diamond

Oil

CASE STUDY

Enhancing oil recovery

Water injection in a well known method used to increase oil recovery. Until around 2000, mechanisms behind this were believed to be physical (maintaining reservoir pressure) in nature.

Through the development of BP's LoSal® (reduced salinity) enhanced oil recovery (EOR) technology, modification of the brine chemistry of the injection fluid has been shown to play an important role in oil recovery performance.

UNIVERSITY OF CAMBRIDGE

The Challenge

Several hypotheses regarding the mechanism involved with reduced salinity waterflood oil recovery have been proposed, but further research is need to fully understand the mechanism.

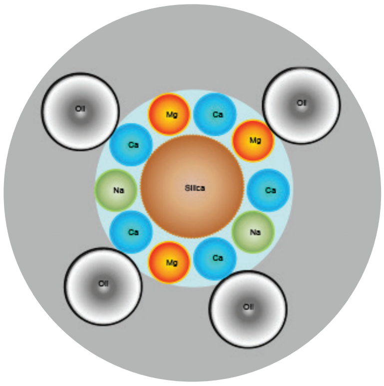
Oilfield fluids contain a complex mixture of different components including oil, water, clay and sand. Here, clay and model silica (“sand”) particles were suspended in organic solvents (“oil”) in the presence of salt and water to model an oilfield fluid.

The Solution

Sophisticated physical chemistry techniques were needed to detect water layers at the particle interface. The research team performed small angle X-ray scattering using beamline I22 at Diamond to measure very thin water layers on the surface of the particles at the Angstrom level.

Complementary neutron scattering measurements were also performed at ISIS and the ILL in Grenoble.

Small angle scattering experiments helped the team to detect and characterise thin water layers surrounding both sand-like and clay-like particles. As the ionic strength of the water falls (lower salinity), the size of the water layer changes.



The Benefits

The conclusions provide support for the mechanism by which BP believe low salinity waterflooding is able to enhance oil recovery. Further work to deepen this understanding is being performed, this technique provides an avenue to understand how to control the process.

> “The combination of synchrotron (at Diamond) and neutron (at ISIS) small angle scattering is ideal for the study of these complex, commercially important systems. The ability to explore each component separately, such as the very thin water layers in an oil based system, has a number of important applications from oil recovery to overbasing agents in engine oils. These experiments can therefore provide unrivalled insight into the materials structure and behaviour”
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> **Dr Stuart Clarke, University of Cambridge**

For further information

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CS-OIL-UCAM-014-2