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The Effect of DC Electrical Potential on Enhancing Sandstone Reservoir Permeability and Oil Recovery

B. Ghosh, E. W. Al Shalabi & M. Haroun

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Abstract

The merits of using electrokinetic phenomena to improve reservoir permeability on sandstone reservoir core plugs are investigated with detail clay mineralogy studies. Normal and reverse DC configuration is applied along with waterflood and studies are conducted on single-phase and two-phase fluid saturation conditions. The produced brines are acid digested and analyzed by inductively coupled plasma mass spectroscopy (ICP-MS). In single-phase flow experiments, permeability enhanced 180% with the normal electrode configuration but negligible change is observed in reverse configuration. In two-phase flow 59% and 10% permeability enhancement is observed in normal and reverse configurations, respectively. In addition, 11.6% additional oil is recovered from normal configuration. The results are examined in terms of electrolyte movement and resulting changes within the clay microstructure. In normal electrode configuration, formation of colloidal clay suspension and flowing out along with

produced brine is evident. This has resulted in increased pore passage and core permeability, whereas in the reverse configuration, clay structures remained unchanged. The given explanations are supported by ICP-MS and X-ray diffraction results.

Keywords:

clay migration | electrokinetics | electromigration | permeability enhancement