FEATURES OF IGNEZING IN ADSORPTION OXIDATION AT LOSS OF WEIGHT

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ABSTRACT

In order to study the specific weightlessness stage and weightlessness characteristic point of adiabatic oxidation of coal gangue, the influence of oxygen concentration and heating rate on the adiabatic oxidation process of coal gangue under different operating conditions was studied by a comprehensive thermal analyzer. The experimental results show that the process of adiabatic oxidation weight loss of coal gangue under different conditions can be divided into four stages, that is, external water loss and water loss stage, internal water loss and water loss stage, volatilization combustion weight loss stage and fixed carbon combustion weight loss stage. With the same oxygen concentration (20%), the TG curve of adiabatic oxidation of coal gangue shifted to high temperature with the increase of heating rate. The four characteristic temperature points (start point, midpoint, inflection point and end point) The linear increase of the rate of increase and the maximum combustion rate of the volatile and fixed carbon combustion weightlessness phase tends to increase, but the quality of the various stages of change is basically the same. Under the same heating rate (10 ℃ / min), with the increase of oxygen concentration, the TG curve of adiabatic oxidation of coal gangue shifted to the low temperature region, and the characteristic temperature point (starting point, Midpoint, inflection point and end point) and weightlessness were basically not affected by the increase of oxygen concentration. The characteristic temperature points (start point, midpoint, inflection point and end point) of volatiles and carbon loss during stationary phase decreased with the increase of oxygen concentration .

Key words: coal gangue;Heating rate;Weightlessness phase;Extreme temperature

1.0 INTRODUCTION

Coal gangue is a kind of hard rock with low carbon content associated with coal during coal formation. It is driven by wellbore roadway excavation, heading face excavation, coal mining face coal mining, washing process discharge or formation Of solid waste(Jia Hailin and Yu Minggao,2008).It is generally composed of carbonaceous shale, sandstone, old stone, mixed coal and a small amount of pyrite, siderite, calcite, dolomite and other components of the specific content and coalfield geological structure, mining conditions, mining technology Factors related. In recent years, spontaneous combustion of coal gangue has caused serious environmental pollution (Deng Dinghai and Cen Wenlong,1999;Wang Shuxia and Lu Mengsheng,2009)and serious safety hazards (Liang Tieshan and Zhang Zhijie,2009;Pan Rongkun and Yu Minggao,2007)more and more people's attention, and on the spontaneous combustion mechanism of coal gangue problems, it is generally simplified that coal gangue spontaneous combustion Spontaneous combustion of coal is essentially the development of spontaneous combustion is also divided into three stages, that is, slow heating, oxidation, automatic heating and stable combustion stage, the critical temperature is generally between 80 ~ 93 ℃ (Jia Baoshan,2001).

2.0 TEST SAMPLE PREPARATION AND ADIABATIC OXIDATION EXPERIMENTS

2.1 TEST SAMPLE PREPARATION

The gangue used in the experiment came from Shanxi Guoyang New Energy Co., Ltd. On the scene of sampling, the large coal gangue was first smashed to the particle size of 20-30 mm, then uniformly mixed and then reduced to about 1 kg according to the conical reduction method, Into a multi-layer plastic bag, sealed and shipped to the laboratory. Coal gangue in the laboratory with the original sealed hammer crusher and seal the prototype crushed evenly with Φ 100 and Φ 150 standard test screening, select 100 to 150 mesh coal gangue installed between the mouth to prepare Experiment used.

2.2 ADIABATIC OXIDATION EXPERIMENT

The experiment of coal gangue adiabatic oxidation was carried out in Henan Key Laboratory of Gas and Fire Prevention and Control of Coal Mine (Henan Polytechnic University). The experimental instrument was STA449C thermogravimetric analyzer produced by German-resistant company. The instrument mainly consists of recording balance, furnace, Temperature control system and recorder and other components. The recording balance is the most important component that acts to change the measured mass change and heat change signal by an appropriate converter into an electrical signal proportional to the mass change and heat change signal and to convert the resulting continuous record Into other ways such as the original data of the differential, integral, logarithmic or other functions, used to conduct experiments on a wide range of thermal analysis.

Experiment, first open the thermogravimetric analyzer, make it preheated stable about 2 h, adjust the protective gas and purge gas output pressure and flow rate and to be stable, and then with one hundred thousandth of the balance of artificial weighing 20 ± 1 mg Of gangue into the sample oven for adiabatic oxidation experiment. The experimental initial temperature was 30 ℃, the experimental termination temperature was 1000 ℃, and the experimental heating rate was 5 ℃ / min, 7.5 ℃ / min, 10 ℃ / min, 12.5 ℃ / min and 15 ℃ / min, respectively. 10%, 15% and 20%.

3.0 CHARACTERISTIC ANALYSIS OF ADIABATIC OXIDATION RESULTS

Under the experimental operating conditions determined by the thermal analyzer, the signals generated by the reaction of coal gangue adiabatic oxidation are automatically collected and automatically plotted as weightlessness integral curves and differential curves of the samples, that is, TG-DTG curves. The TG-DTG curve of coal gangue under the conditions of 20% oxygen concentration and different heating rate (Fig 3.1). The TG-DTG curve of coal gangue at different heating rates of 10℃/ min (Fig 3.2).

With the increase of the heating rate, the maximum combustion of the coal gangue during the weightless combustion phase and the carbonaceous phase during the carbonless combustion phase were observed under the conditions of 20% oxygen concentration and different heating rate. The rate is increasing, which is due to the increase of the heating rate, the shortening of the volatilization time in the sample, the increase of the volatile content and the quick reaction of the sample with oxygen. However, as the heating rate increases, the reaction shifts to the high temperature zone. This is because the increase of the heating rate results in the increase of the temperature difference between inside and outside of the sample particles and the relatively low internal temperature of the particles. The internal reaction rate of the particles is smaller than the external reaction rate of the particles, Resulting in the delay of volatile analysis, the maximum temperature corresponding to the combustion rate to move to the high temperature region, that TG curve to the right offset.

This phenomenon is consistent with the conclusion that Ran Jingyu (Ran Jingyu and Niu Ben,2006)and Liu Jian et al (Liu Jian and Zhao Fengjie,2006) used the integrated thermal analyzer to study the effects of different heating rates on the oxidation process of experimental coal samples, But the difference is that the weight loss of coal coal gangue adiabatic oxidation combustio is eflected in the TG-DTG curve

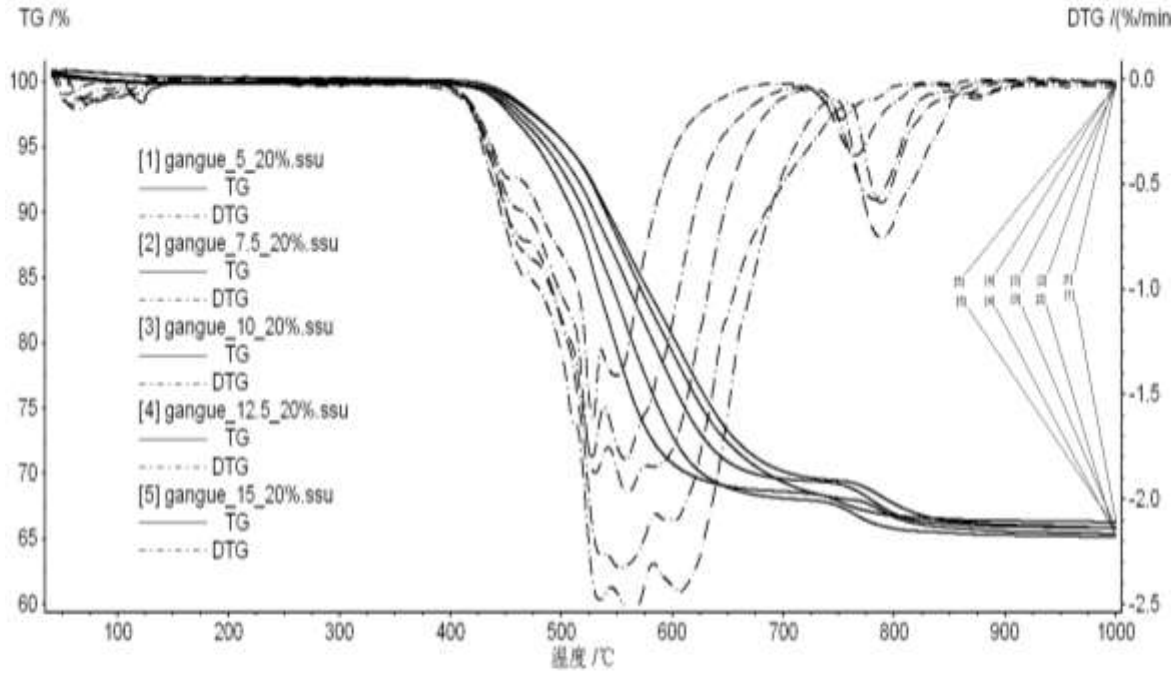

Fig 3.1, 20% O2 concentration TG-DTG curve at different heating rates

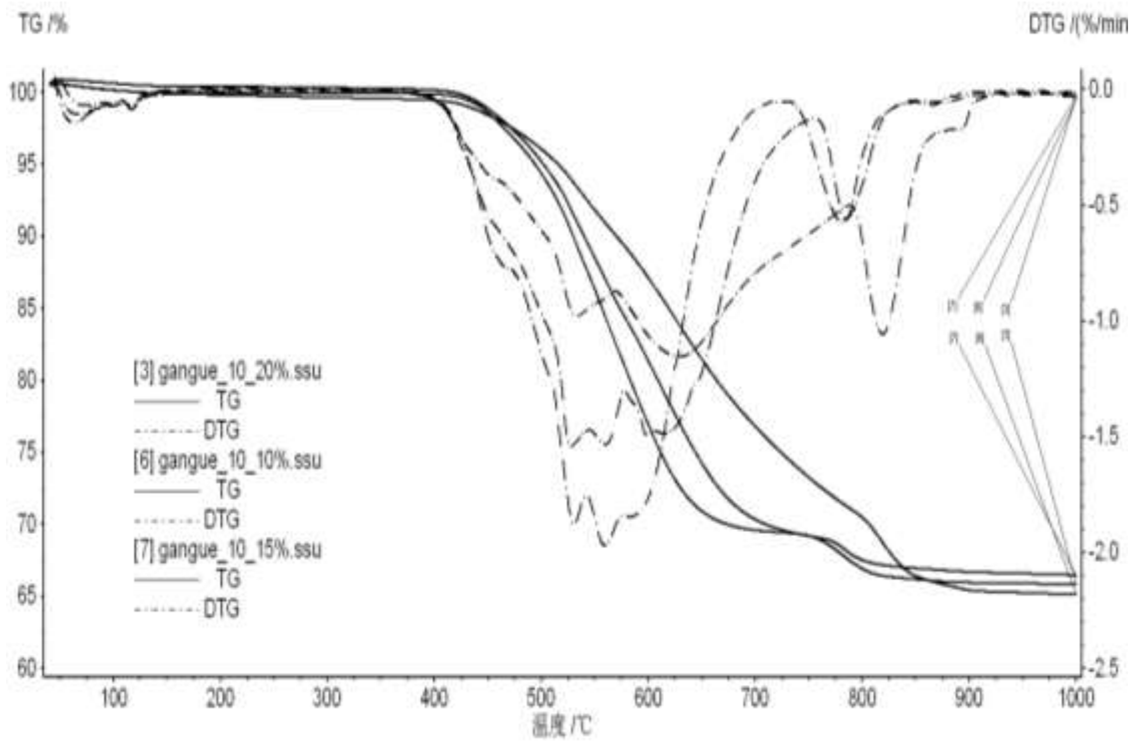

Fig 3.2,10 ℃ / min heating rate different concentrations of O2 TG-DTG curve

can be divided into two distinct stages, and the weight loss of coal adiabatic oxidation combustion is reflected in the TG-DTG curve is only a process.

Observed in Figure 3.2, 10 ℃ / min heating rate, under different oxygen concentrations, the overall trend of adiabatic oxidation of coal gangue also remains the same. With the increase of oxygen concentration, the weight loss of volatile components of coal gangue and the weight loss of fixed carbon The maximum burning rate shows an increasing trend. This is because the increase of the oxygen concentration makes it possible for the volatiles to be precipitated to burn sufficiently, the time for the volatilization to stay in the sample is shortened, and the reaction speed between the sample and the oxygen is accelerated. However, as the oxygen concentration increases, the reaction shifts to the low temperature region. This is because the increase of oxygen concentration leads to the increased contact probability between the inner and outer surfaces of the sample particles and oxygen and the rapid reaction rate inside the particles, resulting in the internal volatilization of the particles Is also relatively full, the maximum temperature corresponding to the combustion rate to move to the low temperature region, that TG curve to the left offset. This phenomenon was compared with that of Wei and Wang [12] and Tang et al. [13] using a comprehensive thermal analyzer to study the effects of different oxygen concentrations on the characteristics of pulverized coal combustion as the oxygen concentration increases and the TG curve shifts to a lower temperature Consistent.

4.0 CONCLUSION

The process of weight loss of adiabatic oxidation combustion of coal gangue is similar to the process of weight loss of adiabatic oxidation combustion of coal, but the difference lies in that the weight loss of adiabatic oxidation combustion of coal gangue is reflected in TG-DTG curve and can be divided into two distinct phases, Adiabatic oxidation combustion weight loss is reflected in the TG-DTG curve is only a process.

The process of adiabatic oxidation and weight loss of coal gangue includes four stages, that is, when the coal gangue is heated, the external water evaporates on the surface of the coal gangue or in the pores, followed by the precipitation and evaporation of the internal water in the coal gangue, and then the coal gangue In the gradual precipitation of combustible volatile components, when the temperature is high and there is enough oxygen, the volatile combustible precipitated combustion occurs, and finally the fixed carbon in coal gangue burning.

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