

Article outline is loading...

JavaScript required for article outline



## Safety Science

Volume 50, Issue 4, April 2012, Pages 842 – 845

First International Symposium on Mine Safety Science and Engineering 2011



Special Issue Article: The First International Symposium on Mine Safety Science and Engineering

## The relationship between oxygen consumption rate and temperature during coal spontaneous combustion ☆

Jianfang Zhu<sup>a,b</sup>, Ning He<sup>a</sup>, Dengji Li<sup>c</sup><sup>a</sup> North China Institute of Science and Technology, Beijing Yanjiao 101601, China<sup>b</sup> China University of Mining & Technology (Beijing), Beijing 100083, China<sup>c</sup> Shendong Power Company, Yulin, Shanxi 719300, China<http://dx.doi.org/10.1016/j.ssci.2011.08.023>, [How to Cite or Link Using DOI](#)[View full text](#)[Purchase \\$39.95](#)

### Abstract

Spontaneous combustion is a major natural disaster in coal production. In the process of exploring coal self-ignition, a series of hypotheses have been put forward, most scholars agree that the current coal-oxygen compound theory. Oxygen consumption rate reflects the status of coal spontaneous combustion, and it is also one of the parameters necessary for numerical simulation of coal spontaneous combustion. In this paper, a coal heating and oxidation experiment was designed, Experimental device consists of heating and oxidation furnace, gas chromatograph, temperature control and data acquisition systems and other equipment components. Three coal samples whose weight each is 5 g were selected for the study. By experiment, oxygen concentration at the inlet and outlet of temperature oxidation furnace was measured. Oxygen consumption rate is calculated in the heating process of coal according to air flow. In the Cartesian coordinate system, the temperature as abscissa and the oxygen consumption rate for the longitudinal coordinates, drawing the relationship between oxygen consumption rate and temperature plot. And then regression analysis was used to analyze the relationship between oxygen consumption rate and coal temperature during the heating and oxidation process of coal. The results show that the oxygen consumption rate and temperature of coal were linear relationships both before and after the critical temperature when the coal temperature is less than 180 ° C. Before the critical temperature oxygen consumption rate is low, however it increases rapidly when coal temperature reaches a critical temperature. The result is important for the prevention and treatment of spontaneous combustion of coal.

### Highlights

- ▶ Coal heating and oxidation experiment was designed.
- ▶ Three coal samples whose weight each is 5 g were selected for the study.
- ▶ Oxygen consumption rate is calculated in the heating process of coal.
- ▶ Oxygen consumption rate and temperature were linear relationships at below 180 ° C.

### Keywords

Spontaneous combustion; Oxygen consumption rate; Heating and oxidation; Critical temperature

Figures and tables from this article:

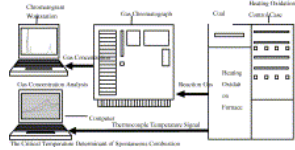


Fig. 1. Installation of coal oxidation heating experimental devices.

Figure options

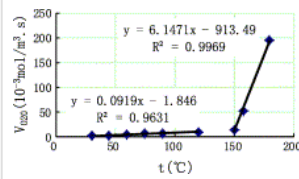


Fig. 2. Fitted equation of relation velocity of oxygen consumption with temperature for 2nd coal.

Figure options

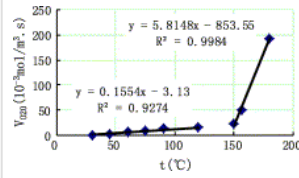


Fig. 3. Fitted equation of relation velocity of oxygen consumption with temperature for 4th coal.

Figure options

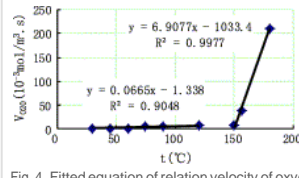


Fig. 4. Fitted equation of relation velocity of oxygen consumption with temperature for 6th coal.

Figure options

Table 1. Oxygen concentration at the outlet in the process of heating and oxidation of coal.


[View Within Article](#)

Table 2. Computational table of velocity of consuming oxygen for 2nd coal.


[View Within Article](#)

Table 3. Computational table of velocity of consuming oxygen for 4th coal.


[View Within Article](#)

Table 4. Computational table of velocity of consuming oxygen for 6th coal.


[View Within Article](#)



and is sponsored by China Academy of Safety Science & Technology (CASST), China University of Mining & Technology (Beijing) (CUMTB), Datong Coal Mine Group, McGill University (Canada) and University of Wollongong (Australia) with participation from several other universities from round the world, research institutes, professional associations and large enterprises. The topics will focus on mines safety field: theory on mine safety science and engineering technology, coal mine safety science & engineering technology, metal and nonmetal mines safety science & engineering technology, petroleum and natural gas exploitation safety science & engineering technology, mine safety management and safety standardization science & technology, occupational health and safety in mine, emergent rescue engineering technology in mine, etc.



Corresponding author at: North China Institute of Science and Technology, Beijing Yanjiao 101601, China.  
Tel.: +86 10 61590325 1; fax: +86 10 61590332.

Copyright ©2011 Elsevier Ltd. All rights reserved.