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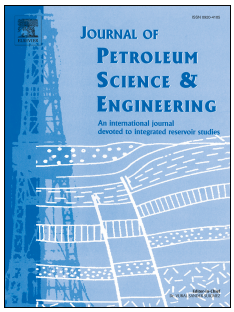

A fully-coupled gas-water two phase productivity equations for low-permeability CBM wells

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A fully-coupled gas-water two phase productivity equations for low-permeability CBM wells

ACCEPTED MANUSCRIPT

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Abstract

To date, much attention has been focused on the high-permeability CBM reservoirs, which results in ignorance of pressure and saturation gradients in the coal seams of previous productivity equations. However, for the low-permeability CBM reservoirs (<1 mD), the pressure and saturation gradients are too large to be neglected during the production process. The CBM reservoirs exhibit stress-dependent permeability changes during early dewatering operation and a strong matrix-shrinkage effect once below the desorption pressure. Thus, considering the pressure profile will enable us to capture the absolute permeability profile in the coal seams. In addition, the gas-water two phase flow will further aggravate the complexity of this issue. Similarity, considering the saturation profile will enable us to capture the relative permeability profile of gas/water phase in the coal seams. Hence, the objective of this research is to develop the productivity equations for low-permeability CBM wells considering both pressure and saturation gradients. Firstly, the previous gas/water phase pseudo-pressure is modified by considering the gas/water phase effective permeability. Secondly, on the basis of gas-water two phase conservation equations of mass and momentum, the relationship between pressure and saturation is established through rigorously derivation. Subsequently, combined with gas-water two phase relative permeability curve, we present

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