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**NONFERROUS METALS INDUSTRY STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

YS/T 461.12-2016

**Methods for chemical analysis of lead and zinc bulk concentrates--Part 12:
Determination of thallium content--Inductively coupled plasma mass
spectrometry and inductively coupled plasma atomic emission spectrometry**

混合铅锌精矿化学分析方法 第12部分：铊量的测定 电感耦合等离子体质谱法和
电感耦合等离子体原子发射光谱法

(English Translation)

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Foreword

YS/T 461 "mixed lead and zinc concentrate chemical analysis method" is divided into 12 parts.

- Part 1. Determination of lead content and zinc content - Separation of Na₂EDTA titration;
- Part 2. Determination of iron content - Na₂EDTA titration;
- Part 3. Determination of sulfur content - Combustion - neutralization titration;
- Part 4. Determination of arsenic iodine titration;
- Part 5. Determination of the amount of silica - Molybdenum blue spectrophotometric method;
- Part 6. Determination of mercury content - Atomic fluorescence spectrometry;
- Part 7. Determination of cadmium content - Flame atomic absorption spectrometric method;
- Part 8. Determination of copper content - Flame atomic absorption spectrometric method;
- Part 9. Determination of silver content - Flame atomic absorption spectrometric method;
- Part 10. Determination of gold and silver;
- Part 11. Determination of arsenic, bismuth, cadmium, cobalt, copper, nickel and antimony - Inductively coupled plasma - atomic emission spectrometry;

Part 12. Determination of thallium content - Inductively coupled plasma mass spectrometry and inductively coupled plasma atomic emission spectrometry.

This part is part 12 of YS/T 461.

This part is drafted in accordance with the rules given in GB/T 1.1-2009.

This part of the National Nonferrous Metals Standardization Technical Committee (SAC/TC243) proposed and centralized.

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Chemical Analysis of Mixed Lead - Zinc Concentrate Part 12. determination of thallium content Inductively coupled plasma mass spectrometry and inductively coupled plasma atomic emission spectrometry

1 Scope

This part of YS/T 461 specifies the method for the determination of thallium in mixed lead-zinc concentrates.

This part is applicable to the determination of thallium in mixed lead and zinc concentrates. Method 1 has a measurement range of 0.000050% to 0.010%; Method 2 is measured the range is 0.0050% ~ 0.10%. Section 1 Scope Cross Section Method 1 is an arbitration method.

2.1 Method Summary

The samples were decomposed by hydrochloric acid, nitric acid and sulfuric acid. The samples were measured on an inductively coupled plasma mass spectrometer with 193Ir as internal standard.

Calculate the amount of thallium in the sample.

2.2 Reagents

In the analysis only use identified as excellent grade pure reagent, the water used as a water.

2.2.1

Hydrochloric acid ($\rho=1.19\text{g/mL}$).

2.2.2

nitric acid ($\rho=1.42\text{g/mL}$).

2.2.3

sulfuric acid ($\rho=1.84\text{g/mL}$).

2.2.4

nitric acid (1 1).

2.2.5

nitric acid sulfuric acid mixed acid (1 1). 500mL nitric acid (2.2.2) while stirring 500mL sulfuric acid (2.2.3), after cooling use.

2.2.6

Thallium standard storage solution. Weigh 0.2795g thallium oxide ($w_{\text{Tl}_2\text{O}_3} > 99.99\%$) placed in 200mL beaker, cover dish, Slowly add 25mL nitric acid (2.2.4) dissolved at low temperature, drive out the nitrogen oxide, remove and cool to room temperature, wash the dish and cup wall with water, 250mL volumetric flask, diluted with water to the mark, mix. This solution 1mL containing 1mg thallium.

2.2.6.1

Thallium standard solution A. Thallium standard storage solution (2.2.6) diluted to thallium concentration of 100ng/mL, 2% nitric acid as the medium.

2.2.6.2

thallium standard solution B. thallium standard solution A diluted to thallium concentration of 10ng/mL, 2% nitric acid as the medium.

2.2.7

internal standard solution. 10 $\mu\text{g/L}$ ^{193}Ir solution, with 2% nitric acid as the medium.

2.2.8

argon. $w_{\text{Ar}} \geq 99.996\%$.

2.3 Instruments

Inductively coupled plasma mass spectrometer. resolution 0.1amu ~ 1amu; 205Tl isotope response value > 105.

2.4 Sample

2.4.1

Specimens shall pass through 0.074mm sieve.