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The characteristic of in situ stress in outburst area of China ☆

J. Han[a, b, c], H.W. Zhang[a], S. Li[a], W.H. Song[a]

[a] College of Resource and Environment Engineering, Liaoning Technical University, Fuxin 123000, China

[b] The State Key Laboratory of Coal Resources and Mine Safety, CUMT, Xuzhou 221008, China

[c] Kailuan Group Ltd., Tangshan 063000, China

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Abstract

In order to obtain the characteristics of in situ stress field in outburst mining area, using the hollow inclusion (HI) technique to measure the in situ stress of coal and gas outburst mining area. The measurement sites located in northeast, middle and east of china, which include eight mining areas such as Fuxin, Pingdingshan, Hebi and Huainan. Base on the analysis of measurement data from outburst mining area, conclusions could be obtained as follow: (a) major principal stress and minor principal stress is horizontal stress and interim principal stress is vertical stress, and the type of outburst area' s stress field is dynamic stress field; (b) the major principal stress and minor principal stress are higher than other regions and the tectonic stress is outstanding; and (c) the ratio of major principal and vertical stress is decrease with the increase of depth and the type of stress field is likely transfer dynamic to static. Thus, in situ stress plays a key role during the occurring and development of coal and gas outburst, which is an important reason of severe outburst in China.

Highlights

► Major and minor principal stress is horizontal, interim principal stress is vertical. ► The horizontal stress is more remarkable in outburst area than others. ► Major horizontal principal stress is 2.5 times of minor horizontal principal stress. ► Ratio of average horizontal principal stress to vertical stress decreased with depth.

Keywords

Coal and gas outburst; In situ stress; Measurement; Stress field type

Figures and tables from this article:

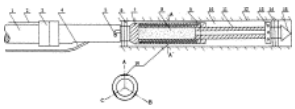

Fig. 1. Structure of KX-81 HI cell (1 – installation pole; 2 – orienting device cable; 3 – orienting device; 4 – data sampling cable; 5 – orienting pin; 6 – waterproof ring; 7 – epoxy colophony canister; 8 – shell (cement inside); 9 – fixed pin; 10 – interspace between cell and borehole; 11 – plunger; 12 – borehole; 13 – glue hole; 14 – waterproof ring; 15 – orienting device head; 16 – strain gauge rosette).

Figure options

Fig. 2. In situ stress measurement area of China. The red dots is the name of in situ stress measurement area of coal and gas outburst, it is illustrated by a legend at the left.

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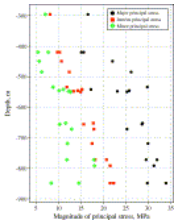

Fig. 3. Relation of principal stress versus depth.

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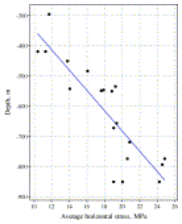

Fig. 4. Average horizontal principal stress versus depth.

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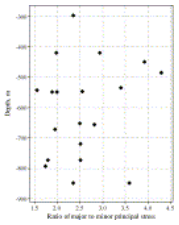

Fig. 5. Ratio of major horizontal principal stress to minor horizontal principal stress versus depth.

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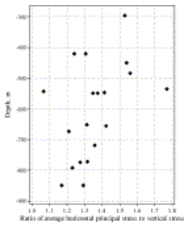

Fig. 6. Ratio of average horizontal principal stress to vertical stress versus depth.

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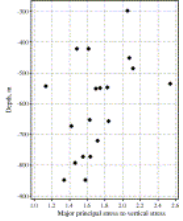

Fig. 7. Ratio of major principal stress to vertical principal stress versus depth.

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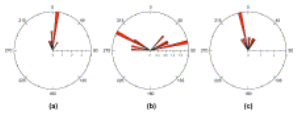

Fig. 8. Principal stress rose diagram (a) major principal stress (b) interim principal stress and (c) minor principal stress.

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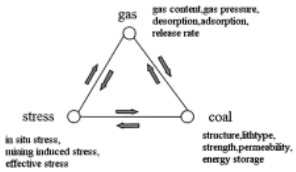

Fig. 9. Schematics of interactions of stress, gas and coal contributing to outburst mechanisms.

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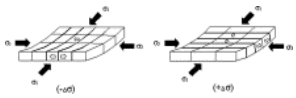

Fig. 10. Relation between principal maximum stress direction and the forced status of coal bed (bold line is main fracture, thin line is secondary fracture).

Figure options

Table 1. Summary of outbursts at research mining area of China.

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Table 2. In situ measurement data.

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Table 3. In situ stress measurement in Wangzhuang coal mine, Qinshui basin.

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Corresponding author. Tel.: +86 418 3350473; fax: +86 418 3350468.