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Effectiveness of CO2 microbubble method for enhanced oil recovery in fractured reservoirs

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Recently, CO2 microbubbles (MBs) injection has become an important method to increase oil production in fractured reservoirs and reduce greenhouse gas emissions due to its unique physicochemical properties. The stability and size distribution of MBs as well as their flow behavior at the pore scale are key to improving the displacement efficiency and regulating the performance. In this study, a high-speed homogenizer was used to prepare CO2 MBs dispersions, and the effectiveness of this method for enhanced oil recovery in fractured reservoirs was investigated by microfluidic experiments. The results showed that the microbubbles consisted of a special three-layer structure and existed independently in the liquid phase without aggregating with each other. Moreover, the prepared MBs had a size range of 9.73-75.53 μm with an average diameter of 38.73 μm. Compared to the low sweep area resulting from inadequate mobility control of water injection, MBs injection can significantly increase flow resistance to achieve maximum sweep efficiency and oil recovery of 93.02% and 91.04%, respectively. This study demonstrates that CO2 MBs can be used as a promising method for enhanced recovery in oil reservoirs.

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