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Ultimate analysis of coal

煤的元素分析

(ISO 17247:2013, Coal - Ultimate analysis, MOD)

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Table of Contents

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1 Scope

This Standard specifies the terms and definitions, method summary, test methods, result expression and test report of ultimate analysis of coal.

This Standard applies to coal.

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 211, *Determination of total moisture in coal*

GB/T 212, *Proximate analysis of coal*

GB/T 214, *Determination of total sulfur in coal*

GB/T 476, *Ultimate analysis of coal* (GB/T 476-2008, ISO 625:1996, MOD)

GB/T 483, *General rules for analytical and testing methods of coal*

GB/T 3715, *Terms relating to properties and analysis of coal*

GB/T 19227, *Determination of nitrogen in coal* (GB/T 19227-2008, ISO 333:1996, MOD; ISO/TS 11725:2002, MOD)

GB/T 25214, *Determination of total sulfur in coal by IR spectrometry* (GB/T 25214-2010, ISO 19579:2006, MOD)

GB/T 30732, *Proximate analysis of coal - Instrumental method*

GB/T 30733, *Determination of total carbon, hydrogen and nitrogen content in coal - Instrumental method*

3 Terms and definitions

For the purposes of this document, the terms and definitions defined in GB/T 483 and GB/T 3715 apply.

Calculate the oxygen by difference (excluding the oxygen in moisture) according to the formula (1):

$$O_{ad} = 100 - C_{ad} - H_{ad} - N_{ad} - S_{t,ad} - A_{ad} - M_{ad} \quad \cdots\cdots (1)$$

Where,

O_{ad} - Content of oxygen by difference of air drying basis (mass fraction), %;

C_{ad} - Carbon content of air drying basis (mass fraction), %;

H_{ad} - Hydrogen content of air drying basis (mass fraction), %;

N_{ad} - Nitrogen content of air drying basis (mass fraction), %;

$S_{t,ad}$ - Total sulfur content of air drying basis (mass fraction), %;

A_{ad} - Ash yield of air drying basis (mass fraction), %;

M_{ad} - Moisture (general analysis test coal sample moisture) content of air drying basis (mass fraction), %.

6.1.2 Oxygen content (including oxygen in moisture)

Calculate the air-drying basis hydrogen ($H_{m,ad}$) content including hydrogen in moisture according to formula (2):

$$H_{m,ad} = H_{ad} + aM_{ad} \quad \cdots\cdots (2)$$

Where,

$H_{m,ad}$ - Air-drying hydrogen content (including hydrogen in moisture) (mass fraction), %;

a - Conversion factor to convert water to hydrogen, taking 0.1119.

The rest of the symbols have the same meaning as before.

Calculate oxygen by difference (including oxygen in moisture) according to formula (3) or formula (4):

$$O_{m,ad} = 100 - C_{ad} - H_{m,ad} - N_{ad} - S_{t,ad} - A_{ad} \quad \cdots\cdots (3)$$

or

$$O_{m,ad} = O_{ad} + bM_{ad} \quad \cdots\cdots (4)$$

Where,

$O_{m,ad}$ - Content of oxygen by difference of air drying basis including oxygen in moisture (mass fraction), %;

b - Conversion factor to convert water to oxygen, taking 0.8881.

The rest of the symbols have the same meaning as before.

6.2 Calculation of different oxygen by difference

6.2.1 Oxygen content of dry basis

Calculate the oxygen content of dry basis according to formula (5):

$$O_d = 100 - C_d - H_d - N_d - S_{t,d} - A_d \quad \cdots\cdots (5)$$

Where,

O_d - Content of oxygen by difference of dry basis (mass fraction), %;

C_d - Carbon content of dry basis (mass fraction), %;

H_d - Hydrogen content of dry basis (mass fraction), %;

N_d - Nitrogen content of dry basis (mass fraction), %;

$S_{t,d}$ - Total sulfur content of dry basis (mass fraction), %;

A_d - Ash yield of dry basis (mass fraction), %.

6.2.2 Oxygen content of received basis

6.2.2.1 Oxygen content (excluding oxygen in total moisture)

Calculate the oxygen content according to formula (6) (excluding the oxygen in the total moisture)

$$O_{ar} = 100 - C_{ar} - H_{ar} - N_{ar} - S_{t,ar} - A_{ar} - M_t \quad \cdots\cdots (6)$$

Where,

O_{ar} - Content of oxygen by difference of received basis (mass fraction), %;

C_{ar} - Carbon content of received basis (mass fraction), %;

H_{ar} - Hydrogen content of received basis (mass fraction), %;

N_{ar} - Nitrogen content of received basis (mass fraction), %;

$S_{t,ar}$ - Total sulfur content of received basis (mass fraction), %;

A_{ar} - Ash yield of received basis (mass fraction), %;

M_t - Total moisture (mass fraction), %.

6.2.2.2 Oxygen content (including oxygen in total moisture)

Calculate the hydrogen content of received basis including hydrogen in the total moisture according to formula (7):

$$H_{m,ar} = H_{ad} \times \frac{100 - M_t}{100 - M_{ad}} + aM_t \qquad \cdots\cdots (7)$$

Where,

$H_{m,ar}$ - Hydrogen content of received basis including hydrogen in the total moisture, %.

The rest of the symbols have the same meaning as before.

Calculate the oxygen content of received basis including oxygen in the total moisture according to formula (8) or (9):

$$O_{m,ar} = 100 - C_{ar} - H_{m,ar} - N_{ar} - S_{t,ar} - A_{ar} \qquad \cdots\cdots (8)$$

or

$$O_{m,ar} = O_{ar} + bM_t \qquad \cdots\cdots (9)$$

Where,

$O_{m,ar}$ - Oxygen content of received basis including oxygen in the total moisture, %.

The rest of the symbols have the same meaning as before.

6.3 Result expression

The test results of carbon, hydrogen, nitrogen, sulfur, ash and moisture of coal and calculated oxygen by difference are expressed in mass fraction. Except for oxygen by difference, other items can be converted based on GB/T 483.

7 Test report

The test report shall include at least the following information:

- Specimen No;

- Test items and compliance standards;

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