

Research on Mining Pressure Dynamic Effect of the Large Dip Angle Working Face

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Abstract

In order to study the mining pressure law of the large dip angle working face, prevent the topping accident of the working face, and cause the roof accident, through the observation of the mining pressure of the working face of Xiaogou coal mine, the law of mine pressure appearance and dynamic effect of the large dip angle working face are obtained. The results show that the initial support force of the working face support is not less than 24 MPa, the lower part of the working face is larger, and the falling rock has not been effectively filled in the middle and lower part of the working face. Therefore, the daily observation of the top and bottom goaf is carried out to determine whether it is a large area of suspended ceiling appears. Taking effective measures for safe mining in a timely manner has great practical significance for reducing roof accidents.

Keywords

Mine Pressure; Working Face; Large Dip Angle; Dynamic Effect.

1. Introduction

Comprehensive research on mining technology research of large dip angle working face, such as overburden movement deformation law, working face pressure characteristics, effective control technology, disaster prevention technology, etc., is the necessary technical basis for ensuring safe and efficient production of mining face [1-3]. Studying and mastering the characteristics of roof movement and the characteristics of mine pressure during the mining process of large dip angle, taking effective measures for safe mining in time, has great practical significance for reducing roof accidents, improving resource recovery, reducing consumption and increasing mine economic benefits [4]. Chinese scholars have reached a certain theoretical level in the mining of large dip angle coal seams, and put forward some hypotheses: the sloping thin plate breaking and the spatial rock mass hypothesis [5-7]. In general, the research on mining of large dip angle coal seams in foreign countries is mainly focused on mining methods and equipment [8-9]. However, there are few studies on the theory of mine pressure related to large dip angle coal seams, and the overall level is low.

2. The Research Status

2.1. Work Surface Overview

The working face is 950 m long, with a tendency of 114 to 136 m long and a length of 114 m at the cut. Coal seam thickness: generally between 2.23 m and 4.79 m, with an average thickness of 4.2 m and a coefficient of variation of 45%. The coal seam is characterized by a coal seam of 320° in the working face, a tendency of 69°, and a dip angle of 38° to 42° in the working face, and the coal seam structure is also relatively stable.

2.2. Test Plan

(1) Roadway surrounding rock deformation monitoring program

Generally, a point should be measured every 50m. Of course, the necessary adjustments can be made according to the surrounding rock structure, properties and surrounding rock stress. If the majestic structure, properties, and surrounding rock stress do not change much, the spacing can be larger: if there are more changes in the surrounding rock structure or properties, or if there are more variations in the surrounding rock stress, the spacing will be smaller.

(2) Roof separation monitoring scheme

At present, the design distance of the top surface of the working face is 100 m. The impact of the general working face on the roof is within 100m. It is recommended that the spacing be first designed to be 40~60m, and then adjusted according to the work monitoring data for later work. Surface monitoring provides the basis.

3. Test Results and Analysis

3.1. Analysis of Deformation Law of Surrounding Rock of Roadway

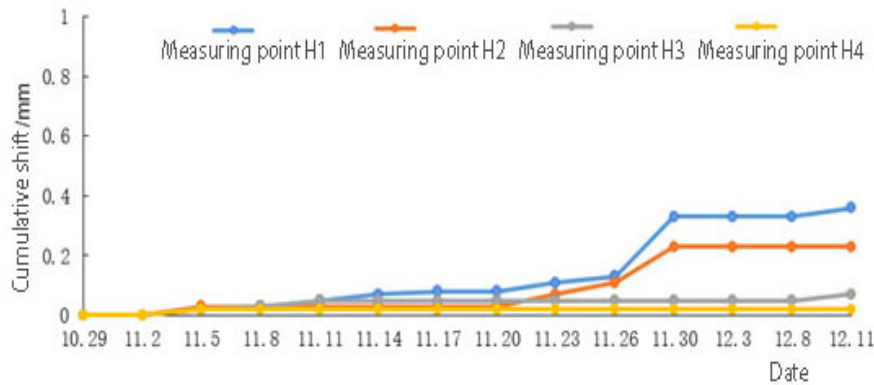


Fig 1. +1270 return air duct top floor shifting amount

According to Fig.1, it can be seen that the displacement of the top and bottom plates of the +1270 m return air duct is affected by the mining disturbance. The closer the working surface is to the closer the top and bottom plates, the closer the working surface is to the H1 measuring point, 52 m, and the two lanes of the roadway move closer. The amount of 0.33 mm is significantly increased compared with the previous period. After 10 days, the working surface is advanced by 81.8 m, the working surface is 38.2 m from the H1 measuring point, and the displacement of the top and bottom plates is 0.36 mm. With continuous advancement, the amount of displacement of the top and bottom plates increases, but the range of the H2, H3, and H4 measuring points of the +1270 m return air duct is weaker by the working face mining, and the overall amount of the top and bottom plates is smaller.

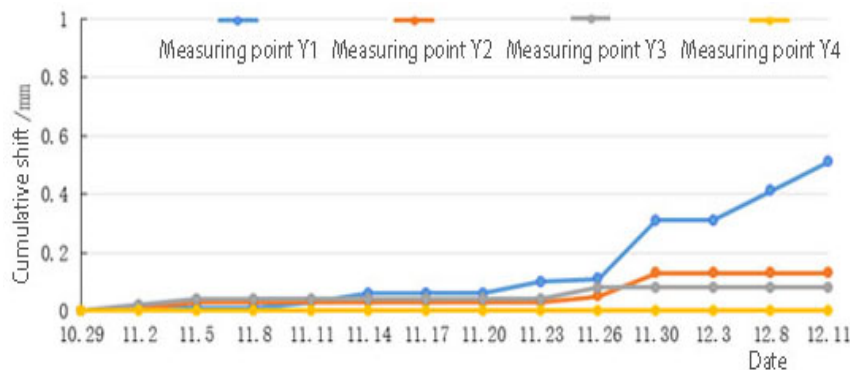


Fig 2. +1270 m return air duct two sets of approaching

According to Fig.2, it can be seen that the displacement of the two gangs of the +1270 m return air channel is obviously changed by the mining surface. The closer the observation point is to the working surface, the larger the distance between the two groups is. The initial working surface distance is Y1. The distance between the two lanes of the roadway is 0.31 mm, and the amount of approaching of the two groups is significantly increased compared with the previous period. The range of the Y1 measuring point enters the working surface and the impact range is advanced. After 10 days, the working surface distance is 38.2 m from the Y1 measuring point. Help move closer to 0.51 mm. The range of Y2, Y3, and Y4 measuring points is far away from the working surface, and the influence of the working face is weaker. Therefore, the approaching amount of the two groups is too small.

In summary, the +1270 return air duct is affected by the mining lead area of about 50 m, and the overall displacement of the top and bottom of the roadway and the two gangs is small, which is in line with the application requirements of the current roadway. With the recovery of the working face, when the measuring points of H1 and Y1 are about 15 m away from the working surface, the working face should be affected by the mining. The top plate observation should be done and the data should be fed back in time.

3.2. Roof Separation Data Analysis

According to the roof separation data provided by the site, the separation points of the monitoring points 1, 2, and 3 appear in the working face mining process. The monitoring points 4, 5, 6, and 7 are far from the working surface and are not affected by the mining disturbance. There is no delamination change in the top plate. Data analysis and analysis are carried out to obtain Fig.3 and Fig.4.

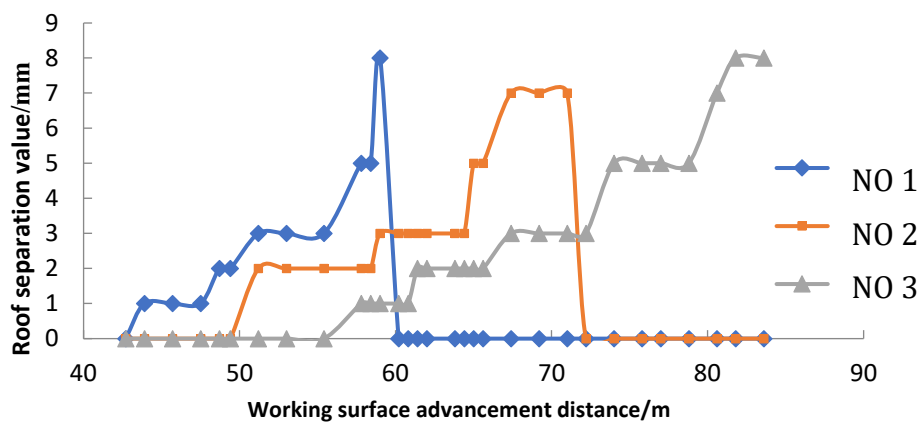


Fig 3. Monitoring and analysis of the separation of the top plate of the +1270 m return air duct

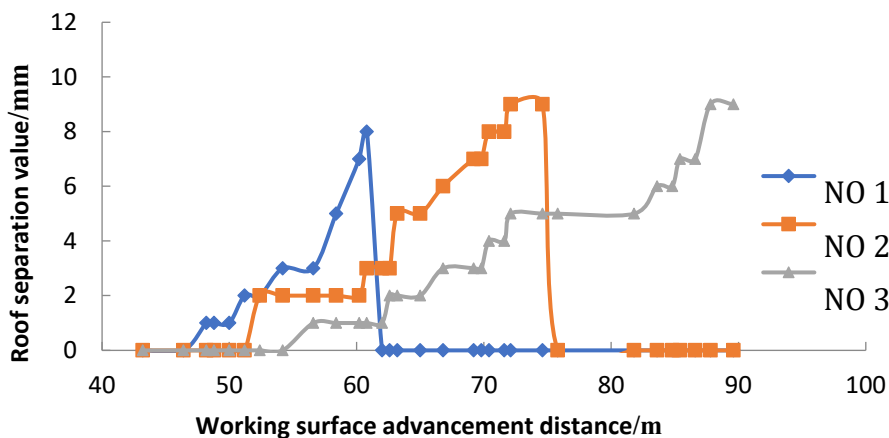


Fig 4. Monitoring and analysis of the top layer of the +1190 m return air duct

It can be seen from Fig. 3 that the overall delamination of the +1270 m return air sluice is not large, and the maximum separation of the monitoring points 1, 2, and 3 is about 8 mm, and the overall roof is relatively stable. The monitoring point is about 20 m away from the working surface, and the top plate is affected by the disturbance of the working face, and the top plate begins to show significant changes.

It can be seen from Fig. 4 that the overall delamination of the +1270 m return air sluice is small, and the maximum separation of the monitoring points 1, 2, and 3 is about 9 mm, and the overall roof is relatively stable. The monitoring point is about 18 m away from the working surface, and the top plate is affected by the disturbance of the working face, and the top plate begins to show significant changes.

In addition, through on-site observation, a large-area roof suspension appears on the working surface behind the groove. Therefore, the strength of the end roadway support should be strengthened to prevent the roof from breaking suddenly, causing a roof accident, in order to solve the large-area suspension roof behind the groove on the working surface. It is recommended to develop a pre-cracking measure for the roof to implement advanced pre-splitting blasting or hydraulic fracturing cutting.

4. Conclusion

(1) Strengthen the upper mine pressure management in the working face, with pressure-moving frame to avoid the separation of the top plate, and prevent the phenomenon of the press-fit of the working face and the phenomenon of coal wall slabs. The lower part of the working face has a larger mine pressure, and the falling rock has not been effectively filled in the middle and lower part of the working face. Therefore, the top plate of the middle and lower goaf is subjected to daily observation to determine whether a large area of the suspended roof appears. At present, the rated working resistance of the bracket is still relatively rich, and the supporting parameters are adapted to the law of roof movement. However, since the working surface is basically top-loaded in the future, it is still necessary to observe the pressure of the bracket at all times, and timely prevent the coal wall gang of the working surface. Abnormal phenomena such as falling of the roof.

(2) The B8 coal seam working face and the lower channel have been completed and supported for 2 years. The surrounding rock movement of the roadway has been basically stable. After field observation, the deformation of the surrounding rock during the mining process is small overall, and the +1270 m return air duct The displacement of the top and bottom plates is 0.36 mm, the displacement of the two gangs is 0.51 mm, the maximum value of the top plate is about 8 mm, the displacement of the top and bottom plates of the +1190 m transport groove is 0.22 mm, and the displacement of the two gangs is 0.83. Mm, the maximum value of the top plate is about 9 mm.

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