SMARTER WAYS TO RECOVER TRAPPED OIL

By
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The National IOR Centre in Norway is exploring new ways to boost the oil recovery rate, focusing on the effects of flooding the rock with polymers and water of varying salinities.

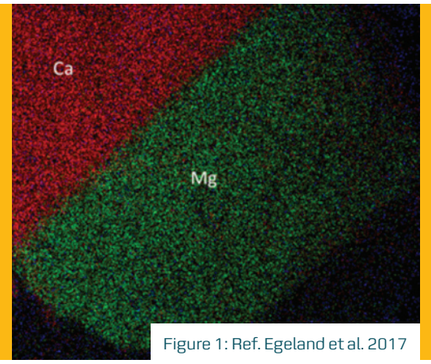

Figure 1: Ref. Egeland et al. 2017

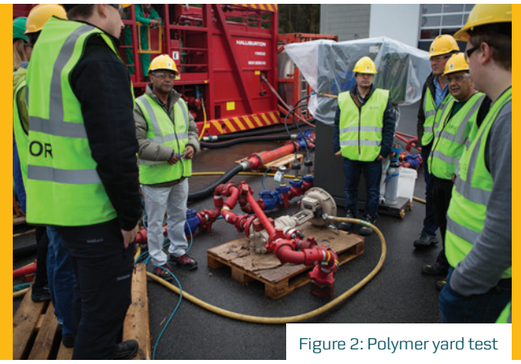

Figure 2: Polymer yard test

The target ultimate recovery rate for the Norwegian continental shelf (NCS) is currently estimated at an impressive 47% by the Norwegian Petroleum Directorate, and the stated ambition is to lift this to 70%. The number reflects both the excellent reservoirs on the Norwegian shelf and a continuous effort to enhance technologies for enhanced or improved oil recovery (EOR or IOR).

INTRODUCING THE NIORC

One such effort is the National IOR Centre of Norway, a partnership between the International Research Institute of Stavanger (IRIS), University of Stavanger (UiS) and Norway's Institute for Energy Technology (IFE). The centre has 10 industrial partners, and Maersk Oil is one of them.

The centre is focusing on two particular IOR technologies, polymer and 'smart water' (adjusted salinity), both of which could be very useful in reservoirs on the NCS. The centre is currently researching aspects of these technologies on all scales from the nano-scale to the field scale, with both experimental and modelling work.

Nano-scale investigations include measurements to quantify the mineralogical changes on carbonate rock flooded with waters of different salinities. The technology has advanced to a point where imaging of minerals with a spot-size of down to 6 nm (0.0000006 millimeters) is possible – see Figure 1.

POLYMER FLOODING

Polymer flooding is an area with potential interest to the Johan Sverdrup licence partners, given that a polymer pilot is included in the field development plan. In polymer flooding, more oil can be recovered by making the injected water more viscous, thus improving the mobility ratio between oil and the injected water. For this to work effectively, it is important to minimise degradation of the polymer, which can happen when the polymer is exposed to shear during injection.

The IOR centre recently conducted a test to investigate how much shearing occurred to two different polymers when pumped through different types of choke valves and at different concentrations. An interesting finding was that it was possible to reduce polymer shear degradation significantly by placing several standard off-the-shelf choke valves in series instead of applying complex specialised choke valves.

OTHER APPROACHES TO IMPROVE RECOVERY

Other interesting developments at the centre include new fluorescent partitioning tracers that can be detected at low concentrations. These are injected into a formation to determine residual oil saturation after water has been injected to improve recovery, and advanced new methods for including seismic data into history matching observed production data from an EOR or IOR field pilot. ■

At a glance

Purpose:
Improved oil recovery

Technology:
Polymers and adjusted salinity water injection

Impact:
Boosting recovery by up to 20% from the Norwegian continental shelf