Contribution ID: **437** Type: **Poster**

A Transient Productivity Model of Multi-stage Fractured Horizontal Wells in Shale Gas Based on the Continuous Succession Pseudo-steady State Method

Tuesday, 15 May 2018 17:15 (1h 30m)

The multi-stage fractured horizontal wells(MFHW) is the key technology for developing shale gas reservoirs. After the stimulated reservoir volume is fractured, the gas flowing in matrix is non-linear seepage controlled by the nano-scale pores, while the seepage in stimulated region is transformed into Darcy flow controlled by the micro-scale fracture network. In this paper, the steady-state productivity model of MFHW is firstly established by comprehensively considering the multi-scale flowing states, shale gas desorption and diffusion after shale fracturing, which coupled flows in matrix and stimulated region. On this basis, for the first time, a transient productivity calculation model of MHFW combined the material balance equation is obtained with the continuous succession pseudo-steady state method (SPSS), which considered the unstable propagation of pressure wave. And the horizontal well productivity prediction and factors analysis are carried out by using the SPSS. The results show that the SPSS has the advantages of simple process of calculation, fast calculation speed and high agreement with numerical simulation results. During the production process, the desorption effect of shale gas is the key factor affecting the transient productivity of gas wells. During the production process, the desorption effect of shale gas is the key factor affecting the middle and late stage production of gas wells. With the increase of the radius and permeability of the mass fractures, the diffusion coefficient and Langmuir volume, the productivity of shale gas wells would increase, while the increasing rate would decrease. And the effect of Langmuir pressure on productivity is less. It is concluded that this method provides a theoretical basis for the calculation of transient productivity of shale gas fractured horizontal wells.

References

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Session Classification: Poster 2

Track Classification: MS 1.01: Multi-scale Particulates Transport through Porous Media Saturated with Multi-Phase Fluids