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Establishment and analysis of characterization model of oil-water flow energy consumption in porous media

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Due to the law of flow energy consumption in the porous media process is relatively vague, in order to effectively control the energy consumption in the process of oil production by water flooding, a characterization model of oil-water flow energy consumption in porous media during oilfields water flooding development is proposed. The influencing factors of reservoir energy consumption under different reservoir geological parameters and different production scheme are analyzed. Through fluid mechanics, the energy conversion relationship among potential energy, pressure energy and kinetic energy in the reservoir is studied. Through Bernoulli equation, the changes of water injection energy, oil production energy and formation elastic energy in reservoir are transformed into the changes of formation pressure. And the energy consumption characterization model of reservoir is established. Through the numerical simulation technology, the pressure, flow and velocity distribution of the reservoir are simulated, and the injection energy, the consumption energy and useless consumption ratio of the whole reservoir are calculated through the flow relationship in the reservoir. Firstly, the energy consumption characterization model of the reservoir subsystem is established by considering the injection energy, production energy and formation energy (potential energy, kinetic energy and pressure energy) of the reservoir system during oil production process. The oil-water flow energy consumption model in porous media is verified by different production systems in the ideal model. With the reservoir development by water injection, the water cut increases gradually, the proportion of energy consumption decreases gradually, but the energy consumption per tonne oil increases gradually. Then, the influence of geological parameters such as permeability and viscosity on energy consumption of reservoir system is considered. Under the same water cut, the energy consumption and its proportion of reservoir system increase with the decrease of permeability and the increase of viscosity. In addition, under the low permeability and high viscosity, the proportion of energy consumption of reservoir is nearly 100%. Finally, the influence of production parameters such as well spacing on energy consumption of reservoir system is considered. Well spacing has little effect on the energy consumption and its proportion of reservoir system. Formation pressure has little effect on the energy consumption, but its proportion decrease with the increase of formation pressure. The characterization model of oil-water flow energy consumption in porous media can quantitatively represent the energy completely lost due to friction in reservoir. Study on the law of oil-water flow energy consumption in porous media can effectively improve production efficiency, reduce useless energy consumption and oil production costs.

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