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Present Situation of Core Mercury Injection Technology of Unconventional Oil and Gas Reservoir

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Unconventional oil and gas step into a new area of global oil and gas exploration due to the success of the development of shale gas of America. Unconventional tight reservoir has huge differences with conventional reservoirs, including cell aggregation, migration patterns, source configuration storage, reservoir characteristics, flow mechanism and so on, which is because of unconventional reservoir with complex pore-throat systems. Therefore, it is of vital importance to research the micro pore throat structure characterization of unconventional reservoir, which contains pore and throat shapes, size, distribution and interconnected relationship (Wu Shenghe, Xiong Qihua, 1998) and can reveal the accumulation regularity of unconventional oil and gas. Absolutely, all of above have an extremely important role in unconventional reservoir exploration and development.

The methods to describe the micro pore-throat structure characterization of unconventional reservoir are various, including scanning electron microscope analysis technology, core mercury injection method, the gas adsorption method, nuclear magnetic resonance, X-ray tomographic 3D scanning technology experiment analysis method and so on. However, every research technique has its own advantages and disadvantages. This paper mainly elaborates the experimental process of core mercury injection and its important role in studying the pore-throat structure of the unconventional tight reservoir.

The core mercury injection technique is one of the most commonly used analysis techniques of the reservoir rock pore structure, which can obtain the information to reflect the reservoir pore-throat size and distribution to divide reservoir types effectively using mercury capillary pressure curves. Core mercury injection technique consists of rate-controlled mercury penetration technique and high pressure mercury injection. The former utilizes to maintain the low speed of mercury into the core samples to conduct

experiments based on conventional mercury penetration theory. Firstly, it can be assumed that the porous medium consists of different diameters and sizes of pore and throat. At the same time, it can obtain pore and throat information. And then, all of above can be better utilized in low or even lower permeability reservoirs, whose pore-throat features are differential extremely (Jiang Yuqiang, Chen Lin et al, 2014). Because the rate-controlled mercury penetration experiment has a steady speed process of mercury and the speed is very slowly, so it can be able to distinguish pore and throat. In addition, the contact angle is closer to the static contact angle. Due to the results of above, the pore throat diameter is closer to real value. Therefore, the rate-controlled mercury penetration technique is an important method to study the microstructure of compact reservoir.

Unconventional reservoir rock capillary pressure curves have its own particularities (Figure 1). We can analyze whether it has a high displacement pressure according to the shape of the figure by capillary force curve. We should start with dealing the capillary curve to analyze whether the capillary has a direct relationship with pore throat radius. The capillary force curve obtained by mercury injection analysis should eliminate the mercury saturation caused by the rough surface roughness of the rock surface firstly (Zang Shibin, Sun Xi et al, 2008). The researcher can calculate the rock permeability of every throat radius by Carman-Kozey formula and analyze the unconventional tight reservoir pore-throat characteristics by combining the mercury saturation.

It is more difficult to carry out the unconventional tight reservoir exploration and development as well as evaluation because of complex unconventional reservoir structure. Although many scholars, at home and abroad, have put forward a variety of methods, there are still limitations due to the reasons for the equipment or technology. Therefore, only we combine more techniques to study the micro pore-throat characteristics of

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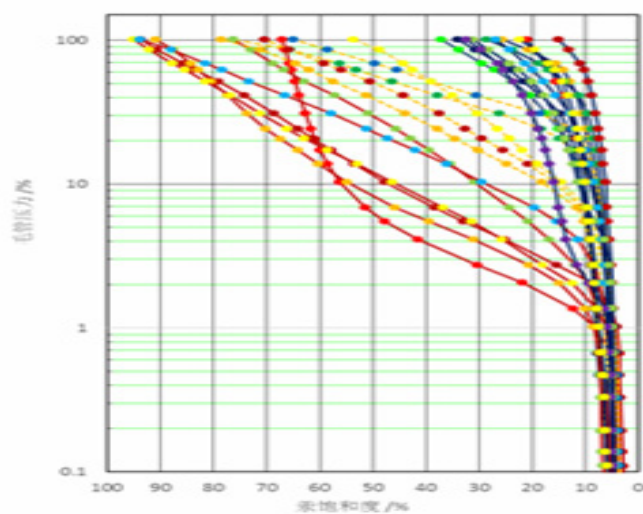


Fig.1 The picture of mercury saturation and capillary force

unconventional reservoir, can we better interpret unconventional reservoir, and prepare for the exploration and development of oil field.

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