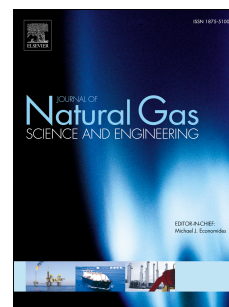


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Analysis of Physical Properties and Influencing Factors of Middle-Rank Coal Reservoirs in China

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ABSTRACT: Middle-rank coal mainly refers to bituminous coal with the vitrinite maximum reflectance ($R_{o,max}$) between 0.65% and 2.0%. Based on the results of a proximate analysis, maceral composition, high-pressure mercury intrusion porosimetry (MIP) experiments and isothermal adsorption experiments, combined with gas content and permeability derived from well test, the pore size distribution (PSD), adsorption characteristics and the evolutionary paths of middle-rank coal were analyzed, and the influencing factors of the gas-bearing property and permeability were discussed. The results indicated that as $R_{o,max}$ increases, the porosity shows first decreasing and then increasing, with the minimum values reached when $R_{o,max} \sim 1.0\%$. The volume and specific surface area of the total pores have the same evolutionary paths with each class of pores, first decreasing and then increasing with the increases of $R_{o,max}$. The minimum value appears when $R_{o,max}$ is between 1.2% and 1.3%. As $R_{o,max}$ increases, V_L increases while P_L first increases and then decreases, the maximum value is again reached at near $R_{o,max} = 1.3\%$. The gas content increases with the increases of $R_{o,max}$, first increasing and then decreasing with the increases of buried depth, and the buried depth at 950 m is the critical depth of gas content. There is a positive correlation between gas content and gas saturation; the permeability decreases with the increases of buried depth, and increases with the increases of coal reservoir porosity. Ground stress is the main controlling factor of reservoir permeability.

Key words: Middle-rank coal; Coal properties; Gas bearing characteristics; Permeability

1. Introduction

Middle-rank coal mainly refers to bituminous coal with the vitrinite maximum reflectance ($R_{o,max}$) between 0.65% and 2.0%. The CBM resource from middle-rank coal is approximately $14.3 \times 10^{12} \text{ m}^3$, accounting for approximately 38.36% of the total CBM resource in China (Che et al., 2008; Li et al., 2009). More than 20 years of development of the CBM resource in China, there have formed the CBM industrial base from high-rank coal. However, the CBM resource development from middle-rank coal developed slowly. Only part of the mining area in the east and south Ordos basin and the south margin of Junggar basin in Xinjiang entered into commercial development (Ye, 2011), the scale is small, the commercialization and production capacity are low. Middle-rank coal was the starting point of the CBM industry in the US, which first obtained CBM breakthroughs in the middle-rank coal of the Black Brave basin and the San Juan basin, and formed a theory of generation and storage

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