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## ***Wettability alteration: MSc and BSc thesis problems***

Alteration of wettability to more water-wet conditions can increase the spontaneous imbibition of brine in fractured carbonate reservoirs. At 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 developed.

### **Thesis problems**

#### ***1. Modelling of wettability alteration processes***

The project aims at developing routines/tools that can be used to model wettability alteration processes on laboratory scale and simulate these processes on reservoir scale. Such tools can be used for evaluation of wettability alteration processes at field scale. In the first phase of the project numerical modelling routine for simulation of physico-chemical processes of wettability alteration during water floods on laboratory scale (1-dimensional) will be developed.

#### **Experiments**

Students are invited to take part in experimental work on the following subjects:

- Wettability alteration in short cores with blocked lateral surfaces
- Wettability alteration in cores with different dimensions
- Wettability alteration and gravity forces
- Wettability alteration and viscous flooding
- Wettability alteration and time dependence
- Characterisation of wettability alteration and flow conditions

#### **Modelling**

##### *Extensions of the model*

- Include viscous forces in the model.

Include a time-dependent effect related to the adsorption of the WA agent.

Consider alternative modelling of wettability alteration based on using a c-dependent contact angle

Include hysteresis in the model

*Problems related to improvements of the numerical method*

Introduce a more implicit treatment of the diffusion terms which will allow larger time steps to be taken. Compare with the current numerical scheme.

Consider higher order accuracy of the convective terms to increase the resolution.

*Construction of analytical solution*

Explore under what conditions a travelling wave and/or self-similar solutions can be obtained. This can provide useful qualitative insight into the solutions (dependence on important parameters) as well as provide a test of the numerical scheme.

Students can carry out experimental work or modelling work.

**Contact experimental studies**

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