Study on Microstructure Differences of Coal Samples before and After Loading

Jiajia Liu[1], Jianliang Gao[2], Gaini Jia[3] and Ming Yang[4]

1. Ph.D, School of Safety Science and Engineering, Henan Polytechnic University, Jiaozuo, China, 454000. Email:liujiajia@hpu.edu.cn

2. Professor, School of Safety Science and Engineering, Henan Polytechnic University, Jiaozuo, China, 454000. Email: gao@hpu.edu.cn

3. Master, School of Safety Science and Engineering, Henan Polytechnic University, Jiaozuo, China, 454000. Email: 849768108@qq.com

4. Associate Professor, The collaborative Innovation center of coal safety production of Henan Province, Jiaozuo, China, 454000. Email:yming@163.com

ABSTRACT

The microscopic pore structure of coal affects the content of adsorbed gas. The microstructure of coal samples before and after loading is different, which will affect the adsorption and permeability of coal seam gas. In order to study this difference, the author carried out mercury intrusion experiments on coal containing different coal samples, and used non-destructive nuclear magnetic resonance (NMR) techniques, scanning electron microscopy and transmission electron microscopy to study the microstructure of coal samples before and after loading. The results show that the cumulative mercury content in the mercury intrusion experiment and the pore volume in the pore volume almost coincide in the micro-hole segment. The T_2 relaxation time of the coal sample measured by NMR before loading is mainly in the (0.1~1ms) region, which corresponds to the micropore segment of the coal sample, which is consistent with the results of the mercury intrusion test; NMR measurement before and after fracturing, the T_2 spectral area of the parallel bedding with different water-bearing coal samples is 12.5% and 25.5% higher than that of the vertical bedding. The permeability of the parallel bedding coal sample is good, and the coal sample exhibits anisotropic properties. Scanning electron microscopy and transmission electron microscopy showed that the pores and cracks of the coal samples increased after loading, and the localized area of the coal sample collapsed and formed a fracture zone, which was not conducive to the occurrence of coal seam gas. Further explanation of the changes in the permeability of the coal sample before and after loading will affect the gas storage and transportation.

Keywords: Loaded coal sample, Microstructures, NMR, SEM, TEM