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**Test method for coal combustion characteristics -
One-dimensional furnaces method**

煤的燃烧特性测定方法 一维炉法

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Test method for coal combustion characteristics - One-dimensional furnaces method

1 Scope

This document specifies the one-dimensional furnaces method, instruments and equipment, test conditions, test testing, data processing and analysis methods, evaluation indexes, precision for ignition temperature and burnout efficiency during pulverized coal combustion process.

This document is applicable to the one-dimensional furnaces method testing for ignition temperature and burnout efficiency of lignite, bituminous and anthracite.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 474, *Method for preparation of coal sample*

GB/T 19494.2, *Mechanical sampling of coal Part 2: Method for sample preparation*

DL/T 567.5, *Test Methods of Fuel in Thermal Power Plants - Part 5: Fineness of Pulverized Coal*

DL/T 567.6, *Test Method for Thermal Power Plant Fuel Part 6: Determination Methods of Fly Ash and Slag Fuel*

DL/T 1106-2009, *Test methods for pulverized coal combustion shagging characteristics and burnout rate on one-dimensional flame furnace*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 ignition temperature; T_i

the starting temperature of the ignition reaction between the pulverized coal

airflow and the surrounding air to form a combustible mixture

3.2 burnout efficiency; B

under the combustion test conditions of the pulverized coal airflow in a one-dimensional furnace, a solid sample is taken at the outlet of the furnace and its combustible content is analyzed; the burnout efficiency refers to the percentage of burnt combustibles to initial combustibles

4 Principle

During the test of the one-dimensional furnace, a certain amount of air flow is used to carry pulverized coal. After entering the furnace, it will be ignited and burned by the heat of the furnace wall, so that it burns. One-dimensional furnace realizes pulverized coal and air suspension combustion test under dynamic conditions. The burning pulverized coal flow moves downwards along the height of the furnace. The ignition temperature of the pulverized coal airflow can be obtained by testing the temperature of the flue gas in the furnace. Through the analysis of combustion products, the characteristics of pulverized coal burnout can be evaluated.

5 Method summary

Multiple temperature measurement points are arranged from the top of the furnace of the one-dimensional furnace downwards. Use thermocouple to measure the temperature change along the pulverized coal gas flow. Analyze to obtain the ignition temperature. Conduct the fly ash sample at the tail flue dust collector. Conduct the bottom slag sample at the ash trough at the bottom of the furnace. Test the combustible content in fly ash and bottom slag. Calculate and analyze the burnout efficiency.

6 Instruments and equipment

6.1 One-dimensional furnace test device

The schematic diagram of the one-dimensional furnace test device is shown in Figure 1. The one-dimensional furnace test bench is mainly composed of powder feeding system, heating and temperature control system, combustion furnace body system, air smoke system and sampling analysis system. The one-dimensional furnace body adopts a vertically arranged electric heating building block structure. It is mainly composed of ignition section, stable combustion section and burnout section. Connect the powder feeder to the

Description of index numbers:

- 1 - Furnace body;
- 2 - Furnace top;
- 3 - Burner;
- 4 - Powder feeder;
- 5 - Blower;
- 6 - Flowmeter;
- 7 - Primary air duct;
- 8 - Secondary air duct;
- 9 - Air preheater;
- 10 - Tail flue;
- 11 - Dust collector;
- 12 - Flue gas cooler;
- 13 - Induced draft fan;
- 14 - Hearth test hole.

Figure 1 -- Schematic diagram of one-dimensional furnace combustion test device

6.2 Test instruments

6.2.1 Primary air and secondary air thermometers (temperature measuring element is thermocouple): control temperature error is $\pm 5^{\circ}\text{C}$.

6.2.2 Primary and secondary air flow meters: precision level is 4%.

6.2.3 Pulverized coal combustion flue gas thermometer (insert the thermocouple into the hearth to test): precision level is 0.25%.

7 Test conditions

7.1 Pulverized coal fineness requirements

7.1.1 Measured value of pulverized coal fineness

Prepare pulverized coal in accordance with the requirements of GB/T 474 or GB/T 19494.2. Take no less than 100g of air-dried coal samples and grind them all. According to the requirements of DL/T 567.5, select and calculate the fineness of pulverized coal until the test coal samples all meet the requirements of R_{200} and R_{90} fineness. The calculation of R_{200} and R_{90} is carried out according to formula (1) and formula (2):

$$\begin{aligned} R_{200} &= m_{200}/m \times 100 & \dots\dots\dots (1) \\ R_{90} &= (m_{200} + m_{90})/m \times 100 & \dots\dots\dots (2) \end{aligned}$$

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