



**International Research Institute of Stavanger**

P.O. Box 8046

4068 Stavanger, Norway

Telephone: (+47) 51 87 50 00

**Fax number: (+47) 51 87 52 00**

**From:** *Ingebret Fjelde*

**Date:** *5 September 2008*

## **Water-based EOR MSc and BSc Thesis topics**

Topics on wettability alteration of chalk and low salinity water flooding are described below.

### **Wettability alteration**

#### **Background**

Processes for alteration of wettability to more water-wet conditions have been developed to increase the spontaneous imbibition of brine in fractured carbonate reservoirs. At the University in Stavanger and IRIS, wettability alteration processes by changing composition of injection water and by addition of chemicals (e.g. cationic surfactants) have been studied.

#### **Thesis topics Wettability alteration**

##### ***1. Retention and desorption of polar oil components in chalk***

The objective is to determine how the retention and desorption of polar oil components in chalk depend on the brine composition, oil composition and temperature. The work should establish knowledge about wettability alteration mechanisms in chalk.

Retention of polar oil components onto chalk surfaces are known to alter the wettability conditions to less water-wet. Stock tank oil will be injected into 100% water saturated chalk plugs, and the retention of the polar oil components will be determined by compositional analyses of the produced fluids. Desorption of polar oil components from the chalk plugs will then be studied during the following water injection. Core plugs of outcrop chalk will be used in the experiments.

Two students can work on this subject.

## **2. Sulfate in reservoir limestone**

Sulfate has been found to alter the wettability conditions to more water-wet and thereby increase the spontaneous imbibition of water. Outcrop chalk and reservoir chalk samples have been found to contain sulfate concentrations high enough to affect the wettability conditions.

The objective is to determine the concentrations of sulfate in different reservoir limestones (a type of carbonate rock). If sulfate is found in the reservoir limestone, it will be evaluated whether these concentrations are high enough to affect the wettability conditions. Both the concentrations of easily accessible sulfate on mineral surfaces and the concentrations of sulfate inside the grains will be determined.

One student can work on this subject.

## **3. Transport of wettability alteration agents**

In fractured chalk reservoirs, the wettability alteration agent can improve the oil recovery in chalk matrix. The transport rate of the wettability alteration agent in the matrix will determine how far into the matrix block wettability alteration will take place during the project life time. The objective is to determine the transport rate of wettability alteration agents in chalk matrix at different initial wettability conditions and water saturations. The experiments will be carried out using outcrop chalk with different initial wettability conditions and water saturations.

One student can work on this subject.

## **Contact experimental studies**

Ingebret Fjelde

Senior Research Scientist

Direct phone number: (+47) 51 87 53 87

E-mail: [Ingebret.Fjelde@iris.no](mailto:Ingebret.Fjelde@iris.no)

## **Low salinity water flooding**

### **Background**

Reduction of salinity of injected water has in the literature been reported to improve the oil recovery in core floods and in field pilot in sandstone rock. Mechanisms have been proposed, but they are not good described.

### **Thesis topics Low salinity water flooding**

#### ***1. Retention and desorption of polar oil components onto chalk***

The objective is to determine how the retention and desorption of polar oil components in sandstone rocks depend on the brine composition, oil composition and temperature. The work should establish knowledge about recovery mechanisms in low salinity water flooding of sandstone.

Retention of polar oil components onto minerals in sandstones are known to alter the wettability of sandstone rock to less water-wet. Stock tank oil will be injected into 100% water saturated sandstone core plugs. The retention of the polar oil components will be determined by compositional analyses of produced fluids. Desorption of polar oil components from the sandstone core plugs will be studied during the followed water injection. It will be studied how the retention and desorption of oil components depend on brine composition, oil composition and temperature. Different types of sandstone rocks are used.

Two students can work on this subject.

### **Contact**

Ingebret Fjelde

Senior Research Scientist

Direct phone number: (+47) 51 87 53 87

E-mail: [Ingebret.Fjelde@iris.no](mailto:Ingebret.Fjelde@iris.no)