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Sandersen, Sara Bülow; von Solms, Nicolas; Stenby, Erling Halfdan

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Pressure Effect on Phase Behavior of Surfactant System

Sara Bülow Sandersen, Erling H. Stenby & Nicolas von Solms
Center for Energy Resources Engineering (CERE), DTU Chemical & Biochemical Engineering, Technical University of Denmark
Contact: sbs@kt.dtu.dk

Introduction

As more than 50 % of the crude oil is expected to remain trapped in many mature oil reservoirs, tertiary oil recovery techniques must be introduced to keep an efficient oil recovery. This is the so-called Enhanced Oil Recovery (EOR). Surfactant flooding is considered as a potential EOR technique, which basically is the injection of appropriate chemicals (surfactants) into the reservoir to lower the interfacial tension (IFT) to ultra low [1].

Surfactants help mobilizing the trapped crude oil leading to an increase in oil recovery. The aim in this project is to study surfactant systems phase behavior at elevated pressures as there are no consensus whether pressure effects the formation of the desired three phase area. Several complex issues follows along, such as sensitivity to salinity, adsorption into the reservoir rock, etc.

Phase Behavior

○ Facts:
  • An increase in temperature entails an increase in optimal salinity.
  • Effect of pressure is debatable.

○ Type of surfactant systems considered:
  • Typically the so-called Winsor type system are used.

Experimental Work

○ Surfactant system tested:
  Sodium Dodecyl Sulphate/1-Butanol/Heptane/Water in Sodium Chloride [2].

○ High pressure equipment:
  - DBR JEFRI PVT cell
  - Allowing phase volume measurements through a window.
  - At a wide range of pressures and temperatures.

Results

#1: 2 phases at P=78 bar and T=45 °C
#2: 3 phases at P=50 bar and T=40 °C

All observations are reversible an reproduced

Future Work

Further experimental study of the conditions for change in number of phases, thus presence of an microemulsion phase.

References