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Physical simulation experiment and numerical inversion of the full lifecycle development of shale gas well

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Shale reservoirs generally have very low porosity and permeability and complex occurrence and transport state, which lead to its unique L-curve production characteristics, representing complicated flow mechanism. A physical experiment using full diameter core was designed to simulate the full lifecycle development process of the shale gas well. From the experiment, many important and comprehensive production dates corresponding to the real production process, such as pressure and daily gas production, were obtained, which solves the difficulty to collect real production dates derived from short production time or operation discontinuity of the shale gas well. This experiment lasted 1631 days and the results showed that there is an ideal similarity of production between physical simulation and shale gas well. Based on the simulation data, the core's critical desorption pressure(12MPa), the free gas volume(3820.8ml), and adsorbed gas volume(2152.2ml) were confirmed accurately. Furthermore, the ratio of free gas and adsorbed gas in daily gas production at different time and pressure, the lasting production time and final recovery efficiency at the abandonment pressure were accurately determined. Based on well test and similarity theory, numerical inversion was applied to calculate the production dynamic curve of shale gas well and predict the development effect of gas well based on the similarity between core and gas well.

References

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