthrough, and this behaviour is attributed to a water wettability of the system. Under the same conditions, no adhesion of the oil on the glass was observed during the surface-scale experiments.

At low values of the brine pH, an early brine breakthrough was observed followed by a slow increase in oil production. This behaviour, typical of an oil-wet system was found to be coherent to the crude oil adhesion observed at the surface-scale under the same conditions.