Study of Supercritical CO_2 Flooding with Diverting Agents in Heterogeneous Reservoirs

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Abstract

CO_2 flooding technology has become a relatively mature tertiary oil recovery technique, showing promising application prospects in complex small block oilfields. However, after the large-scale injection of CO_2, some reservoirs have experienced severe gas channeling issues. Foam diversion and blocking are among the primary methods for controlling gas channeling. This study addresses the gas channeling problem in the JS oilfield, examining the effects of temperature, pressure, diverting agent concentration, and supercritical CO_2 on the foaming ability, foam stability, and foam comprehensive index (FCI) of the gas-soluble diverting agent G-CF4 and the water-soluble diverting agent W-CF1. The results indicate that under the target reservoir conditions (100 ℃, 15MPa), the optimal foam system is G-CF4 at a concentration of 0.25%. Subsequently, experiments were conducted to evaluate the adsorption effect, plugging effect, and oil displacement efficiency of the G-CF4 diverting agent. The experimental results show that the greater the permeability differential, the better the plugging ability of G-CF4 in high-permeability cores. During the CO_2 flooding stage following the injection of the diverting agent, G-CF4 was able to maintain the resistance factor of high-permeability cores above 9.2 in cores with a permeability differential of 90 md. G-CF4 exhibits strong plugging capabilities for CO_2 flooding, with the optimal injection slug size being 0.3 PV, under which conditions it can enhance oil displacement efficiency by 15%.

Keywords

CO_2 Flooding, Diverting Agent, Supercritical CO_2 Environment, Heterogeneous Reservoir