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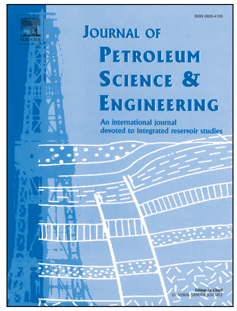

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Temperature Effect on Gas Adsorption Capacity in Different Sized Pores of Coal: Experiment and Numerical Modeling

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Abstract: Accurate methane gas adsorption capacity estimation is key for the coalbed methane (CBM) reservoir gas-in-place assessment. As *in situ*, the reservoir pressure and temperature vary from one location to another. The temperature induced gas sorption capacity evaluation is important for the CBM and mining industry. In this study, grand canonical Monte Carlo (GCMC) simulation was used to investigate temperature effect on methane adsorption capacity and adsorbed methane density for different sized pores. Methane adsorption experiments were performed to show realistic temperature effect on methane adsorption capacity and the experimental data were used directly to validate the numerical model. The pore structure of coal was characterized by high-pressure mercury injection, low-pressure N_2 gas adsorption, low-pressure CO_2 gas adsorption. The simulation results revealed that, first, temperature influence on methane adsorption was more obvious in smaller pores than that in larger pores. Based on the characteristics of the temperature influence on methane adsorption, pores can be divided into three categories: 0.7-0.9 nm pores, 1.0-1.3 nm pores and pores larger than 1.4 nm. In the 0.7-0.9 nm group, methane adsorption capacity decreased by approximately 19% at 3MPa from 20°C to 100°C. In contrast, in the 1.0-1.3 nm pores and pores larger than 1.4 nm, methane adsorption capacity decreased by approximately 32% and 45%. Second, in 0.7 nm and 1.0 nm pores, methane adsorption capacity decreased linearly with an increase in temperature. In 4.0 nm pores methane adsorption capacity exhibited a negative exponential decrease with increasing temperature at low pressure (< 3 MPa). Third, when the pore size was the same, the temperature effect was more obvious at a lower pressure than that at a higher pressure. The experimental results indicated that methane adsorption capacity in the coal sample decreased linearly with temperature increasing, and temperature effect on reducing methane adsorption capacity was greater at low pressure. These experimental results were consistent with the simulation results. Based on simulation and experimental data, it was obvious that temperature-induced gas adsorption capacity variation was both pore size dependent and pressure dependent.

Key words: Coalbed methane; temperature effect; methane adsorption; pore structure; GCMC;

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