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NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 30903-2026

Replacing GB/T 30903-2014

Inorganic chemicals for industrial use - Determination of impurity elements - Inductively coupled plasma mass spectrometry

无机化工产品 杂质元素的测定 电感耦合等离子体质谱法（ICP-MS）

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1 Scope

GB/T 30903-2026 is the Chinese national standard covering trace metal impurities in an industrial chemical by ICP-MS - the technique that reaches parts per billion across most of the periodic table in a single run. It replaces GB/T 30903-2014 and has been in force since 1 October 2026, with the ion chromatography method GB/T 31197-2026 revised alongside it. It was issued on 31 March 2026 and takes effect on 1 October 2026, replacing GB/T 30903-2014. The document is under the responsibility of the China Petroleum and Chemical Industry Federation. This page is published from the official record of the 2026 edition; the clause text of a standard this recent is not yet in circulation, and the figures, limits and tables it contains are those of the document itself, delivered in full with the English translation.

This document provides reagents or materials, apparatus for the determination of metallic and non-metallic impurity elements in inorganic chemical products by inductively coupled plasma mass spectrometry (ICP-MS). It describes the principle, general provisions, apparatus, test procedures, precision, and recovery rate of the determination of metallic and non-metallic impurity elements in inorganic chemical products by inductively coupled plasma mass spectrometry (ICP-MS). This document applies to the determination of the content of metallic and non-metallic impurity elements in inorganic chemical products by inductively coupled plasma mass spectrometry (ICP-MS).

2 Normative references

The provisions of the following documents constitute the essential clauses of this document through normative references in this text. Among them, for any dated reference, only the

version corresponding to that date applies to this document; for any undated reference, the latest version (including all amendments) applies to this document.

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 14666-2025 Terms for analytical chemistry

3 Terms and definitions

The terms and definitions defined in GB/T 14666-2025, as well as the following terms and definitions, apply to this document.

3.1 plasma Ionized gas with a degree of ionization greater than 0.1%. NOTE. It is composed of electrons, ions, atoms and molecules, with the numbers of electrons and ions being roughly equal, and the whole is neutral. [Source: GB/T 14666-2025, 7.1.22]

3.2 inductively coupled plasma; ICP The torch flame that is formed by applying high-frequency power to a coil coupled to a plasma torch.

3.3 sampling cone A crucial cone-shaped component for the interface between atmospheric pressure plasma and high vacuum mass analyzers. NOTE. There is a cone-shaped hole of about 1 mm in the center of the sampling cone. Through this cone-shaped hole, ions in the plasma torch enter the first-stage vacuum chamber supported by a mechanical pump.

3.4 skimmer cone Another important cone-shaped component for the interface between atmospheric pressure plasma and a high vacuum mass analyzer. NOTE. The center of the skimmer cone has a cone hole less than 1 mm in diameter, which is concentric with the axis of the sampling cone hole. Ions enter the mass analyzer through this cone hole.

3.5 auxiliary gas Argon gas flow that is introduced between the middle tube and the central tube of the torch. NOTE. The auxiliary gas serves to support the plasma formed at the torch opening, control the position of the plasma flame, and protect the central tube.

3.6 carry gas The airflow introduced through the central tube. NOTE. The role of the carry gas is to transport aerosols into the plasma.

3.7 cooling gas During the operation of the inductively coupled plasma mass spectrometer, the gas that provides a central channel for the sample (nebulized gas), participates in the plasma ignition process, forms a stable plasma torch flame, and isolates and protects the torch. NOTE. The cooling gas is usually argon.

3.8 interface A device consisting of a sampling cone, a skimmer cone, etc., allows ions formed by plasma to enter the channel of a mass separator.

3.9 mass spectral interference Interference caused by one or more atomic ions having a similar mass-to-charge ratio to the analyte ions.

3.10 polyatomic ion interference Interference caused by complex ions composed of two or more atoms having a similar mass-to-charge ratio to the analyte ions.

4 Principle

The test solution is introduced by a carry gas (argon) into the nebulization system and nebulized, and then enters the plasma central region as an aerosol. In the high temperature and inert atmosphere, it is desolvated, vaporized, dissociated, and ionized, transforming into positively charged ions. These ions are then collected by an ion acquisition system and sent to a mass spectrometer. The mass spectrometer separates the ions based on their mass-to-charge ratio, and the ion signals are received by an electron multiplier, amplified, and detected. Qualitative or quantitative analysis of each element is performed based on the intensity of its mass spectrometric peaks.

5 General provisions

5.1 Reagents. Unless otherwise specified, all reagents refer to guaranteed reagents. Hydrochloric acid and nitric acid shall be purified by sub-boiling distillation if necessary. The sub-boiling distillation acid purification apparatus is shown in Appendix A. Commonly used inorganic acids include nitric acid (HNO_3), hydrochloric acid (HCl), hydrofluoric acid (HF), perchloric acid ($HClO_4$), and sulfuric acid (H_2SO_4).

5.2 Water. The conductivity (25 °C) shall not exceed 0.0055 mS/m.

5.3 Impurity standard solutions. It shall be prepared using certified reference materials.

6 Apparatus

6.1 Inductively coupled plasma mass spectrometer. It is composed of a sample injection system, cooling system, vacuum system, ion source, interface, ion lens system, mass separator, detector, control and data processing system, etc., and can be equipped with collision/reaction cells, coupling equipment, etc.

6.2 Containers. The containers used for digestion should be selected based on whether the background value of the target element to be tested is within the allowable error range of the analysis. Generally, polytetrafluoroethylene (PTFE), fluoroplastic (PFA), or quartz vessels are used. Containers for holding the sample solution are generally made of polytetrafluoroethylene (PTFE) or fluoroplastic (PFA), or sample vials or quartz sample vials made of tetrafluoroethylene with perfluorinated alkyl side chains, low-density polyethylene (LDPE), high-density polyethylene (HDPE), or polypropylene (PP). Before use, the containers shall be soaked in a 20%~30% nitric acid solution for several hours, washed

thoroughly with water, and then dried in an electric thermostatic drying oven.

7.1 Sample preparation

7.1.1 Dissolution method For samples of easily soluble inorganic chemical products, weigh an appropriate amount of the specimen, add a certain amount of solvent (usually water or dilute acid) to dissolve it, so that the component to be tested is converted into a measurable form, and then dilute it to a certain volume of test solution for the determination of the content of the component to be tested.

7.1.2 Fusion method For samples of insoluble inorganic chemical products, weigh an appropriate amount of the specimen, place it in a crucible, add 5~20 times the amount of alkali metal flux (such as lithium metaborate, lithium tetraborate, sodium carbonate, sodium hydroxide, sodium peroxide, corresponding potassium salts and alkali metal fluorides), and mix. Then, heat and melt the mixture in a high-temperature furnace, generally at a temperature of 500 °C~1200 °C. Then, leach the mixture with water or acid to convert the component to be tested into a measurable form and dilute it to a certain volume of test solution for determining the content of the component to be tested.

7.1.3 Wet digestion method Weigh an appropriate amount of inorganic chemical product specimen, add a certain amount of a mixture of different acids or mixed acids with hydrogen peroxide or other oxidants, heat and digest to convert the component to be tested into a measurable form, and dilute it to a certain volume of test solution for the determination of the content of the component to be tested. Commonly used digestion reagents for wet digestion include HNO3, HNO3-HClO4, HNO3-H2SO4, H2SO4-KMnO4, H2SO4-H2O2, HNO3-H2SO4-HClO4, HNO3-H2SO4- V2O5, etc. Wet digestion methods include open container digestion, sealed high-pressure digestion, and microwave digestion, as detailed below.

a) Open container digestion method. The specimen and digestion reagent are added to an open container and heated for digestion.

b) Sealed high-pressure digestion method. The specimen and digestion reagent are placed in a suitable container and digested under high temperature and high pressure.

c) Microwave digestion method. The specimen and digestion reagent are placed in a sealed container and digested using microwaves.

7.1.4 Separation and preconcentration methods Inorganic chemical product samples are separated using methods such as solvent extraction, ion exchange, and coprecipitation/adsorption to remove potential matrix effects and interferences, achieve preconcentration, and lower the limit of quantitation.

7.2 Test solution requirements After processing, samples of inorganic chemical products are diluted to a certain volume based on the content of the analyte and made into test