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Manganese ores - Determination of moisture content

(ISO 4299:1989, MOD)

锰矿石 水分含量测定

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Manganese ores - Determination of moisture content

WARNING -- The personnel who uses this Standard shall have practical experience in formal laboratory work. This Standard does not point out all possible security issues. It is the user's responsibility to take appropriate safety and health measures and ensure compliance with the conditions set by the relevant national regulations.

1 Scope

This Standard specifies the determination method of moisture content of manganese ores.

This Standard is applicable to the determination of moisture content of natural manganese ores and processed manganese ores (including flotation or pellets).

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 2011, *Method of sampling and sample preparation of manganese ores in bulk*

3 Terms and definitions

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

3.1 lot

A certain amount of manganese ores that are processed or produced under the same conditions.

3.2 consignment

A certain amount of manganese ores in one delivery. A consignment may consist of a lot, several lots or partial lots of manganese ores.

3.3 increment

7.2.3 Place the drying pan into the drying oven that has been pre-adjusted to 105°C. Dry at this temperature for not less than 4h.

7.2.4 Take out the drying pan. Immediately weigh. The weighing device shall use thermal insulation material to prevent the heat transfer of material.

7.2.5 Place the drying pan into the drying oven once again. Maintain 1h. Take it out to weigh and record.

7.2.6 Repeat the above steps till the weight is constant, that is, the difference between the two-weighings is less than 0.05% of the initial mass. After the repeated drying, the mass shall increase and the last weighing data before the last testing shall be used as the calculation data.

7.2.7 For the samples that are difficult to sieve, break, and divide due to excessive humidity or stickiness, it may pre-dry the sample till there is no difficulty in sample preparation (see Annex A).

7.2.8 The calibration of sprayed water and/or rain is conducted according to Annex B.

8 Calculation and result expression

8.1 Calculation of moisture content of test portion

The moisture content w_i is calculated according to formula (1), expressed in mass fraction (%). The result is expressed to two digits after the decimal place:

$$w_i = \frac{m_1 - m_2}{m_1} \times 100\% \quad \dots\dots\dots (1)$$

Where,

m_1 - Initial mass of test portion, in grams (g);

m_2 - Dried mass of test portion, in grams (g).

8.2 Calculation of moisture content of consignment

8.2.1 When moisture is determined by gross sample, the moisture content of consignment shall be calculated according to formula (2). The result is expressed to one digit after the decimal place:

$$\bar{w} = \frac{w_1 + w_2}{2} \quad \dots\dots\dots (2)$$

Annex A

(normative)

Test method for moisture content of sticky manganese

When the sample is difficult to sieve, break or divide due to excessive humidity or stickiness, it may perform pre-drying. In such a situation, it shall conduct the moisture test according to the following pre-drying methods.

A.1 Weigh the initial mass of the test sample.

A.2 Tile the test sample to the uniform thickness. Place it in the air or place it in a drying oven of which the temperature is not greater than 105°C. The drying temperature and time shall not cause the sample to reabsorb moisture in the subsequent operations.

A.3 Weigh the dried manganese ore once again.

A.4 According to formula (A.1), calculate the pre-drying moisture content of the test sample w_p (%):

$$w_p = \frac{m'_1 - m'_2}{m'_1} \times 100\% \quad \dots\dots\dots (A.1)$$

Where,

m'_1 - Test sample mass before pre-drying, in kilograms (kg);

m'_2 - Test sample mass after pre-drying, in kilograms (kg).

A.5 Record the pre-drying moisture content to the second digit after the decimal place.

A.6 Prepare test portion from the pre-drying samples according to Clause 6.

A.7 Measure the weight loss of test portion. According to the method described in Clause 7, then according to sub-clause 8.1, calculate the moisture content of test portion (mass fraction).

A.8 According to formula (A.2), calculate the total moisture content, w_{pd} (%):

Annex B

(normative)

Calibration of sprayed water and/or rain

B.1 Introduction

To prevent dust from polluting the environment, it needs to spray water on the ores during loading-unloading. Therefore, the moisture content of the consignment shall be calibrated according to the mass of sprayed water. The calibration procedures are in accordance with the provisions of this Annex.

This Annex is also applicable to the moisture content calibration of the consignment of manganese ores that are exposed in rain.

B.2 General rules

B.2.1 Sprayed water due to the following reasons:

- a) The environmental regulations of loading/unloading ports have requirements for dust;
- b) It is more convenient to spray water for reasons such as minerals, weather, or disposal equipment.

B.2.2 When the rain has a considerable effect on the moisture content of the consignment, it shall consider the rain calibration. But the corrected coefficient shall be agreed with the relevant stakeholders.

B.3 Calibration of sprayed water

B.3.1 Sprayed water

Sprayed water refers to the water that is added between the moisture determination and the determination of total mass of cargo.

B.3.2 Determination of sprayed water mass

It may use a flowmeter of which the accuracy is $\pm 5\%$ to determine the sprayed water mass. Multiply the determined volume by the density of the sprayed water and convert it to the mass m_3 that is represented in t.

NOTE: The density of fresh water is assumed to be 1t/m^3 .

B.3.3 Mass of consignment

B.4.2 Effective area exposed to rain

The effective area exposed to rain shall be calculated according to the provisions of B.4.2.1~B.4.2.3 and rounded off to square meters.

B.4.2.1 Cargo compartment

The area calculation of cargo compartment exposed to rain shall be based on the cargo ship plan view provided by the ship owner.

B.4.2.2 Feed bin

The area calculation of feed bin exposed to rain shall be based on the feed bin plan view.

B.4.2.3 Belt transport

During belt transport, the calculation of the area exposed to rain shall multiply the effective width of the belt by the length of the exposed rain, that is, the distance from the container to the sampling point when the cargos are transported.

B.4.3 Rainfall duration

If the vessel uses a water gauge to weigh, the rainfall duration shall be from the beginning of the water gauge identification to the end of sampling.

B.4.4 Measurement method of rainwater

The measurement of rainwater shall use a certified rain gauge. During measurement, place it near the loading-unloading ores. The rainfall is expressed in millimeters (mm).

B.4.5 Mass of rain

The mass of rain is expressed in m_R , in tons (t). Use formula (B.3) to calculate to an integer.

$$m_R = \frac{AR\rho}{1\ 000} \dots\dots\dots (B.3)$$

Where,

A - Raining effective area calculated according to B.4.2, in square meters (m²);

R - Rainfall measured according to B.4.4, in millimeters (mm);

ρ - Rain density, in tons per cubic meter (t/m³); usually it is 1t/m³.

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