MICRO-NANO SCALES FLOWING SIMULATION IN SHALE GAS

Duan Yonggang, State Key Laboratory of Oil and Gas Reservoir Geology and Exploitation (Southwest Petroleum University), China
nanchongdyg@163.com
Zhang Tiantian, State Key Laboratory of Oil and Gas Reservoir Geology and Exploitation (Southwest Petroleum University), China
Cao Tingkuan, Post-doctoral Research Station, SINOPEC Southwest Oil & Gas Company, China
Fang Quantang, State Key Laboratory of Oil and Gas Reservoir Geology and Exploitation (Southwest Petroleum University), China

Keywords: shale gas, transport mechanisms, pore network model, nano-scale flowing simulation, flowing characteristics

The storage space of shale reservoir is mainly composed of complicated nanoscale pore, in which the gas exists in the form of absorbed gas and free gas. Due to the complicated pore structure and various gas storage states, gas flowing in the pore space is affected by multiple transport mechanisms including adsorption, desorption, Darcy flow, slippage and diffusion, etc. Therefore, a comprehensive research on the effects of transport mechanisms on shale gas flow is the key to study the shale gas migration rule, evaluate production capacity, and make reasonable development plan. Firstly, according to the physical meanings and interactive relationships of transport mechanisms, the flowing mathematical model is established for the pure methane gas. Then, based on the pore network model, which takes both the geometrical morphology and topological structure of shale matrix pore space into consideration, the above flowing mathematical model is discretized to construct the corresponding pore network flowing numerical model. Finally, gas flowing simulation is carried out by solving the model. The impacts of various transport mechanisms on gas flowing in the process of shale gas development under different physical properties and pore pressures are studied, and the changes of gas flow mechanisms at different stages are also analyzed. The research results will contribute to the understanding of the gas transport rules in shale gas reservoir, improve seepage theory of this unconventional reservoir and provide a theoretical support for rational development plans.