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Investigation of phase behavior of Brine/Heptane/SDS/1-butanol Mixtures at Reservoir Conditions Using Spectroscopic Methods

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In the search for new solutions to recover oil from more complicated areas or discarded reservoirs, enhanced oil recovery (EOR) methods are constantly being developed for further improvement and enhancement. After applying primary and secondary (water flooding) recovery techniques on an average oil reservoir, approximately two-third of the oil will remain captured in reservoir. The application of EOR techniques is to optimize the recovery of the remaining trapped oil from inside the narrow pore structured reservoir.

Investigation of phase behavior has previous been conducted in matter of improving the oil production offshore, which leads to the need of investigating these systems thoroughly in the laboratory, to provide good models for evaluating surfactant flooding. It has been found that relatively simple systems containing brine, heptane, SDS and butanol as co-surfactant provides good description of reservoirs off shore, thus this system will be used as a model. To evaluate realistic circumstances, the minimum concentration of surfactant that is necessary to create a micro emulsion as well as the minimum ratio between surfactant and co-surfactant for creating this third phase has to be identified.

The main objective in this work is to investigate the phase properties in relation to surfactant flooding and oil/brine systems.

To evaluate the phase behavior, systems of different composition and concentration will be evaluated at ambient conditions. Analytical techniques such as Raman spectroscopy and Dynamic Light Scattering (DLS) will be investigated in a variable volume high-pressure view-cell, where temperature and pressure can be adjusted to resemble North Sea reservoir conditions.

The use of spectroscopic methods is coupled with chemometrics, especially Multivariate Curve Resolution Alternating Least Squares (MCR-ALS) to form a model of the phase behavior at reservoir conditions. This model may help predict the formation of micro-emulsions at various concentrations of SDS and salinities when injected into the reservoir.