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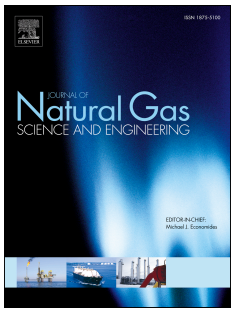

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Apparent permeability model for gas transport in shale reservoirs with nano-scale porous media

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Abstract

Understanding mechanisms of gas transport in shale matrix pores is of great importance for more accurate production prediction of shale gas wells. Shale matrix is generally considered to be composed of organic matrix and inorganic matrix, and the gas transport mechanisms in different types of matrix pores are different. To date, most of the gas transport models assume that the gas transport channels in shale porous media are cylindrical capillaries or slits with uniform pore size, which ignore the effect of pore size distribution (PSD) on gas transport capacity. In addition, there are few transport models considering the presence of water in inorganic matrix, and the gas transport capacity will be overestimated ignoring this factor. Therefore, a real gas transport model for shale matrix pores is proposed so that the shale gas transport behavior can be analyzed more accurately. First, the nanopores in shale matrix is represented by cylindrical capillaries, and a logarithmic normal distribution function is utilized to characterize the PSD in shale organic and inorganic porous media. Then, the gas transport models are constructed for organic porous media and inorganic porous media, respectively. The total transport model can be obtained by coupling the two types of models. What is more, the influence of stress dependence and real gas effect are taken into account in the models. After that, the models are validated, which show that the proposed models fit well with published