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Effect of Porous media on Minimum Miscibility Pressure

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Nowadays, due to the substantial oil consumption and a significant reduction in the natural oil reservoir production capacity, the demand for methods to enhance and optimize production life, especially in mature reservoirs, has grown. Enhancing oil recovery (EOR) from mature reservoirs is a well-known technique that can meet growing energy demands. Among various EOR methods, gas-based techniques stand out as the most effective. This could be attributed to some advantages, including easier injection, higher efficiency, and reduced costs in comparison to alternative methods. In gas-based injection techniques, the minimum miscibility pressure (MMP) and enrichment (MME) are among the two determining factors for operational optimization. The impact of porous media on MMP is a key question from the scientific and operational point of view because due to the confinement of a porous media, the phase behavior of both oil and gas can vary according to the porous media characteristics, such as porosity and permeability.
The primary objective of this study is to present the Vanishing Interfacial Tension (VIT) test as an easy and fast experimental approach compared to the slim tube technique for the analysis and determination of optimal conditions in gas injection processes. This research covers the introduction of both laboratory experiments and mathematical modeling of the VIT test for a live oil sample and an injected hydrocarbon gas. This method aids in assessing the sensitivity of active mechanisms within gas injection processes to the composition of the injection gas. Furthermore, the VIT model in this study has been modified based on porous media porosity and permeability, which the results show the reduction of MMP by permeability/porosity ratio decrease, for example in one case the MMP varied from 3600 to 3200 psi by decreasing the permeability/porosity ratio from 2 to 0.1. Also, the interfacial tension of oil and gas varies from 8 to 6 mN/m. Hence, the miscibility can happen more easily by permeability/porosity ratio reduction.

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