

ICS 77.100



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

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**Ferronickel - Determination of carbon content - Infrared
absorption method after induction furnace combustion**

(English Translation)

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1 Scope

This document specifies the method for determining the carbon content in ferronickel using the infrared absorption method after induction furnace combustion.

This document applies to the determination of carbon content in ferronickel, determination range (mass fraction). 0.001% ~ 2.5%.

2 Normative References

The contents of the following documents constitute indispensable clauses of this document through the normative references in the text. In terms of references with a specified date, only versions with a specified date are applicable to this document. In terms of references without a specified date, the latest version (including all the modifications) is applicable to this document.

GB/T 6379.1 Accuracy (trueness and precision) of Measurement Methods and Results - Part 1.

General Principles and Definitions (GB/T 6379.1-2004, ISO 5725-1.1994, IDT)

GB/T 6379.2 Accuracy (trueness and precision) of Measurement Methods and Results - Part 2.

Basic Method for the Determination of Repeatability and Reproducibility of a Standard

Measurement Method (GB/T 6379.2-2004, ISO 5725-2.1994, IDT)

GB/T 6379.3 Accuracy (trueness and precision) of Measurement Methods and Results - Part 3.

Intermediate Measures of the Precision of a Standard Measurement Method (GB/T 6379.3-2012, ISO 5725-3.1994, IDT)

GB/T 8170 Rules of Rounding off for Numerical Values & Expression and Judgement of Limiting Values

GB/T 25050 Ferronickel Ingots or Pieces - Sampling for Analysis (GB/T 25050-2010, ISO 8050.1988, IDT)

GB/T 25051 Ferronickel Shot - Sampling for Analysis (GB/T 25051-2010, ISO 8049.1988, IDT)

3 Terms and Definitions

The following terms and definitions are applicable to this document.

3.1

flux

Primarily used to lower the melting point of the sample, making it easier to melt and flow at high temperatures, thus ensuring the full release of carbon and sulfur.

3.2

promoter

Typically used to accelerate chemical reactions, and increase the reaction rate, thus enabling carbon and sulfur to be converted into detectable gaseous products more quickly.

4 Principle

The test portion is heated and burned in the oxygen stream of an induction furnace. Under the action of the flux and promoter, carbon is converted into carbon dioxide or carbon monoxide, which is carried by the oxygen stream to an infrared absorption cell. The absorption of infrared light at a specific wavelength is measured by an infrared detector, and the carbon content is determined based on the change in infrared energy received by the detector.

5.1 Oxygen

Purity at least 99.5% (mass fraction).

5.2 Alkali Asbestos

Particle size. 0.7 mm ~ 1.2 mm, used for absorbing carbon dioxide.

5.3 Anhydrous Magnesium Perchlorate [Mg(ClO₄)₂]

Particle size. 0.7 mm ~ 1.2 mm, used for absorbing moisture.

5.4 Glass Wool Filter

Place glass wool in a dedicated reagent tube to filter dust and particulate matter generated during high-frequency induction combustion and protect detection components at the back end from contamination.

5.5 Flux

Common fluxes are tin, copper with tin, copper or tungsten.

5.6 Promoter

Common promoters are copper, iron, tungsten or nickel.

Some materials act as both fluxes and promoters. Both the flux and promoter used shall have a low carbon content and shall be simultaneously used in the calibration procedures. Various factors (oxygen, crucible, flux and promoter) contribute to the carbon blank value. When the carbon content of the sample to be determined is $\leq 0.1\%$ (mass fraction), it is required that the blank value shall not exceed 0.0005% (mass fraction); when the carbon content of the sample to be determined is $> 0.1\%$ (mass fraction), it is required that the blank value shall not exceed

0.001% (mass fraction).

5.7 Certified Reference Materials/Samples of Steel or Ferronickel

Carbon content (mass fraction) is 0.001% ~ 2.6%.

6.1 Carbon Analyzer

6.1.1

High-frequency induction furnaces and infrared absorption carbon determinators are available from multiple instrument manufacturers. The instruments and equipment shall be operated in accordance with the manufacturer's instructions. In accordance with the

manufacturer's specifications, a pressure regulator is required to control the oxygen pressure entering the instrument's combustion furnace.

6.1.2

Oxygen shall be purified using a quartz tube filled with alkali asbestos (5.2) and anhydrous magnesium perchlorate (5.3). In standby mode, a flow rate of approximately 0.5 L/min shall be maintained.

6.1.3

A glass wool filter (5.4) shall be installed between the high-frequency induction furnace chamber and the analyzer and replaced as necessary. The furnace chamber, furnace column, and filter screen shall be frequently cleaned to remove oxide residues.

6.1.4

The instrument manufacturer may recommend setting up a pre-combustion program before oxygen intake. During the pre-combustion, the test portion is in a red-hot state. When oxygen is introduced during the combustion stage, the temperature will significantly rise.

6.1.5

The temperature reached during combustion depends on the furnace and the type and quantity of metal in the crucible. After melting, the specimen is maintained at a high temperature ($> 1,700\text{ }^{\circ}\text{C}$) to ensure complete transfer of carbon dioxide from the furnace to the infrared analysis cell.

6.1.6

After the instrument has been idle for several hours or after cleaning the furnace or filter, the instrument shall be stabilized in accordance with the steps described in 8.1.

NOTE: Appendix C provides characteristics of commercial instruments.

6.2 Ceramic Crucible

A ceramic crucible is required to hold the sample and other necessary additives for the subsequent melting process. The crucible shall be dimensionally accurate and fit the support, so that the test portion in the crucible is precisely within the heating induction coil.

Typical dimensions of the crucible are.

---Height. 25 mm;

---Outer diameter. 25 mm;

---Inner diameter. 20 mm;

---Wall thickness. 2.5 mm;

---Bottom thickness. 8 mm;