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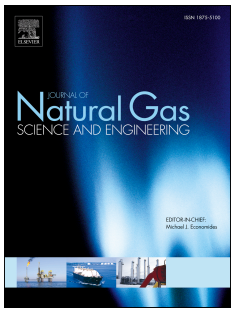

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Dengke Wang, Ruihuan Lv, Jianping Wei, Ping Zhang, Chong Yu, Banghua Yao

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An Experimental Study of the Anisotropic Permeability Rule of Coal Containing Gas

Dengke Wang[a, b, c, d] *, Ruihuan Lv [a, c], Jianping Wei [a, c], Ping Zhang [a, c], Chong Yu [a, c], Banghua Yao [a, c]

[a] State Key Laboratory Cultivation Base for Gas Geology and Gas Control, Henan Polytechnic University, JiaoZuo, 454000, China
[b] Work Safety Key Lab on Prevention and Control of Gas and Roof Disasters for Southern Coal Mines, Xiangtan, 411201, China
[c] The Collaborative Innovation Center of coal safety production of Henan, Jiaozuo, 454000, China
[d] State Key Laboratory of Coal Mine Disaster Dynamics and Control (Chongqing University), Chongqing, 400030, China

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ABSTRACT

To examine the characteristics of the anisotropic seepage of the coal containing gas, a study of the anisotropic seepage rule of the coal containing gas was carried out based on the tri-axial seepage experimental system with raw coal samples. The calculation method determined the principal value and the azimuth of the anisotropic permeability of the coal containing gas. Also, the permeability anisotropic ratio of the coal containing gas was defined. The permeability anisotropic dynamic variation rule and the phenomenon of the change of the dominant flow direction of the coal containing gas were thoroughly analyzed. The results showed that the flow of the methane in the coal had very obvious characteristics of anisotropy. The calculation method of anisotropy permeability of the coal containing gas proposed in this study was found to be simple and effective. The coal containing gas displayed strong stress-sensitivity. The variation rule between the permeability of the methane in the coal and the effective stress was determined to be in accordance with the negative exponential function. The change of the permeability anisotropy of the gases in the coal with effective stress showed an obvious dynamic change law of development, and changes were observed in the dominant flow direction of the gas in the coal.

1. Introduction

The permeability of coal which contains gases is a key parameter in the process of coal-bed methane (CBM) extraction, and affects the efficiency of the CBM extraction. The permeabilities of the coal seams in China are generally low (Ye et al., 1999). China's coal seams are often affected by sedimentary environments, coalification, and tectonic effects that result in an anisotropic permeability. Therefore, the examination of the stress sensitivity of the permeability anisotropy of the coal containing gas has an important guiding significance for the prediction and prevention of gas disasters, as well as the efficient extraction of CBM.

Therefore, researchers have previously carried out relevant research regarding the permeability and gas migration law of coal. For example, Pomeroy and Robinson (1967) conducted a water seepage experiment on cubic coal samples, and determined that the water seepage rates were obviously different when the confining pressure was perpendicular to the face cleats, butt cleats, and bedding planes, respectively. In a seepage experiment involving coal samples from the San Juan Basin of the La Plata Mine, Gash et al. (1993) discovered that the permeabilities of the coal samples which contained gases varied greatly in different directions. Also, the permeabilities along the cleat directions displayed only minor differences, and the permeability in the direction vertical to the bedding plane was observed to be small. These findings also confirmed the permeability anisotropy of the coal samples. Massarotto et al. (2003) defined the

responding author.
E-mail address: dengkew@126.com (Dengke Wang)