

Research advances of microscopic pore-throat structural characterization techniques in unconventional tight oil and gas reservoirs

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Nano-scale pore throats dominate in the unconventional tight oil and gas reservoirs and the pore-throat microscopic structure plays a key role in leading to low-permeability and low-porosity reservoir features. Currently, there are a variety of methods on pore-structure study of conventional reservoirs, while there are fewer on pore-throat characterization study for unconventional tight oil and gas reservoirs, most of which are at exploration stage. By using multiple testing methods involving nanoscale material science, physical chemistry and analytical chemistry and by selecting distinct characterization associations on basis of different lithologic features, initial progresses are achieved in characterization of size, morphology, distribution and 3-D extension of pores, besides, characterization precision of nano-scale microscopic pore-throat structure in unconventional reservoirs is also greatly promoted, which helps to realize more accurate and scientific characterization of pore-throat structure.

1) Using series of methods to characterize the different types and scale of pore-throats system in artificial cores and natural cores and to establish the best technical combination for different rocks.

2) Optimize one or several pore structure parameters to characterize the property of tight reservoirs, and subdivide types in detail.

3) The permeability of tight shale is at micro-Darcy even nano-Darcy scale. Based on the comparison of experimental data and numerical simulation, effective methods for pores recognition and definition in tight reservoirs should be developed. The combination of data obtained from different methods may be helpful to characterize the micro-nanometer pore-throats systems.