# Comparision Modificated Method of Peng-Robinson Equation of State in the Process of Gas Injection of Nanopores


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With the development of large quantities of gas injection in shale and tight reservoirs, the multiphase behavior in nanoscale pores before and after gas injection has gradually attracted people's attention. A large number of published literature have shown that due to wall adsorption and capillary force, the phase behavior of confined fluid in micro and nano pores is significantly different from that of conventional reservoirs, such as phase transformation hysteresis. The existing EOS equation, especially the PR-EOS method for the calculation of gas-liquid equilibrium, has been unable to accurately describe the change of gas-fluid phase state in nanopores. Therefore, it is necessary to modify the EOS equation according to the relevant terms introduced in the phase state mechanism of corresponding nano pores or combining with other methods. Our discussion focuses on three kinds of correction methods for phase state calculation in nanoscale pores, including: correction of gravitational phase and volume parameters in the equation of state; The capillary force and critical parameters in micro-nano pore channels were considered; Engineering Density Functional Theory (DFT) is combined with equations of state. Although the above methods in the literature are in order to improve the EOS model in the prediction of phase behavior change in a nanoscale pore precision for the result, but in the case of a given component simulated calculation, in the process of gas injection, the component concentration changing, each part of the existing EOS correction method adaptability to variable components is unknown, and they lack of contact with each other between various correction method. This discussion through the three kinds of PR - EOS correction method of micro/nano pores in the process of gas injection gas - liquid phase change contrast the actual situation of deviation rate, consider in the process of high temperature and high pressure gas injection with different pores scale, selection and analysis of the influence of key parameters on the phase behavior change and its sensitivity, finially,we can obtainted gas fluid EOS correction method of the accuracy and applicability after gas injection in the micro/nano pores. The results show that the three nano-scale pores phase state correction methods can reflect the phase state change better to a certain extent. Considering the change of composition, the changes of capillary force and critical parameters in micro and nano pores are more concise and the adjustable parameter range is larger. The fitting results can better reflect the changes of fluid phase state in micro and nano pores. The other two methods can clearly consider the intermolecular and fluid-surface interaction forces and can explain the restricted fluid phase behavior in micro and nano pores from the molecular perspective, but the calculation process involves large-scale calculation and is relatively complex.

Reference

[1]Leonardo, Travalloni, Marcelo, et al. Phase equilibrium of fluids confined in porous media from an extended Peng–Robinson equation of state-ScienceDirect[J].Fluid Phase Equilibria, 2014, 362(1):335-341.

[2]Teklu T W , Alharthy N , Kazemi H , et al. Phase Behavior and Minimum Miscibility Pressure in Nanopores[J]. SPE Reservoir Evaluation & Engineering, 2014, 17(03):396-403.

[3]Li Z , Jin Z , Firoozabadi A . Phase Behavior and Adsorption of Pure Substances and Mixtures and Characterization in Nanopore Structures by Density Functional Theory[J]. Spe Journal, 2014, 19(06):1096-1109.

[4]Wang, Lei, Neeves, Keith, Yin, Xiaolong,et al. Experimental Study and Modeling of the Effect of Pore Size Distribution on Hydrocarbon Phase Behavior in Nanopores[C] Spe Western North America & Rocky Mountain Joint Conference & Exhibition. 2014.