

ICS 77.1
CCS H11



**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 41496-2022

**Ferroalloys - Determination of the moisture content of lots -
Gravimetric method**

铁合金 交货批水分的测定 重量法

Issued on: April 15, 2022

Implemented on: November 1, 2022

**Issued by: State Administration for Market Regulation;
Standardization Administration of the PRC**

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1 Scope

China's national gravimetric method for determining the moisture content of ferroalloy lots. It specifies the terms and definitions, the principle and the procedure. Ferroalloys are bought by weight and used by their alloy content, so the moisture they carry is directly a commercial quantity: a buyer paying for a hundred tonnes of ferromanganese at two per cent moisture is paying for two tonnes of water. The material is stored and shipped in the open, arrives wet, and the moisture varies through a consignment, so the determination has to be made on a sample that represents the lot - which is the hard part and the reason the standard is about lots rather than about samples. Moisture also matters technically: water entering a molten bath with the alloy flashes to steam and can eject metal, and the hydrogen it introduces dissolves in the steel and causes flaking in heavy sections, which is why alloy additions are preheated.

This document specifies a method for the gravimetric determination of the moisture content of ferroalloys. This document is applicable to the determination of moisture content, between 0.010% and 1.00%, in the delivery batch of iron alloys and nickel-iron ingots or blocks, that are not easily chemically changed, during the drying process, in GB/T 4010.

2 Normative references

The contents of the following documents constitute essential provisions of this document through normative references in the text. Among them, for dated references, only the version corresponding to the date applies to this document; for undated references, the

latest version (including all amendments) is applicable to this document.

GB/T 4010 Ferroalloys sampling and preparation of samples for chemical analysis

GB/T 8170 Rules of rounding off for numerical values and expression and judgement of limiting values

GB/T 25050 Ferronickel ingots or pieces - Sampling for analysis

GB/T 28296 Pig iron containing nickel

3 Terms and definitions

The following terms and definitions apply to this document.

3.1 Lots Ferroalloys of the same specification, in one delivery.

Note: The lots may consist of one or more batches.

4 Principles

Weigh a certain mass of ferroalloy test samples. Place them in a drying oven, at $105\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$, to dry it, until the mass is constant. Calculate the mass fraction of moisture, as relative to the mass lost as relative to the initial mass.

5 Instruments

5.1 Drying tray: A stainless metal tray, which has a smooth and clean surface, AND can hold a specified number of measurement samples, whose thickness does not exceed

31.5 mm (or can hold a whole nickel-iron ingot or several pieces of non-fragile iron alloy).

5.2 Drying oven: It has the function of electric heating and blasting; the temperature can be controlled at $105\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$.

5.3 Balance: The measuring range is more than 5000 g; the sensitivity is

0.1 g.

6 Sampling and sample preparation

The sampling and preparation of samples, for the determination of moisture in the lots of ferroalloys, shall be carried out, in accordance with the provisions of GB/T 4010. If the content of nickel-containing pig iron and nickel-iron ingots or blocks is different, the sampling for the determination of moisture in the lots shall be in accordance with the provisions of GB/T 25050 and GB/T 28296.

7 Samples

7.1 Samples of fragile alloys for determination of moisture Fragile alloys include high-carbon ferrochromium, ferrosilicon, ferrotitanium, ferromanganese, ferromolybdenum, ferrotungsten, manganese-silicon alloy, silicon- chromium alloy, ferrovanadium, ferroboron, ferroniobium, and other ferroalloys, which can be directly crushed, by jaw crusher. The moisture determination shall be carried out, immediately after the sample preparation is completed. The minimum mass of the sample, which is required for moisture determination, is as shown in Table 1. Spread the measurement sample in the weighed drying tray (5.1). The thickness of the fragile alloy sample layer shall not exceed

31.5 mm; immediately measure the total mass. Record the mass of the drying tray AND the total mass of the drying tray and the test sample; calculate the initial mass of the measurement sample AND a value of 0.02% of the initial mass of the measurement sample. Place the drying tray (5.1), which contains the measurement sample, in the drying oven (5.2), which was set at 105 °C; keep this temperature for not less than 2 h. Take out the drying tray, which contains the test sample, from the drying oven. Weigh it immediately, to avoid the re-absorption of moisture. Alternatively, in a container with a sealed lid, weigh the measurement sample, after cooling in air. Put the drying tray, which contains the measurement sample, into the drying oven again, to continue to heat for 30 min. Repeat the weighing. Repeat the above procedure, until reaching the constant weight (the mass difference between the last two consecutive weighing is not greater than 0.02% of the initial mass of the measurement sample).

9 Calculation and representation of results

9.1 Calculations for the determination of sample moisture The moisture content of each measurement sample is calculated, according to formula (1) AND rounded off according to GB/T8170; the test result is rounded off to the third decimal place. Where: ω_i - Determination result of moisture content of the i th measurement sample, expressed in mass fraction (%); m_1 - The initial mass of the measurement sample, in grams (g); m_2 - The mass of the measurement sample after drying, in grams (g).

9.2 Calculation of the moisture content of lots

9.2.1 The moisture content of the lots shall be calculated, according to one of the formulas (2) ~ (5) as needed, rounded off according to GB/T 8170, reported to the second decimal place.

9.2.2 When the moisture content is measured, by the use of the bulk sample, which is taken out from the lots, the average moisture content () of the whole batch of Where: k - The number of parts of unequal mass of ferroalloy in the lots; m_i - The mass of the i th part, in grams (g); ω_i - The determination result of moisture content of the i th part, expressed in mass fraction (%). For the number of samples for parallel determination, it may refer to the 2nd ~ 3rd row in Table 2; i - 1, 2, 3, ..., k .

9.2.5 When the moisture content of each incremental sample is measured, the moisture content of the lots shall be calculated, according to the arithmetic mean () of all the incremental sample results, which are obtained in 9.1, according to formula (5). The moisture content result of each incremental sample is calculated to the third decimal place; the moisture content result of whole batch is reported to the second decimal place. Where: n - Number of incremental samples; ω_{gi} - The determination result of moisture content of the i th incremental sample, expressed in mass fraction (%); i - 1, 2, 3, ..., n .

Note: For non-fragile alloys, it usually use this method for the determination of moisture content.