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Numerical and experimental study of "threshold pressure" in low-permeability porous media

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The threshold pressure gradientis usually used to describe macrolow-velocitynon-Darcycharacterization of single-phase flow characteristics in low permeability oil-gas reservoir in china, but there is few mechanism studies of threshold pressure gradient from the microcosmic point. What's more, thethreshold pressure gradient on two phase flow research is less. In this paper, based on the capillary pressure characteristic of pore structure, a simplified network of pore structure of anisotropic pore media is presented. First of all, the irreducible water saturation and the capillary forceare evaluated based on the capillary model. Then based on the pore distribution character of this model,a equation have been derived to calculate the effective permeability and water saturationof the core under different pressure drop and pore structure. Then experiments have been designed to examine the model. Firstly,thecapillary pressure curve andthe distribution character of the pore (eg. The same as the pore model) established by using mercury injection experiment. Thenthe effective permeability and the water saturation could be got throughdisplacement experiment under different pressure drop. The exprimental results have been compared to model predictions and they agree with each other very well. Different pore structure is also studed to analysis in this model, the results show that the fluid in large pore will first flow and the effective permeability is small when the pressure drop overcomesthe minimumcapillary pressure, thenthe capillary pressure of the smaller pore can overcome and the effective permeability increase with the increase of pressure drop until the a larger capillary pressure could not overcome in the region of pressure drop,which result of a a stablepermeability.so,the overcomed capillary pressure of different pore structure results of the macro"threshold pressure",which is function of pore structure and interfacial tension.What's more, because threshold pressure is drainage radius independent,so the threshold pressure gradient should not be used to desrible thislow-velocity non-darcy phenomenon. With this study of "threshold pressure", there is a better understanding on the essence of "threshold pressure", which is very important for the understanding the character of low-velocity Non-Darcy phenomenon.

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