ICS 77.120.99
CCS H 14

NATIONAL STANDARD OF THE

PEOPLE'S REPUBLIC OF CHINA

GB/T 34500.7-2026

Chemical analysis methods for rare earth residues and waste water - Part 7: Determination of thorium and uranium contents - Inductively coupled plasma mass spectrometry

稀土废渣、废水化学分析方法 第7部分：钍、铀含量的测定 电感耦合等离子体质谱法

Issued on: May 25, 2026 **Implemented on: December 1, 2026**

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

Table of Contents

Foreword

This document complies with the provisions of GB/T 1.1-2020 "Standardization Work Guidelines Part

1.Structure and Drafting Rules of Standardization Documents". Drafting. This document is Part 7 of GB/T 34500, "Chemical Analysis Methods for Rare Earth Waste Residue and Wastewater". GB/T 34500 has already published the following... part.

1.Determination of Fluoride Ion Content using Ion-Selective Electrode Method;

2.Determination of Chemical Oxygen Demand (COD);

3.Determination of weak radioactivity (total alpha and beta activity);

4.Determination of the content of copper, zinc, lead, chromium, cadmium, barium, cobalt, manganese, nickel, and titanium by inductively coupled plasma atomic emission spectrometry;

5.Determination of Ammonia Nitrogen Content;

7.Determination of Thorium and Uranium Content by Inductively Coupled Plasma Mass Spectrometry Please note that some content in this document may involve patents. The issuing organization of this document assumes no responsibility for identifying patents. This document was proposed and is under the jurisdiction of the National Rare Earth Standardization Technical Committee (SAC/TC229). This document was drafted by: Jiangxi Provincial Tungsten and Rare Earth Products Quality Supervision and Inspection Center (Jiangxi Provincial Tungsten and Rare Earth Research Institute) and Qiandong Rare Earth

Group. Joint-stock company, Baotou Rare Earth Research Institute, Fujian Jinlong Rare Earth Co., Ltd., Jiangyin Jiahua New Material Resources Co., Ltd., Hunan Rare Earth Earth Metal Materials Research Institute Co., Ltd., and Sichuan Leshan Ruifeng Metallurgy Co., Ltd. The main drafters of this document are. Sun Na, Yang Xianggeng, Xu Na, Wang Fang, Wen Bin, Liu Chun, Chen Yan, Yu Yahui, Wang Baohua, Zhao Pinghong, and Huang Xiaori. Su Tingting and Jiang Yuan.

Rare earth waste residue and wastewater mainly refer to various waste materials generated in the entire process of rare earth mineral resource development and utilization, covering rare earth mining. Waste residue and wastewater discharged from various processes, including ore beneficiation and processing, metal smelting and refining, and subsequent deep processing. This document focuses on... The focus is on heavy metals and other potentially harmful substances contained in the leachate and wastewater of waste residue that may pose a threat to environmental quality and human health. To identify harmful components, research is being conducted on standard testing methods. GB/T 34500, "Chemical Analysis Methods for Rare Earth Waste Residue and Wastewater," has established a set of scientific methods through systematic experimental research and extensive practical verification. Learn a complete, practical, and environmentally friendly technical methodology and standard system to guide enterprises in implementing these systems during the development and utilization of rare earth resources. The concepts of energy conservation, emission reduction, and environmental protection provide standardized technical guidance for related industries. GB/T 34500 is proposed to consist of 7 parts.

1.Determination of Fluoride Ion Content using Ion-Selective Electrode Method. The purpose is to describe the ion-selective electrode method for determining the concentration of fluoride ions in rare earth waste residue. Fluoride ion content in wastewater.

2.Determination of Chemical Oxygen Demand (COD). The purpose is to describe the potassium dichromate titration method and chlorine correction method for the determination of rare earth elements. Chemical oxygen demand (COD) in waste residue and wastewater.

3.Determination of Weak Radioactivity (Total alpha and beta Activity). The purpose is to describe the determination of weak radioactivity in rare earth waste residue and wastewater. The method for (total alpha and beta activities).

4.Determination of the amounts of copper, zinc, lead, chromium, cadmium, barium, cobalt, manganese, nickel and titanium by inductively coupled plasma atomic emission spectrometry. The purpose is to describe the determination of copper, zinc, lead, chromium, cadmium, and other minerals in rare earth waste residues and wastewater using inductively coupled plasma atomic emission spectrometry. Content of barium, cobalt, manganese, nickel, and titanium.

5.Determination of Ammonia Nitrogen. The purpose is to describe the Nessler's reagent spectrophotometric method, the salicylic acid spectrophotometric method, and the distillation-neutralization method. The ammonia nitrogen content in rare earth waste residue and wastewater was determined by titration.

5.8 Extraction agent. Transfer

0.46 mL of sulfuric acid and nitric acid mixture (5.7) into 2 L of water, stir well, and the pH of the solution is 3.20 ± 0.05.

5.9 Thorium standard solution (rho=1000μg/mL), certified standard solution.

5.10 Uranium standard solution (rho=1000μg/mL), certified standard solution.

5.11 Rhodium Standard Stock Solution. Accurately weigh 0.3593 g of ammonium chlororhodium (w>=) that has been dried at 110 °C and cooled to room temperature in a desiccator. 99.99%), placed in a 100mL beaker, added 20mL hydrochloric acid (5.6), covered with a watch glass, dissolved at low temperature, cooled to room temperature, and transferred to a 100mL... Dilute to the mark with water in a volumetric flask and mix well. 1 mL of this solution contains 1 mg of rhodium.

5.12 Cesium Standard Stock Solution. Accurately weigh 0.1267 g of cesium chloride, dried at 110 °C and cooled to room temperature in a desiccator, and place it in a container... Add 10 mL of nitric acid (5.2) to a 100 mL beaker, cover with a watch glass, heat at a low temperature until completely dissolved, cool to room temperature, and transfer to a 100 mL container. Dilute to the mark with water in a volumetric flask and mix well. 1 mL of this solution contains 1 mg of cesium.

5.13 Rhenium Standard Stock Solution. Weigh 0.1000 g of metallic rhenium (w >= 99.99%), place it in a 100 mL beaker, and add 3 mL of hydrochloric acid. (5.6) 1 mL of nitric acid (5.2), cover with a watch glass, heat at low temperature until completely dissolved, cool to room temperature, transfer to a 100 mL volumetric flask, add 10 mL of nitric acid. Hydrochloric acid (5.6), diluted with water to the mark, and mixed well. 1 mL of this solution contains 1 mg of rhenium.

5.14 Bismuth Standard Stock Solution. Weigh 0.1000 g of metallic bismuth (w >= 99.99%), place it in a 250 mL beaker, and add 50 mL of nitric acid. (5.2) Cover with a watch glass, heat at low temperature until completely dissolved, boil to remove nitrogen oxides, and cool to room temperature. Transfer to a 100 mL volumetric flask with nitric acid (5.3). Dilute the solution in a volumetric flask to the mark with water and mix well. 1 mL of this solution contains 1 mg of bismuth.

5.15 Indium Standard Stock Solution. Accurately weigh 0.1000 g of metallic indium (w >= 99.99%), place it in a 100 mL beaker, and add 10 mL of salt. The acid (5.6) was heated at low temperature until completely dissolved, cooled to room temperature, transferred to a 100 mL volumetric flask, diluted to the mark with water, and mixed well. 1m contains 1mg of indium.

5.16 Mixed Standard Solution A. Transfer

1.00 mL each of the thorium standard solution (5.9) and the uranium standard solution (5.10) into a 100 mL volumetric flask. Add 5 mL of nitric acid (5.1) to the solution, dilute to the mark with water, and mix well. Transfer

10.00 mL of this solution to a 100 mL volumetric flask and add... Dilute 5 mL of nitric acid (5.1) to the mark with water and mix well. 1 mL of this solution contains 1 μg of thorium and uranium, respectively.

5.17 Mixed Standard Solution B. Transfer

10.00 mL of mixed standard solution A (5.16) into a 100 mL volumetric flask, add 5 mL of nitric acid. (5.1) Dilute with water to the mark and mix well. 1 mL of this solution contains 100 ng of thorium and uranium respectively.

5.18 Mixed internal standard solution. Transfer rhodium standard stock solution (5.11), cesium standard stock solution (5.12), and rhenium standard stock solution separately. (5.13)

1.00 mL each of bismuth standard stock solution (5.14) and indium standard stock solution (5.15) are placed in a 100 mL volumetric flask, and 5 mL of nitrate is added. Acid (5.1), diluted to the mark with water and mixed well. 1 mL of this solution contains 10 μg each of rhodium, cesium, rhenium, bismuth, and indium.

6 Instruments and Equipment

6.1 The inductively coupled plasma mass spectrometer, under optimal operating conditions, shall achieve the following specifications.

---Calibration items and technical specifications for quadrupole plasma mass spectrometers that meet the requirements of JJF1159;

---The recommended analytical mass numbers for the elements to be determined are shown in Table 1.

6.2 pH meter. pH measurement accuracy of 0.05, or an instrument or device with equivalent function.

6.3 Extraction bottle. Glass bottle or polyethylene (PE) bottle, 2L volume.

6.4 Flip-type oscillator. speed adjustable, speed accuracy 2 r/min.

7 Samples