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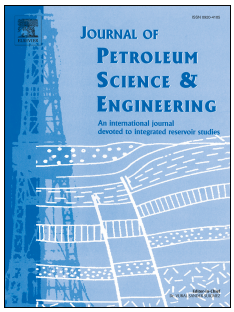

Self-Colmatation in terrigenic oil reservoirs of Eastern Siberia

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SELF-COLMATATION IN TERRIGENIC OIL RESERVOIRS OF EASTERN SIBERIA

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Abstract

The main objective of this work is to study formation damage phenomenon associated with in-situ migration of fines in rock samples from terrigenic reservoirs of Eastern Siberia experimentally. Results of oil flooding for the wide range of flow rates and permeabilities show that oil does not lead to fine mobilization and its consequent retention with permeability reduction. The permeability decrease is observed only when water is flowing in the porous space. Water itself is shown to be a strong driver of self-colmatation, which is likely because of its intensive physicochemical reaction with pore surface. Performing multiple core flooding tests and analyzing the data, we define the range of rock properties and flow conditions corresponding to development of the situ formation damage (self-colmatation). We classify self-colmatation over 5 types characterized with different behaviors of permeability decrease. We comprehensively study the dependencies of permeability reduction specifics on rock properties and flooding conditions. The dependencies account for multiple parameters correlated with permeability reduction: absolute permeability, residual oil saturation, three characteristic pore diameters, four characteristic grain diameters and four major minerals within the rock structure. We discovered that the increase of formation damages are associated with high absolute permeability and low residual oil saturations. It was shown that characteristic size of migrating fines is 0.01-0.005 mm and the diameter of pores where these fines can be strained is 12 μm. We derive a single numerical criterion to estimate the influence of 13 parameters on colmatation process. The absolute permeability and the fraction of pore throats with diameters higher than 30 μm are shown to be the strongest influencers on colmatation.

Keywords:
colmatation, formation damage, permeability reduction, water flooding, fine migration, rock properties

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