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Experimental Study on the Effect of Moisture on Adsorption and Diffusion of Coalbed Methane

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Adsorption is one of the most important ways of coalbed methane stored in the coal seam. Methane diffusion in coal plays an important role in coalbed methane production. Understanding the characteristics of adsorption and diffusion of coalbed methane is keys to correctly evaluate the gas content and effectively enhance the gas production. As well known, most coal seams contain a certain amount of moisture. Its influence on methane sorption and diffusion should be considered in studies of coalbed methane content estimation and gas production prediction. To investigate the effects of moisture on adsorption and diffusion of coalbed methane, isothermal adsorption experiments of coal samples with different water contents at different temperatures and pressures were carried out. The “stretched exponential” model which couples a characteristic rate parameter k_0 with a stretching parameter β was adopted to calculate the diffusion coefficient by using the data of adsorption experiments. The results show that the methane adsorption obey the adsorption model of “Dubinin-Astakhov+ k ” for all dry coal samples and moist coal samples, the methane adsorption capacity was decreased with the increase of water content, meanwhile, the diffusion coefficient in the moist coal samples is much lower than the diffusion coefficient in the dry coal samples, which mean that the water hinders the gas transportation in the pores of coal obviously. Moreover, increasing the temperature can decrease the methane adsorption capacity and enhance the diffusion of gas for all dry samples and moist samples.

Keywords: moisture; adsorption; coal; stretched exponential; diffusion

References

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Primary author: Mr HAN, Wencheng (China University of Petroleum)

Co-authors: Ms LI, Aifen (China University of Petroleum); Mr TIAN, Weibing (China University of Petroleum); Mr FANG, Qi (China University of Petroleum); Mr FU, Shuaishi (China University of Petroleum)

Presenter: Mr HAN, Wencheng (China University of Petroleum)

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