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Research on the occurrence states of microscopic remaining oil in ultra-low permeability reservoirs

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The Chang 6 reservoir represented by Wangyao Area in Ansai Oilfield is the earliest developed reservoir in Changqing Oilfield. After nearly 40 years of exploration and development, the comprehensive water cut has reached 72.8%, and the degree of geological reserves recovery is only about 17.8%. The reservoir has entered the middle and late stage of development, and the reserve-production ratio has decreased year by year, and the problems of production decline and low recovery degree have become more and more serious. The effect of conventional water flood adjustment and cyclic water flooding are not obvious. So it is necessary to use polymer injection, phlogisticated air injection and carbon dioxide injection to enhanced oil recovery. However, due to the great differences in the micro-pore structure of the reservoir, the location and shape of the micro-remaining oil are different, and the corresponding tapping methods for different types of micro-remaining oil are also significantly different. Therefore, it is necessary to carry out systematic water drive experimental research on the ultra-low permeability reservoir whose micro-remaining oil occurrence characteristics and production mechanism are not completely clear at present. In this study, the ultra-low permeability lithology reservoir of Chang 6 formation in Ansai Oilfield was taken as the research target area. By using the dynamic displacement scanning technology to obtain two-dimensional image information of micro-plunger core in different water flooding stages, and reconstruct the occurrence states of micro-remaining oil in three-dimensional pore space, and the types of micro-remaining oil were divided and quantitatively calculated according to its formation mechanism and three-dimensional structural parameters. Furthermore, the types and dynamic changes of micro-remaining oil in different water drive stages are analyzed, and the potential of micro-remaining oil in different development stages and corresponding utilization methods are defined, in order to provide theoretical guidance for the smooth implementation of water drive and tertiary oil recovery in ultra-low permeability reservoir.

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