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Study on the Law of CO2 Miscible Displacement Under Different Injection Methods in Heterogeneous Reservoir

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Abstract: There is still more residual oil in heterogeneous reservoirs after water injection, and it is difficult to recover them by further water flooding. As a common gas flooding medium, CO₂ can further improve the recovery of heterogeneous reservoirs after water flooding, so it is of great significance to study the laws of CO₂ miscible flooding under different injection methods in heterogeneous reservoirs. In this study, according to the heterogeneity characteristics of Lunnan Oilfield in Tarim, China, a single 1 m double-layer long core model was designed and prepared, and CO₂ miscible displacement experiments with four different injection methods were carried out. Through the comparison and analysis of the experimental data, the displacement effect of CO₂ miscible flooding under different displacement methods is obtained, and the laws of CO₂ miscible flooding under different injection methods in heterogeneous reservoirs are summarized. The research shows that: ① The oil displacement efficiency of different injection methods of CO₂ miscible flooding in heterogeneous reservoirs from high to low is: CO₂-water alternate injection, continuous CO₂ flooding, periodic CO₂ flooding, and CO₂-hydrocarbon gas alternate injection. ② CO₂ miscible flooding in heterogeneous reservoirs mainly relies on convective diffusion and miscible mass transfer to recover crude oil. ③ The effect of convective diffusion mainly depends on the plugging of the dominant channels in high-permeability areas and the control of injection-production pressure differential. The effect of miscible mass transfer mainly depends on the degree of displacement in the early stage and the strength of gas miscibility. ④ To improve the recovery efficiency of CO₂ miscible flooding in heterogeneous reservoirs, on the one hand, gas channeling should be slowed down, dominant channels should be blocked, and displacement pressure differential should be improved. On the other hand, the miscibility of CO₂ should be improved.
Keywords: Different injection methods; Heterogeneous reservoir; CO₂ miscible flooding;

Participation

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References

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