Study on Drilling Technology in Special Concentrated Area of Rock Burst

Yazhu Zhang[1, a], Tingming Wang[1]

[1]Shandong University of science and Technology, QingDao 266590, China.

[a]17853267870@163.com

Abstract

Rockburst is a dynamic phenomenon in coal mine, and it is one of the most serious natural disasters in coal mine in the world. It releases the deformation energy of coal and rock mass in a sudden, sharp and violent situation, and the coal and rock mass are thrown into the mining space, resulting in the damage of support and other equipment in the mining space, as well as the deformation of mining space, such as roof fall, roadway blockage and so on. When serious, it causes casualties and the destruction of the shaft and roadway, and even causes the collapse of the ground surface. An earthquake. Often accompanied by loud noise, vibration and air waves. The time of vibration is from several seconds to tens of seconds, and the coal and rock thrown from several tons to several hundred tons. In recent years, with the increase of mining depth, dynamic disasters become more obvious, which has brought great threat to mine production and safety. Therefore, it is necessary to conduct a systematic and in-depth study on the prevention and control of these dynamic phenomena.

Keywords

Rock burst, Borehole pressure relief, Disaster prevention.

1. Introduction

Discussions on the construction technology of the borehole against scouring and pressure relief in coal mines have further enriched and optimized the construction mechanism and technology of the borehole with advanced pressure relief in coal seam. It not only effectively improves the efficiency of the borehole with pressure relief, but also effectively reduces the labor intensity, improves the safe production conditions of coal mines, and greatly improves the borehole construction technology. The degree of automation has good economic and social benefits.

The project is carried out according to the following routes: research on the construction mechanism and technology of advanced pressure relief boreholes in coal seams at home and abroad analysis and summary of our unit's experience study and optimize the construction technology of advanced pressure relief boreholes in different mine pressure zones study and optimize the design of supporting facilities for borehole construction technology Summarize and popularize the application.

2. Study on Drilling Technology in Special Concentrated Area of Rock Burst

With the continuous increase of mining depth in China's coal mines, the number of coal roadways in particularly concentrated areas of rock burst is also increasing. Because the surrounding rock of this kind of coal roadway has high stress and is prone to deformation and instability, conventional support is difficult to effectively control the excessive deformation of surrounding rock. Experience at home and abroad shows that borehole pressure relief technology can release the stress around the roadway, improve the stress environment of

surrounding rock, make high stress transfer to the deep surrounding rock, so as to reduce the deformation of surrounding rock and reduce support pressure. In this part, RFPA system, i. e. Rock Failure Process Analysis System, is used to compare the spacing of drilling holes in the special concentration area of rock burst, and to analyze the pressure relief effect of drilling holes in the special concentration area of rock burst.

(1) Mechanical parameters of model

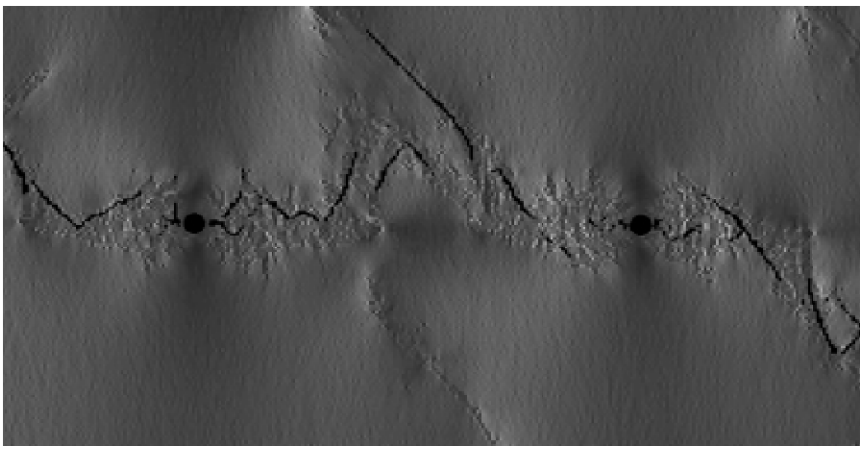
The effect analysis model of whole spacing for pressure relief drilling in special concentrated area of rock burst is shown in Table 1.

Table 1. Analysis of mechanical parameters of whole spacing effect analysis model

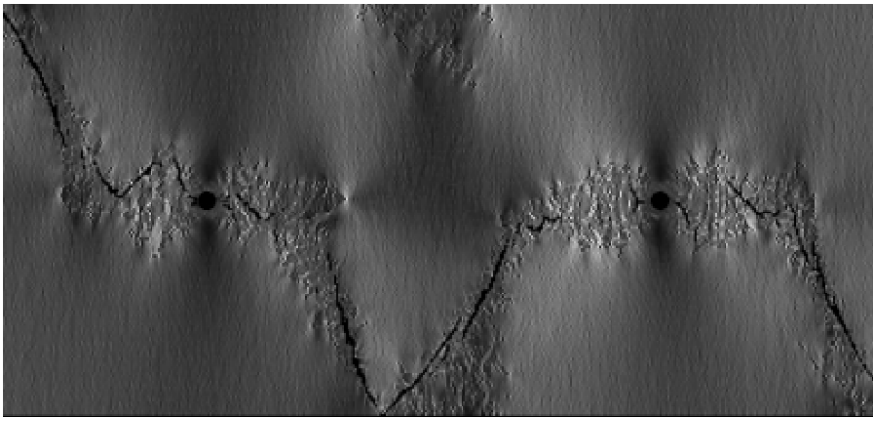
Rock layer	Modulus of elasticity		compressive strength		Nuxy		Compression ratio
	mean value	average/GPa	mean value	average/MPa	mean value	average	
Coal	10	4	10	15	100	0.3	10

(2) Result and analysis of borehole pressure relief in special concentrated area of rock burst.

When the vertical stress of coal is 30 MPa, the pressure relief effect is 2, 3 and 4 m respectively. The design model is applied to the construction of pressure relief boreholes on the 5-6m wide model when loaded to a vertical stress of 30 MPa.



(a) L=3m



(b) L=4m

Figure 1. The pore size is 200 mm and the vertical stress is 30 MPa. Failure of coal with different borehole spacing

Two boreholes with diameter D = 200mm were formed on the model; the distance between boreholes L = 3m, 4m; the vertical stress_ = 30MPa boreholes were drilled, and then no longer loaded, the failure of the coal was shown in Figure 1.

As can be seen from Figure 1 (a), when the distance between boreholes is 3 m, the coal around the borehole is destroyed, forming a much larger broken area than the borehole diameter, and the broken areas between the two boreholes are interconnected to achieve the effect of pressure relief. As can be seen from Figure 1 (b), when the distance between boreholes is 4 m, more than 1 m fractured area is formed on each side of the borehole, but there is no destroyed area of coal body in the middle of the two boreholes, indicating that the pressure relief zone is not connected and the pressure relief effect is not achieved. Therefore, during the construction of pressure relief boreholes under high stress conditions, the interval between 4m and 4m cannot be used.

When the spacing of boreholes is 3 m, the stress variation in the middle section of coal body before and after drilling is shown in Figure 3.2. It can be seen that the average stress in coal body before drilling is 30 MP, and the stress instantaneously drops to 12.03 MPa after drilling. The boreholes play an obvious role in relieving pressure.

3. Drilling Technology Requirements for Rock Burst Special Concentrated Area

Through the study and test of drilling technology in the special concentration area of rock burst, the difficult problem of drilling whole formation in the special concentration area of rock burst has been successfully solved. At the same time, some construction experiences have been explored. The main points are as follows:

(1) Advanced drilling equipment suitable for drilling engineering geological conditions is the guarantee for drilling holes in soft rock. ZDY-4000S full hydraulic drilling rig has a large torque and steeples speed range. It is the key to solve the problems of easy collapse, easy shrinkage and easy sticking in soft rock drilling by matching the high strength grooved geological spiral drilling pipe with large diameter design.

(2) By using the good flocculation, adhesion, drag reduction and thickening properties of polyacrylamide (PAM), the problems of whole wall stability, lubrication and deep whole powder discharging are solved, which play an important role in soft rock drilling in stress concentration area.

(3) Adopt double circuit power supply, high-flow high-pressure water pump dynamic pressure water supply, keep drilling continuous, and speed drilling. During the construction of deep vertical holes in soft rock, the influence of power cut and water cut on whole formation should be minimized. When power cut and water cut off, the drilling tools should be lifted to the safe whole section in advance to avoid sticking and burying drilling accidents.

(4) The problems of mudstone pasting dead bit and rock powder backfilling blocking drill pipe in the process of constant water pressure clear water drilling can be effectively solved by using dynamic pressure water supply of large flow high pressure mud pump with adjustable liquid supply and inserting back check valve in drill pipe.

4. Conclusion

According to the drilling conditions in the rock burst concentrated area, the drill pipe butting technology is optimized, and the automatic drill pipe butting and unloading device is designed to realize the automatic butting and unloading of the drill pipe, so as to accurately butt the drill pipe and avoid the drill pipe falling off.

The drill pipe automatic unloading device is composed of drill pipe lifting, drill pipe grasping mechanism and drill pipe box. When the drill pipe is loaded into the power head, the drill pipe lifting mechanism lowers the drill pipe in the drill pipe box to the drill pipe grabbing mechanism; while when the drill pipe is removed from the power head, the drill pipe in the drill pipe grabbing mechanism is lifted to the drill pipe box by the rod lifting mechanism.

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