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THE EFFECT OF RESERVOIR CONDITIONS AND WETTABILITY ON THE CAPILLARY PRESSURE CURVE

by

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ABSTRACT

Capillary pressure curves have been determined on sandstone core plugs from three North Sea reservoirs using the porous plate method.

Traditionally, restored or native state samples are compared with cleaned samples in studies of the effect of wettability on capillary pressure. In this study cleaned samples were restored during a capillary pressure drainage test. This is supposed to be more similar to the process taking place during migration of the oil in the reservoir.

Capillary pressure curves, refined oil displacing brine, at reservoir and ambient temperature, both with ambient pressure and reservoir conditions, (reservoir temperature and pressure), are presented.

Next capillary pressure curves, crude oil displacing brine, at reservoir and ambient temperature both with ambient pressure are presented.

Finally capillary pressure curves, live crude oil displacing brine, at reservoir conditions are presented.

The wettability preference of the samples was determined both prior to and after the capillary pressure tests.

The capillary pressure curves were displaced toward a lower wetting-phase saturation when the temperature was increased to reservoir temperature, for the refined oil/brine system.

For the samples which remain water-wet throughout the capillary pressure measurements, it is found that the difference between the capillary pressure curve at reservoir conditions and at ambient conditions is due to temperature effects rather than to pressure effects. The pressure effects the capillary pressure curve only in the transition zone lying immediately above the water table.

The crude oil/brine capillary pressure curves are different from the refined oil/brine capillary pressure curves when both measurements were performed with cleaned samples. At high capillary pressure the reduced crude oil/brine capillary pressure curves (P_c/γ) are above the reduced refined oil/brine capillary pressure curves, (P_c/γ), *i.e.* for a given capillary pressure, the brine saturation from crude oil measurements are higher than brine saturations from refined oil measurements. This difference in brine saturation is related to a wettability change for the samples displaced with crude oil. The greatest difference in brine saturation is found for the samples with the largest wettability change.