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Theoretical Derivation of Basic Mechanical Property Required for Triggering Mine-pillar Rockburst

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Abstract

Rockburst is divided into two types, one is strain-type resulting from rock damage and another is sliding-type resulting from fault slip events. Triggering mine pillar rockburst mainly consists of two steps: the occurrence of shear-band and the application of disturbance. In this paper, mechanical model of mine pillar subjected to uniaxial compression is established. By simplifying the complete stress-strain curve and the crack propagation behaviour, based on the derived energy expressions corresponding to different crack propagation stages, the type of rockburst that the disturbance-induced pillar instability belongs to is defined. Next, by establishing the model of mine pillar with one inclined shear-band and by simplifying the stress evolution on the band, based on the necessary physical characteristics for triggering dynamic events, the basic mechanical property of mine pillar required for triggering instability is derived. It shows that the post-peak modulus greater than or equal to the pre-peak modulus is the basic mechanical property required for triggering mine pillar instability. Finally, by conducting laboratory experiments, the proposed model is verified. The requirement that the post-peak modulus is greater than or equal to the pre-peak modulus may be the reason why triggered mine pillar rockburst is not often observed.

Key words: rockburst, mine pillar, equivalent-average, disturbance, basic mechanical property.

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