

Study on the Distribution Law of "Three Zones" of Hyperthick Coal Seam Spontaneous Combustion

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Abstract: Pick to go through to the existing working face goaf spontaneous combustion "three zones" division methods and standards, rules of coal oxidation in goaf spontaneous combustion "three zones" internal floating, and the CO absolute value and change law of spontaneous combustion prediction are analyzed, combining with the instance, guide the exploitation of coal seam spontaneous combustion deformation-failure of nitrogen injection of "prevention first" fire prevention measures.

1. Introduction

Coal spontaneous combustion fire is one of the main disasters in China's coal mines. It seriously affects the safety of coal production. In recent years, the comprehensive prevention technology of spontaneous combustion based on nitrogen injection and fire prevention has been gradually formed in large-scale high-yielding and high-efficiency working face in China [1-2]. It provides necessary safety technical guarantee for fully mechanized caving mining of extra-thick spontaneous combustion coal seam [3-5].

2. Classification standard of "three zones" of goaf spontaneous combustion

Coal spontaneous combustion in goaf must have several conditions: coal has the characteristics of spontaneous combustion, there is continuous oxygen supply, good heat storage conditions and lasting enough time. According to the different spontaneous combustion risk of floating coal in goaf, goaf can be divided into scattered tropical zone, oxidation zone and asphyxiation zone. In the process of advancing the coal face, the scope of "three zones" of goaf spontaneous combustion changes dynamically. The width of "three zones" changes dynamically with factors such as air leakage rate, oxygen concentration, floating coal thickness and goaf temperature [6].

3. Index gas in coal oxidation process

Early prediction of coal spontaneous combustion is an important part of mine fire prevention technology. In the process of coal pyrolysis, some coal pyrolysis associated gases without or with very low content in the normal atmosphere will be generated. The production of these pyrolysis associated gases is related to the degree of pyrolysis development. One or more coal pyrolysis associated gases can be selected as the hallmark gas for early prediction of coal spontaneous combustion. The most commonly used symbol gas of spontaneous combustion is CO. Taking other gases as the signature gas, it is easy to be affected by the air volume, difficult to accurately detect, and easy to cause the omission or false alarm. In the actual operation process, CO absolute amount method is mainly used. When the increase rate of CO absolute amount is significant, sampling detection and comprehensive analysis of spontaneous combustion risk are conducted.

4. Application case analysis

The fully mechanized caving face of 8102 in tashan mine started mining in June 2006, and CO was detected in the return air on July 15. After July 15, the on-site monitoring of CO in the return air flow found that CO always appeared in the return air flow, and at the beginning, CO showed a slow upward trend, and the relative amount of CO always remained below 20PPm, without a sharp increase. According to the experience of similar working face, after the appearance of CO, it is estimated that the width of the goaf oxidation zone is 150~180m. At the beginning of nitrogen injection, CO showed a certain trend of decline, but at the later stage, CO showed a trend of increase. According to the theory of coal oxidation, coal oxidation produce CO, goaf spontaneous combustion "three zones" in the process of distribution, the sublevel caving mining situation, goaf coal situation, and return air CO absolute change in the comprehensive analysis, we concluded that CO will be fully into the suffocation with starting cut in decline, after after, with the constant range of goaf spontaneous combustion "three zones", and long-term to maintain a certain level; The occurrence of a certain absolute amount of CO in the return air is the basic characteristic of large scale, high yield and high efficiency fully mechanized caving face in the spontaneous combustion coal seam. Adhere to the implementation of nitrogen injection - based fully mechanized caving face fire prevention measures to strengthen the two leakage air. According to continuous data monitoring and statistical analysis, by September 21, the return air CO began to show a downward trend.

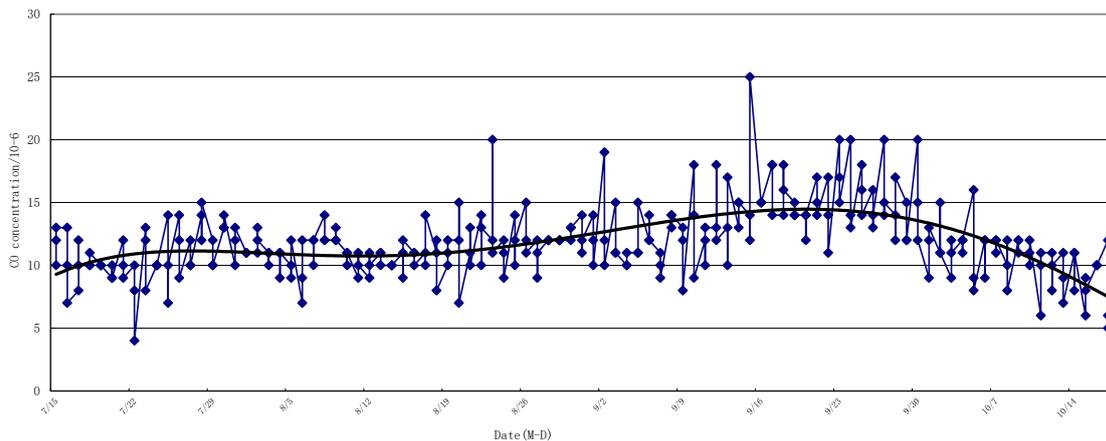


Figure 1. Change and trend of return air CO in fully mechanized caving face along with the advance of working face

According to the monitoring results of CO return air in the early mining period of fully mechanized caving face, the goaf spontaneous combustion "three zones" are divided: the maximum width of the scattered tropical zone is 56m, and the maximum width of the oxidation zone is 186 combined with the experiment of the shortest spontaneous combustion period, the shortest spontaneous combustion period of coal seam is 68 days, and the minimum monthly propelling degree is calculated to be 90m. The actual situation of CO continuously appearing in the return air of 8102 fully mechanized caving face is explained scientifically.

5. Applicability analysis of the new method

According to the monitoring results of return air CO in the early mining period of fully mechanized caving face, there are certain applicable conditions for the classification of "three zones" of spontaneous combustion in goaf: the monitoring data must be obtained on the basis of effective fire prevention in the working face; The coal seam metamorphism degree is different, different spontaneous combustion characteristics, low temperature oxidation produced by the absolute amount of CO may have a big difference, it is necessary to combine the actual situation of coal seam spontaneous combustion characteristics of the experiment for special research; It is necessary to

monitor and analyze the working face with big difference in exploiting and mining ventilation conditions. In addition, the abnormal monitoring value of CO during the working face mining at the beginning of abnormal stoping should be specially analyzed. It can be divided by using goaf buried beam tube for spontaneous combustion "three belt" test verification.

6. Conclusion

Based on the characteristics and the spontaneous combustion of coal low temperature oxidation CO sign gas such as law, analysis of the existing goaf spontaneous combustion "three zones" monitoring and analysis method, summarized suitable for mining thick coal seam spontaneous combustion according to the deformation-failure of mining of the fully mechanized top coal caving mining faces in the early return air CO monitoring results, the classification method of goaf spontaneous combustion "three zones", and practical application in datong mining itself. This method can scientifically explain the actual situation that a certain amount of CO continues to appear in the return air of fully mechanized caving face, simplify the actual measurement work of "three zones" of spontaneous combustion in goaf, which is of important guiding significance for the implementation of "prevention first" fire prevention measures in fully mechanized caving face of fully mechanized caving face of mining spontaneous combustion coal seam, and has certain reference significance for similar working face.

References

- [1] Z H, WANG Haiyan, and HE, et al. Journal of Liaoning Technical University, 32 (09): 1153-1156 (2013)
- [2] C X, WANG and Jian. Journal of China University of Mining & Technology, 526-530 (2012)
- [3] W H, Dlugogorski and Kennedy. Progress in Energy and Combustion Science, 487-513 (2004)
- [4] H K, Gurgenci H. Transp. Porous Media, 249-267 (2008)
- [5] L Y, WANG C, CHE D. Energy Sources, 810-819 (2012)
- [6] L R, Enke A and Liu Z. Journal of Tongji University, 42 (9): 1415-1420 (2014)