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Organic matter–oil adhesion force and ultimate flow distance of adsorbed oil in shale reservoirs

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In China, continental shale oil reservoirs are featured with extremely low porosity and permeability, where oil is greatly subjected to solid–liquid adhesion force. The organic matter–oil adhesion force plays a crucial role in shale oil occurrence and movability in shale reservoirs. To effectively characterize the organic matter–oil adhesion force, this paper presents an AFM testing method to measure the adhesion force and derives the formula of pressure distribution with the adhesion force as the major flow resistance. It is found that organic matter shows the largest roughness, followed by felsic; and pyrites and interstitial materials show the smallest roughness. Organic matter exhibits larger average grain size, but smaller pore number than felsic. Given a similar organic matter maturity, the organic matter–oil adhesion force decreases with increasing content of light components. If pore wall length in organic matter is larger than the ultimate flow distance, adsorbed oil will not be desorbed to form free oil; on the contrary, adsorbed oil will be desorbed and turn into free oil. Hydraulic fracturing can raise reservoir pressure and the ultimate flow distance of adsorbed oil, thus allowing more adsorbed oil to be produced.

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