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Integrated investigation of coal seam gas reservoir characterization

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Statement of the Problem: Coal seam gas (CSG) reservoirs possess a great quantity of coal seam gas, which is a hazard to coal mining but also a significant energy resource. Therefore, to extract CSG from coal seams is very significant for the supply of our energy. However, coal seam gas reservoirs have many unique characteristics which differ from conventional reservoirs (e.g. gas adsorption and desorption, naturally fractured coal seams and stress/pressure-dependent permeability). These raise a great challenge in reservoir characterization by using conventional methods, namely, wireline logs, core description and seismic.

Methodology & Theoretical Orientation: A fine characterized fractured near-wellbore model, based on the available geological, geophysical and production data, is built and validated through history matching with actual well test data. A parametric study is carried out to numerically investigate the pressure transient behaviors of various fractures in low permeable coal seams.

Findings: Different fracture properties, including fracture permeability, fracture orientation and fracture spacing, have varied and obvious responses on the derivative plots of bottomhole pressure in the near-wellbore models. And some new features in the flow regimes of the derivative plots of the bottomhole pressure are presented and discussed by using velocity profiles. An application of the fine characterized near-wellbore model with explicit description of fractures in well Guluguba 5 demonstrates that only the results from the fractured near-wellbore model can match well with the actual well test data.

Conclusion & Significance: The fine characterized fractured near-wellbore models can incorporate all available geological and geophysical data and describe the reservoir structure and fluid properties in naturally fractured coal seam gas reservoirs accurately, which are vital for gas production prediction and enhanced coal seam gas recovery.

Figure 1

(a) Fractures perpendicular to the flow direction; (b) Fractures parallel to the flow direction; (c) Mixed fracture orientations. Blue points represent the wellbores.

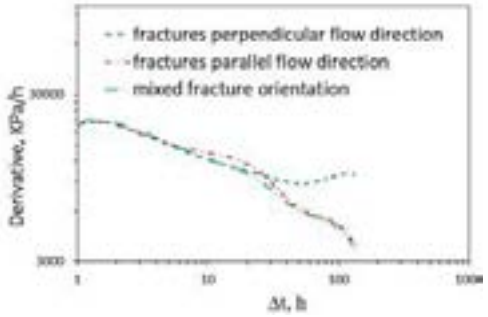

Figure 2

Comparison of the derivative plots of bottomhole pressure between different fracture orientations.

Biography

Qin Li has a great interest in improving unconventional gas reservoir exploitation, particularly in unconventional reservoir characterization. She integrates all available geological and geophysical information into a fine characterized fractured near-wellbore model to accurately represent the reservoir structure and fluid properties in the near-wellbore region in coal seam gas reservoirs. This model is validated by using pressure transient testing data from the field and the proposed near-wellbore model is utilized in well Guluguba 5 in Surat Basin in Queensland, Australia. The related application results demonstrate the usefulness and accuracy of the proposed method in capturing the major features of naturally fractured low permeable coal seam gas reservoirs.

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