

论文

回采巷道煤体荷载传递机理及其极限平衡区的研究

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摘要:

基于支承压力作用下回采巷道两帮煤体的力学模型, 分析了煤体与顶底板界面应力、煤体轴力的基本分布规律, 首次对煤帮水平位移进行了力学推导, 建立了极限平衡区宽度新的理论计算公式, 讨论了塑性条件下煤帮极限平衡区宽度的主要影响因素。结果表明: ① 极限平衡区煤体的垂直应力、顶底板与煤层界面的剪应力及其水平压力均呈双曲函数分布; ② 煤帮处煤体垂直应力的大小随巷道高度及顶底板与煤层界面力学参数的改变而改变, 其水平位移与弹塑性界面的侧压力系数、峰值应力及煤体极限平衡区宽度成正增长关系, 与煤体综合弹性模量成反比; ③ 煤体极限平衡区宽度与巷道埋深、上覆岩层平均容重、煤体与顶底板界面的强度参数、应力集中系数及侧压力系数、巷道高度及煤体综合弹性模量密切相关, 随巷道埋深和巷道高度的增加而增大, 随煤体与顶底板界面内摩擦角和黏聚力的增加而减小。最后, 通过工程实例, 验证了分析结果的合理性。

关键词: 回采巷道; 荷载传递; 煤帮极限平衡区; 水平位移; 影响因素

Study on load transmission mechanism and limit equilibrium zone of coal wall in extraction opening

Abstract:

Based on the mechanical model of the coal wall in extraction opening under high bearing pressure, this paper analyzed the basic distribution of the stress on the interfaces between the coal and rock and the axial force of coal. It first mechanically derived the total horizontal displacement of the coal and established a new theoretical width formulas about the limit equilibrium zone in sidewalls. On this basis, discussed the main factors of the width without failure zone. The analysis results show that the stress and level pressure of the coal in the limit equilibrium zone distributes at the pattern of hyperbolic function. The vertical stress of the sidewall coal changes by the roadway height and mechanical parameters on the interfaces between the coal and rock. The horizontal displacement increases with the lateral pressure coefficient and peak stress of the elastic plastic interface and the width of the limit equilibrium zone, while inversely proportional to the average elastic modulus of the coal. The width of the limit equilibrium zone depends on the external factors such as extraction opening depth, the average density of the overburden, the strength parameters of the interfaces between the coal and rock, stress concentration factor, lateral pressure coefficient, extraction opening height as well as composite elastic modulus of the coal. It increases with the addition of the extraction opening depth and extraction opening height and decreases with the addition of the internal friction angle and cohesion interfaces between the coal and rock. Finally, the rationality of these results were verified by an engineering example.

Keywords: extraction opening; load transfer; limit equilibrium zone; horizontal displacement; impact factor

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