Geophysical Research Abstracts
Vol. 20, EGU2018-19284, 2018
EGU General Assembly 2018

Triaxial experiments of chalks at uniaxial strain conditions – the mechanical impact of seawater ion adsorption

Anders Nermoen (1,2), Reidar I. Korsnes (2), Aksel Hiorth (1,2), and Merete V. Madland (2)

(1) IRIS AS, Energy, Enhanced Oil Recovery, Norway (anermoen@gmail.com), (2) The National IOR Centre of Norway, University of Stavanger, Norway

The laboratories at University of Stavanger are equipped with tools and software designed to automatic control of the side stress for constant diameter measurements of cylindrical cores. In addition, the experimental setup allows for independent control of the overburden stress, pore pressure, temperature, flow rate and chemical composition of the injected fluids. The experimental setup enables experimental simulation of complicated scenarios of any choice (constant or dynamic) of overburden and side stress, pore pressure, temperature, and fluid injection scenario.
We have used this experimental setup to simulate complex reservoir operations in which hydrocarbon production is performed by combining pore pressure depletion (at the production well) and brine flow (through injection wells). This leads to spatial and time dependent variations in the chemical composition of the pore fluid, temperature, and the pore pressure thereby affecting the effective stress. Because of the calcite affinity to polar components, and the excessive surface area of chalk, all of its mechanical properties depend largely upon the pore fluid composition. Experiments have shown how the elastic stiffness parameters, the rate of deformation, and tensile, compressive yield, and shear failure strength are affected by the ionic composition of the brine.

Here, we present the results of a series of experiments in which the observed creep strain rate is affected by the injection of seawater at both high, and low effective stress – corresponding to the depleted and re-pressured phase of oil production. The tests were performed at uni-axial strain condition, i.e. at constant diameter and overburden stress and varying side stress. The test matrix was duplicated as temperatures of 92 and 130°C was used. Seawater was injected after a prolonged period of 1.1 M NaCl flow - a fluid almost inert to the chalk surface. At high effective stresses, the injection seawater led to significantly increased the axial strain, while the side stress required to keep its spatial diameter was increased. At low effective stresses, however, the impact of seawater injection is negligible. The mechanical impact of seawater injection is more pronounced for the 130°C experiments than the 92°C indicating how cooling of the reservoir would affect the overall dynamics.