Experimental Study on Fractal Characteristics of Adsorption Pore Structure of Coal

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Abstract:

The adsorption pore structure is the key affecting the technology of enhanced coal bed methane recovery (ECBM). In this paper, nitrogen adsorption measurement (NAM) and low-field nuclear magnetic resonance (NMR) methods are used to test the structural parameters of adsorption pores of four coal samples with different metamorphic degrees. Combining with the fractal theory, the applicability and the physical significance of fractal dimensions obtained from different models are analyzed. Finally, the main factors affecting the complexity of the pore size structure and the influence of fractal characteristics on the adsorption properties of coal are discussed. The results show that with the increase in the degree of metamorphism, the ranking order of the volume and the specific surface area of adsorption pores of four coal samples are long flame coal > anthracite > gas coal > coking coal. The fractal dimension D_2 calculated by the Frenkel?Halsey?Hill (FHH) fractal model ranges from 2.5 to 2.9, representing the degree of the pore surface irregularity, and D_3 calculated by the FHH fractal model ranges from 2.004 to 2.037, representing the complexity of pore size distribution. There is no clear quantitative relationship between the fractal dimension and the single structure parameters of adsorption pores. The more the pore diameter distribution is concentrated in the range of 2?5 nm, the larger the fractal dimension is, the higher the complexity of adsorption pore structure is; D_2, which represents the irregularity of the surface of coal, has a good linear positive correlation with the maximum adsorption capacity of N_2.