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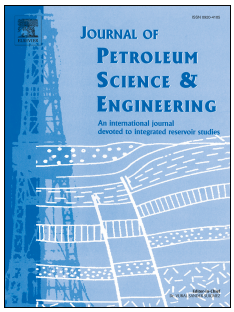

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Streaming Potential Measurements for Downhole Monitoring of Reservoir Fluid Flows: A Laboratory Study

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Abstract

In this paper, we conduct an experimental study to investigate the use of streaming potential measurements for downhole monitoring of fluid flows in porous media for production and stimulation operations. The streaming potential arises from the movement of conductive fluid through a porous medium under an applied pressure gradient. It is generated through a passive electrokinetic process that does not require any electrical power source. Existing coreflooding apparatus is enhanced with capability of streaming potential measurements as oils or brines of different composition and salinity are injected at varying flow rates into carbonate core samples at elevated pressure. The main objective is to establish a correlation between the trend in the variations of the streaming potential and fluid flow in the core and develop the experimental fundamentals within the coreflood equipment. First experimental results are found consistent with previously published data which verifies the new experimental setup. This is followed by performing and analysis of additional experimental cases showing the sensitivity of streaming potential response on the composition of the saturating fluid and the rock permeability. The magnitude of the streaming potential is observed to decrease as the salinity of the brine injected into the core sample is increased and/or rock permeability is higher when maintaining the same fluid injection rate. The streaming potential is also measured for oil-saturated cores while injecting brine. The obtained trend in the streaming potential demonstrates the potential use of such measurements to track the water front during production operations. The goal is to establish experimental fundamentals within the coreflood equipment and this will be used for a further large scale experiment. This is expected to enable a better understanding of the electrokinetic process and alleviate the inherent uncertainties associated with the application of the streaming potential in the field.

Keywords: Streaming potential; coreflooding experiments; flow in porous media; production and stimulation operations.

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