Contribution ID: **753** Type: **Oral 20 Minutes**

Using Nanofluids to Control Fines Migration for Oil Recovery: Nanofluids Co-injection and Nanofluids Pre-flush

Tuesday, 15 May 2018 10:08 (15 minutes)

This work provides a comprehensive study to evaluate and optimize the effectiveness of nanofluids to both prevent fines migration and enhance oil recovery using different utilization approaches: nanofluids co-injection and pre-flush. To do that, 1) a comprehensive review of both laboratory experiments and field cases is adopted to confirm the effectiveness of nanoparticles to control fines migration. 2) A novel model of maximum fines retention concentration is then introduced to find out the physical mechanisms on how nanoparticles control fines migration. 3) Through matching with lab experiments, the physical behaviors of fines migration and attachment with the effects of different types of nanofluids are characterized, including fines attachment and straining rates, and breakthrough time of injected fines. 4) As a new criterion, mitigation index (MI) is defined to find out the more excellent performance of nanofluids pre-treatment that that of nanofluids co-injection. 5) In two-phase oil/water flow, analytical modeling and solutions of nanoparticles to control fines migration is developed, in terms of both enhanced oil recovery and well injectivity. 6) The pros and cons of fines migration on performance of low-salinity water flooding are discussed comprehensively, in this work, and the success of combining nanofluids with low-salinity water flooding is also confirmed to achieve more oil recovery. The outcomes of this work will help extend the applications of nanofluids in reservoirs suffering from problems of fines migration.

References

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Session Classification: Parallel 3-F

Track Classification: MS 1.01: Multi-scale Particulates Transport through Porous Media Saturated with Multi-Phase Fluids