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ABSTRACT

Enhancing Oil Recovery Efficiency with Manganese Dioxide Nanofluids: Exploring the Role of Electrochemical Potentials and Electromagnetic Fields

Hassan Soleimani

Geoscience Department Universiti Teknologi PETRONAS, 32610 Seri Iskandar Perak Malaysia

Enhanced Oil Recovery (EOR) techniques aim to maximize the extraction of crude oil from reservoirs by improving recovery efficiency. In recent years, the application of nanofluids, specifically manganese dioxide (MnO2) nanofluids, has garnered attention due to their unique properties, such as increased surface area, reactivity, and potential to interact with reservoir environments. This study investigates the role of MnO2 nanofluids in EOR, focusing on how electrochemical potentials and electromagnetic fields can enhance their performance in improving oil recovery. Manganese dioxide nanofluids exhibit a range of properties that can benefit EOR processes. These include their ability to reduce the viscosity of injected fluids, enhance the displacement of trapped oil, and facilitate better interactions with reservoir rock surfaces. The electrochemical potentials of MnO2 nanoparticles play a crucial role in these interactions, influencing the wettability of the reservoir rock, altering the interfacial tension between the oil and water phases, and promoting the mobilization of oil from pores that are typically resistant to conventional recovery methods. Additionally, the application of electromagnetic fields has been shown to further enhance the movement and dispersion of MnO2 nanofluids in porous media, improving the overall displacement efficiency.

This research highlights the synergistic effects of electrochemical potentials and electromagnetic fields in optimizing MnO2 nanofluid behavior. The study explores the underlying mechanisms driving these effects, including alterations in surface charge, ionic interactions, and fluid dynamics within the reservoir. Laboratory experiments and simulations are used to quantify the impact of these factors on recovery efficiency, providing insights into the practical application of MnO2 nanofluids for EOR. Ultimately, this work demonstrates that the incorporation of MnO2 nanofluids, combined with electrochemical potentials and electromagnetic fields, offers a promising approach to enhance oil recovery efficiency, presenting a potential breakthrough in the field of EOR for challenging reservoir conditions.

References:

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