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Research on Fracture Propagation Law of Shale Hydraulic Fracturing Based on Mineral Interface Effect

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To address the scientific problems of fracture initiation and expansion of hydraulic fractures in the process of shale gas reservoir extraction, this paper focuses on the influence of shale minerals on fracture initiation and expansion of hydraulic fractures under the influence of mineral interface, establishes a geometric model of random distribution of shale minerals at the microscopic scale, and uses the cohesion model to characterize the mineral interface, and constructs a microstructure model of shale considering the influence of mineral interface. Numerical simulations are used to study the effects of mineral interface stiffness, mineral content and mineral grain size on hydraulic fracture expansion, and the fracture expansion pattern of shale hydraulic fracture under the influence of mineral interface is obtained. The results of the study help to reveal the mechanism of shale minerals on hydraulic fracture extension under the influence of mineral interface, and provide a theoretical basis for the reasonable selection of hydraulic fracturing layer in shale gas reservoir. The results show that.
(1) The mechanical response of mineral interface to shale is more obvious, and when subjected to external force, the damage appears first at the mineral interface, and then the damage starts to occur gradually inside the mineral, and the damage inside the quartz mineral is the largest, and the damage inside the clay mineral is the smallest. (2) As the stiffness of mineral interface increases, short and wide cracks are formed more easily; as the percentage of brittle minerals increases, long and wide cracks are formed more easily; when the mineral grain size increases from 40μm to 60μm, long and wide cracks are formed more easily, and when the mineral grain size increases from 60μm to 80μm, short and narrow cracks are formed more easily, and the form of crack damage is mainly tensile damage. (3) The shale hydraulic fracturing operation should give priority to the fracturing of layers with low mineral interface stiffness, high brittle mineral content and large mineral grain size, which is conducive to the construction of seepage channels in shale reservoirs and improving the transport capacity of shale reservoirs.

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