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CO₂ injection for enhanced oil recovery in Bakken tight oil reservoirs

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Highlights

- The CO₂ huff-n-puff for EOR in the Bakken is investigated.
- CO₂ molecular diffusivity is a significant factor.
- Sensitivity studies are performed to quantify the key parameters.
- More heterogeneity is much favorable for the CO₂ huff-n-puff process.

Abstract

The combination of horizontal drilling and multi stage hydraulic fracturing have boosted

The combination of horizontal drilling and multi-stage hydraulic fracturing have boosted the oil production from Bakken tight oil reservoirs. However, the primary oil recovery factor is very low due to the extremely tight formation, resulting in substantial volumes of oil still remaining in place. Hence, it is important to investigate the potential of applying enhanced oil recovery methods to increase oil recovery in the Bakken formation. Although carbon dioxide (CO₂) is widely used in conventional reservoirs to improve oil recovery, it is a new subject and not well-understood in unconventional oil reservoirs such as the Bakken formation. In this paper, we use numerical reservoir simulation to model CO₂ injection as a huff-n-puff process with typical reservoir and fracture properties from the Bakken formation. Effects of CO₂ molecular diffusion, number of cycle, fracture half-length, permeability and reservoir heterogeneity on the well performance of CO₂ huff-n-puff are examined in detail. The results show that the CO₂ diffusion plays a significant role in improving oil recovery from tight oil reservoirs, which cannot be neglected in the reservoir simulation model. Additionally, the tight oil formation with lower permeability, longer fracture half-length, and more heterogeneity is more favorable for the CO₂ huff-n-puff process. This work can provide a better understanding of the physical mechanisms and key parameters affecting the effectiveness of CO₂ injection for enhanced oil recovery in the Bakken formation.



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Keywords

CO₂ huff-n-puff; Enhanced oil recovery; CO₂ diffusion; Tight oil; Bakken

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