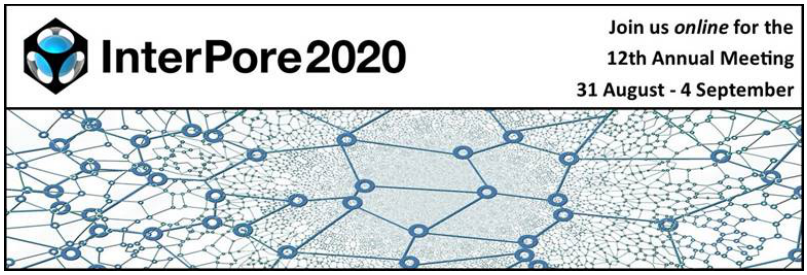

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Microscopic flow mechanism of shale oil based on digital cores with multi-mineral phases

It's important to understand the transport behaviors of fluid through organic/inorganic nanopores for shale oil reservoir development. Flow in nanochannels is affected notably by fluid slippage and adsorption on the nanochannel surfaces. Both slippage and adsorption are related to wettability. The wettability of shale oil reservoir has a wide spectrum from water-wet to mixed-wet and oil-wet due to the multi-mineral phases. In this work, a 3-D digital core with multi-mineral phases is reconstructed from 2-D SEM images of a shale sample. A math model of shale fluid flow considering the slippage boundary condition and varying fluid viscosity is established based on the N-S equation, combined with the slip length formula and apparent viscosity formula obtained by molecular dynamics simulation. Based on the digital core and math model, the single-phase flow simulation is solved based on semi-implicit method for pressure-linked equations (SIMPLE), and the two-phase flow simulation is solved based on volume-of-fluid (VOF) method. By changing the pressure difference and fluid properties, the flow rates in the digital core are obtained, and a relationship chart between the pressure difference and flow rate is made to analyze effects of various factors on the flow.

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References

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