

Author's Accepted Manuscript

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www.elsevier.com/locate/petrol

PII: S0920-4105(16)30258-3
DOI: <http://dx.doi.org/10.1016/j.petrol.2016.06.039>
Reference: PETROL3531

To appear in: *Journal of Petroleum Science and Engineering*

Received date: 23 February 2016
Revised date: 23 June 2016
Accepted date: 23 June 2016

Cite this article as: Junchao. Wang, Jiangwen Xu, Yongqing Wang and Haitao Li, A new production predicting model of fractured horizontal wells in dual porosity gas reservoirs on non-Darcy flow conditions, *Journal of Petroleum Science and Engineering*, <http://dx.doi.org/10.1016/j.petrol.2016.06.039>

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A new production predicting model of fractured horizontal wells in dual-porosity gas reservoirs on non-Darcy flow conditions

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Abstract

Dual-porosity is a common method to model natural fractured reservoirs or complex fracture network after volume hydraulic fracturing. To analyze the productivity of fractured horizontal gas wells, a new volumetric source model with high velocity non-Darcy flow in hydraulic fractures is developed. The basic volumetric source function is solved by utilizing orthogonal transformation in real space, which solves the problem that the non-linear equation (indicating non-Darcy effect) cannot adopt Laplace transformation. The volumetric source model is verified by the tri-linear flow model and a field example. Results shows increasing width of hydraulic fractures and enlarging size of proppant have significant effect on weaken non-Darcy flow. The volumetric source model is a fast and accurate method to predict the productivity. In addition, this model can provide a more reasonable method to optimize hydraulic fracturing considering non-Darcy flow effect.

Keywords: high velocity non-Darcy flow; dual-porosity gas reservoir; fractured horizontal well; volumetric source model

Nomenclature

| | | |
|----------|--|-----------------|
| x_e | Length of reservoir | m |
| y_e | Width of reservoir | m |
| z_e | Height of reservoir | m |
| L_H | Length of horizontal well | m |
| r_w | Radius of horizontal well | m |
| k_m | Bulk permeability of matrix | μm^2 |
| ϕ_m | Bulk porosity of matrix | dimensionless |
| k_f | Bulk permeability of natural fractures | μm^2 |
| ϕ_f | Bulk porosity of natural fractures | dimensionless |
| α | Shape factor | m^{-2} |
| y_F | Length of hydraulic fracture | m |
| z_F | Height of hydraulic fracture | m |
| w_F | Width of hydraulic fracture | m |

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