Study on the Temperature Rise Law and Spontaneous Combustion Mechanism of Lignite During Spring Railway Transportation

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Abstract

Railway transportation plays an important role in coal transportation. However, spontaneous combustion often occurs during coal transportation from north to south, especially during the alternation of winter and spring. However, the internal and external causes of spontaneous combustion during transportation are still unknown. In this paper, the low-temperature oxidation system is used to study the gas production law of raw coal and frozen coal under different influencing factors. At the same time, the changes of pore size structure and free radical concentration of coal samples are analyzed in combination with BET and ESR experiments. On this basis, the internal causes of spontaneous combustion during railway transportation of coal from north to south are analyzed. At the same time, combined with the field test data and numerical simulation methods to explore the external causes of coal spontaneous combustion. The experimental results show that the active structure of the coal sample produced by crushing can be stable at low temperature, and will react quickly once it is in contact with oxygen. Compared with raw coal, more CO, CO_2 and other gases will be generated and a large amount of heat will be released. The concentration of free radicals in the coal sample will increase significantly after freezing, which is mainly due to the increase in the concentration of oxygen containing free radicals. Through the study of the external causes of coal spontaneous combustion, it is found that the slower the vehicle speed, the more prone to spontaneous combustion, and the front and rear of the carriage are more prone to spontaneous combustion, which is mainly due to the appearance of the carriage gas turbulence provides a good heat storage and oxygen supply environment. Through the investigation of the internal and external causes of spontaneous combustion in coal transportation, it is suggested that measures and means should be taken to make and load the oxidizing and inerting materials of the initial active structure and reduce the existence of gas eddy in the carriage during coal railway transportation.

Keywords

Low Temperature Oxidation, Railway Transportation, Temperature Rise Variation Law, Numerical Simulation, Field Testing