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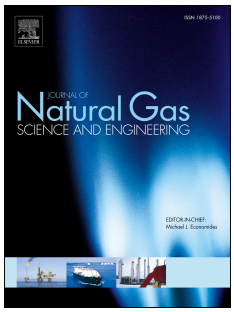

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Xiaofei Liu, Xiaoran Wang, Enyuan Wang, Xiangguo Kong, Chong Zhang, Shuaijie Liu, Enlai Zhao

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Effects of gas pressure on bursting liability of coal under uniaxial conditions

Xiaofei Liu [a, b,*], Xiaoran Wang [b], Enyuan Wang [a, b,*], Xiangguo Kong [b], Chong Zhang [b], Shuaijie Liu[b], Enlai Zhao [b]

[a] Key Laboratory of Coal Mine Gas and Fire Prevention and Control of the Ministry of Education, China University of Mining and Technology, Xuzhou, Jiangsu 221116, China

[b] School of Safety Engineering, China University of Mining and Technology, Xuzhou, Jiangsu 221116, China

E-mail address: cumtwey@163.com (E.Wang), liuxiaofei@cumt.edu.cn (X.Liu)

Abstract: When exploiting deep high-gas coal seams with a bursting liability, complicated rockburst disaster conditions exist because of the combined influence of stress and gas pressure. An understanding of the influence of gas on the bursting liability of coal can enable an analysis of the mechanism of the rockburst induced by gas pressure and the bursting liability of coal. Using a custom sealed pressure system, experimental studies of coal samples with a bursting liability were carried out under different gas pressure conditions. The experimental results are explained based on the coal structure, the structural effective stress, and the corrosion-damage effect of the gas on the coal. Research results show that: (1) an inverse relationship exists between gas pressure and coal bursting liability; that the duration of dynamic fracture (*DT*) increases exponentially; and that the elastic strain energy index (W_{ET}), bursting energy index (K_E), and uniaxial compressive strength (R_C) decrease linearly with increase in gas pressure. The coal dissipation energy increases with an increase in pore gas pressure, the elastic strain energy stored before the stress peak reduces, and the elastic energy release rate decreases rapidly. (2) The existence of gas pressure decreases the structural effective stress of the coal body and prolongs the *DT*; and the destruction mode of coal changes from brittle to ductile failure. Mechanical and corrosion damage caused by the gas decreases the coal strength, the accumulated elastic strain energy, and the coal bursting liability indices, including R_C, W_{ET} and K_E. Rockburst disasters in gas-containing coal seams result from the large-scale fracture of the surrounding coal and rock during mining. Gas reduces the degree of rockburst damage but increases the rockburst frequency in high-gas coal seams with a bursting liability.

Keywords: Gas pressure; Bursting liability of coal; Structural effective stress; Corrosion-damage effect; Mechanical effect.

1 Introduction

Rockburst, is a dynamic phenomenon caused by the release of accumulated energy in coal and rock mass. It yields sudden and instantaneous vibration, and causes massive destruction of macroscopic characteristics (Lannacchione and Tadolini, 2016; Jiang and Zhao, 2015; Dou et al, 2009; Liu et al, 2015; Wen et al, 2016), and its damage ranges from a few meters to hundreds of meters. The maximum length of roadway damaged by rockburst reaches more than 600m in Muchengjian coal mine in Beijing, China (Jiang et al, 2007). Some scholars have studied rockburst mechanisms to prevent rockburst disasters, and they have proposed strength, stiffness, energy, bursting liability, three principles, instability and fractal theories. (Dyskin and Germanovich, 1993; Procghazka, 2004; Manoj and Petros, 2009; Xie and Pariseau, 1993; Mark et al, 2016; Zhang et al, 2015). Bursting liability theory holds that under the same geological and mining conditions, rockburst in coal seams yielded large differences, and its occurrence was determined by the inherent mechanical properties of coal. This inherent property is regarded as the bursting liability of coal. The so-called bursting liability indices, duration of dynamic fracture