

Study of Sealing Technology of Downward&Permeable Borehole

Hu Zu Xiang
College of Resource and Safety
Anhui University of Science and Technology
Huainan, china

Abstract: In gas prediction and prevention, it is important for the Mine-managers to know coal-seam gas-pressure. Because of the limitation of geological conditions, some seam can not use upward bore to measure gas pressure, so using downward bore is essential, but coal-seam gas-pressure measure is difficult on the this condition (Qixiang Yu, 1992). In order to resolve this problem, the way of “subsection and time-sharing hole sealing” is propounded in this paper. By using this method, the crevice water of wall rock is blockaded effectively and the influence of measure gas pressure by crevice water is avoided. It can provide guarantee to measure gas pressure under the complicated condition. By the local practice, good effect is achieved.

Keywords: crevice water; hole-sealing; gas pressure

1. Introduction

With the extension of mining depth, how to accurately obtain gas pressure in original coal seam is important, because for the Mine-managers it is a basis to carry out gas prediction and prevention. However the limitation of geological conditions, it can not use upward bore to measure gas pressure. On the other hand downward borehole may be drill through aquiclude, which cause artesian water invade borehole in aquifer and even the whole borehole is submerged by the fracture water. The intrusive water enclose coal and prevent the gas release normally. So on the this condition the value of gas pressure can get great error. Gas prediction and prevention can not base on it. In order to improve measure precision of gas pressure in coal seam, 17238 high drainage of Zhangji coal mine in Huainan mining group was selected to measure gas pressure in 6 seam. The geological conditions in this area is complicated and crevice water of wall rock is abundant. Zhangji coal mine asked the researcher of Anhui University of Science and Technology to resolve this problem. A new hole sealing way, which was called “subsection and time-sharing hole sealing” was given after careful research.

2. Theoretical Analysis of Subsection And Time-Sharing Hole Sealing

The principle of “subsection and time-sharing hole sealing” is using high-pressure grouting at different times and hole sealing segments and the cement slurry keep freezing in high-pressure state, thus, the cement slurry can press-in the fracture of wall rock and plugged fracture is

gotten. Drill a minor diameter hole in the freezed concrete with the same azimuth and then the borehole drill through the aquifer, which avoid the influence of pressure water, good effect about hole sealing is obtained (QunShanYang etc, 2007).

3. Technique of “Subsection and Time-Sharing Hole Sealing”

The technique include two steps, which is given as follow:

- 1) Drilling the major borehole
- 2) fixing orifice tube
- 3) High-pressure grouting
- 4) Drilling the minor borehole
- 5) grouting
- 6) Brush borehole
- 7) Hole sealing

The specific technical process include:

- (1) using drilling bit ($\Phi=133\text{mm}$) to drill a borehole (depth=5m), and the original hole is gotten (fig.1), and then clean out rock powder in borehole with water or compressed air.

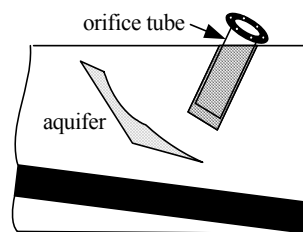


Fig.1 Installing orifice tube and flanges

- (2) Install the orifice tube ($\Phi=108\text{mm}$) with a flange (length=4~5m). The purpose of it is improve lithology of wall rock at orifice and on the other hand, the orifice tube is the base of flange and can afford favorable conditions for hole sealing. Then, use the cement slurry with sodium silicate to consolidate orifice tube. At last, breakdown test in orifice tube was done and the pressure must meet the demands of High-pressure grouting.

- (3) After breakdown test in orifice tube was completed, using drilling bit ($\Phi=91\text{mm}$) to penetrate aquifer and the

length exceed 2m, which is given in fig.2. then put flange to impress cement slurry into borehole by high pressure. In order to the cement slurry infiltrate surrounding rock fracture around borehole quickly, which get a good sealed effect for fracture, the injection pump must keep high pressure always. The pump can't be moved in this period.

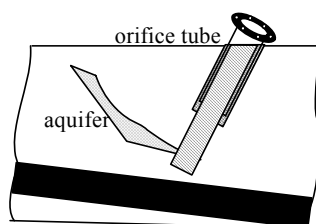


Fig.2 Plugging aquifer fracture

(4) After the cement slurry become frozen completely, using minor diameter drilling bit to drill a borehole to penetrate coal seam floor and the length exceed 0.5m. this step is very important because it decide whether measure gas pressure can succeed or not, so minor diameter borehole must penetrate interior of major diameter borehole parallel and only this way the aquifer can be avoided effectively. At last, using compressed air blow down borehole.

(5) As be seen in fig.3, piezometric pipe, which its bottom was winded by kelp or cotton yarn, was sent to the depth of borehole. At the same time, the drain-pipe paralleled piezometric pipe, was laid down so as to discharge the water, which was penetrated when grouting and hole sealing. (the main purpose is send compressed air to piezometric pipe and force water in borehole bottom discharged from the drain-pipe). After piezometric pipe and drain-pipe was laid down, A small amount of cement slurry mixed with sodium silicate was impressed into which made kelp or cotton yarn of the piezometric pipe plugged up borehole after absorb water and expand. At last the cement slurry was filled with the whole borehole (because it take 1 hour or so to freeze) after 1 hour.

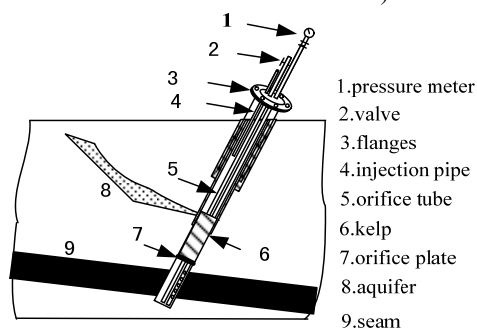


Fig.3 Sealing hole figure of downward borehole

(6) After complete the step above and the cement slurry freezed completely, pressure instrument and valve were installed and reading was recorded.

4.Character of “Subsection and Time-Sharing Hole Sealing”

The high pressure cement slurry can penetrate fracture of aquifer in surrounding rock around borehole effectly by the way of “subsection and time-sharing hole sealing”. And it can block up fracture interconnected by surrounding rock and borehole and fracture water was stopped well. At the same time surrounding rock around aquifer, which was pass through by borehole was reinforced and it resolve the influence of fracture water in aquifer radically (ShuJianHe.2003). In the experiment, some factors should be attended: the precision of angle of dip must be insured when using minor diameter hole to drill and the azimuth is consistent with the prior major diameter hole. In addition, in order to prevent orifice tube was forced out by high pressure grouting, breakdown test must be done after install orifice tube.

5. Engineering Projects

In this test, 6 seam of zhangji coal mine in huainan mining group was selected to measure gas pressure. because there is no floor roadway in 6 seam, it is necessary for mensure gas pressure to drill downward borehole. For 6 seam, the roof is soft and structural fracture is abundant, at the same time, the enclosing of roof is bad and there exist serious water penetration. so, the way of “subsection and time-sharing hole sealing” was used to measure gas pressure at different spots in 17238 high drainage. The value of gas pressure was given in Tab.1.

Table1 Gas pressure value of different level in 6 seam

level/m	gas pressure value /MPa						
	1	2	3	4	5	6	7
-500m	0.09	0.14	0.16	0.20	0.26	0.26	0.26
-520m	0.22	0.38	0.45	0.56	0.62	0.64	0.64
-540m	0.12	0.36	0.66	0.96	1.20	1.21	1.21
-560m	0.34	0.64	0.98	1.28	1.50	1.54	1.54

Tab.1 show that gas pressure was measured successfully at four different spots in 17238 high drainage and there is no abnormal phenomena take place in test. Gas pressure rise up stably and pressure present positive correlation with depth of seam. As shown fig.4. The gas pressure gradient accord with variation of methane belt. The measure result is correct and effective.

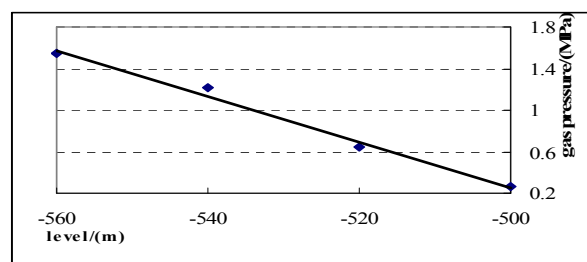


Fig4 the diagrams of gas pressure and the level (6spot)

6. Conclusion

Using the way of “subsection and time-sharing hole sealing” to measure gas pressure for downward borehole can resolve the influence of surrounding rock fracture water. “The problem of hydraulic pressure”, which existed prior way of sealing hole, was resolved completely. At the same time, when the water in pour pressure hole and the coal seam was enclosed, which caused the velocity of gas emission was restrained. So the value of gas pressure produced deviation. And this method avoided the above problem and the seam can release gas normally. In a word, this method reduced the

difficulty of gas measure in the downward borehole and provided guarantee for the accurate determination of gas pressure in complex geological conditions. Good effect was obtained at Zhangji mine.

References

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