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The degree and law of the influence of microscopic pore structure on permeability in digital rocks

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The three-dimensional digital core, which describes the microstructure of the rock on the pore scale, has become the basis for quantitative analysis of the pore structure and physical properties of the rock. The microscopic pore structure of rock greatly affects its seepage properties. Permeability is a parameter that characterizes the ability of a rock to conduct fluid, and it is one of the most important physical properties of rock. Using numerical simulation methods to study the influence of microscopic factors on the permeability can make up for the deficiencies of traditional rock physics experiments and provide a bridge for quantitatively investigating the relationship between pore structure and permeability. In this paper, the degree and law of influence of microscopic factors on permeability are explored by using pore network model. Taking the X-ray CT rock and process-based model as the digital core material, the maximum ball technique is used to establish pore network model equivalent to the digital core, and their topological properties, pore throat size, and pore throat shape are analyzed. Based on the quasi-static principle and these digital cores, the influence of various factors (including grain skeleton, pore characteristics, fluid properties) on permeability is analyzed quantitatively. The primary and secondary factors can be judged by comparing the change times of the permeability of each pore throat parameter in the variation interval: throat size > coordination number > throat shape > pore size > pore shape. In addition, the relationship models between univariate factors and permeability parameters are established and analyzed. This research is helpful to understand the influence of micro-pore structure on permeability, find out primary and secondary factors, and provide more reference for reservoir logging prediction and petrophysical permeability model construction.

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References

Time Block Preference

Time Block A (09:00-12:00 CET)

Participation

Online

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