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YS/T 820.10-2012

Methods for chemical analysis of laterite nickel ores - Part 10: Determination of calcium, cobalt, copper, magnesium, manganese, nickel, phosphate and zinc content - Inductively coupled plasma atomic emission spectrometry

红土镍矿化学分析方法

第 10 部分：钙、钴、铜、镁、锰、镍、磷和锌量的测定

电感耦合等离子体-原子发射光谱法

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Foreword

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

YS/T 820-2012 “Methods for chemical analysis of laterite nickel ores” is divided into 26 parts:

- Part 1: Determination of nickel content - Flame atomic absorption spectrometry;
- Part 2: Determination of nickel content - Dimetylglyoxime spectrophotometry;
- Part 3: Determination of total iron content - Potassium dichromate titration;
- Part 4: Determination of phosphorus content - Phosphorus molybdenum blue spectrophotometry;
- Part 5: Determination of cobalt content - Flame atomic absorption spectrometry;
- Part 6: Determination of copper content - Flame atomic absorption spectrometry;
- Part 7: Determination of calcium and magnesium content - Flame atomic absorption spectrometry;
- Part 8: Determination of silica content - Potassium silicafluoride titrimetric method;
- Part 9: Determination of scandium and cadmium contents - Inductively coupled plasma mass spectrometry;
- Part 10: Determination of calcium, cobalt, copper, magnesium, manganese, nickel, phosphate and zinc content - Inductively coupled plasma atomic emission spectrometry;
- Part 11: Determination of fluorine and chlorine contents - Ion chromatography;
- Part 12: Determination of manganese content - Flame atomic absorption spectrometry;
- Part 13: Determination of lead content - Flame atomic absorption spectrometry;
- Part 14: Determination of the zinc content - Flame atomic absorption spectrometry;

Methods for chemical analysis of laterite nickel ores - Part 10: Determination of calcium, cobalt, copper, magnesium, manganese, nickel, phosphate and zinc content - Inductively coupled plasma atomic emission spectrometry

1 Scope

This part of YS/T 820 specifies the method for determining calcium, cobalt, copper, magnesium, manganese, nickel, phosphate and zinc content in laterite nickel ores.

This part applies to the simultaneous determination of calcium, cobalt, copper, magnesium, manganese, nickel, phosphorus and zinc contents in laterite nickel ores. The range of determination is as shown in Table 1.

Table 1 -- Range of determination (mass fraction)

Element	Range of determination / %
Ca	0.020~0.30
Co	0.010~0.20
Cu	0.003~0.030
Mg	0.40~6.00
Mn	0.20~1.50
Ni	0.30~2.00
P	0.003~0.030
Zn	0.010~0.060

2 Normative references

The following documents are essential to the application of this document. For the dated documents, only the versions with the dates indicated are applicable to this document; for the undated documents, only the latest version (including all the amendments) are applicable to this standard.

YS/T 820.24-2012 Methods for chemical analysis of laterite nickel ores - Part 24: Determination hygroscopic moisture content - Gravimetric method

99.95%); PLACE it in a 300 mL beaker; COVER the watch glass; slowly ADD 40 mL of nitric acid (4.4) to dissolve it at low temperature; DRIVE out the nitrogen oxide; REMOVE and COOL it to room temperature; USE water to rinse the watch glass and beaker's wall; TRANSFER it into a 1000 mL volumetric flask; USE water to dilute it to the mark; MIX it uniformly. 1 mL of this solution contains 0.2 mg of copper.

4.10 Magnesium standard stock solution: WEIGH 0.8290 g of magnesium oxide (w_{MgO} ≥ 99.99%, which is burnt in advance at 800 °C ± 50 °C to constant weight and cooled in a desiccator to room temperature); PLACE it in a 300 mL beaker; COVER the watch glass; slowly ADD 30 mL of hydrochloric acid (4.2); DISSOLVE it at low temperature; REMOVE and COOL it to room temperature; USE water to rinse the watch glass and beaker's wall; TRANSFER it into a 1000 mL volumetric flask; USE water to dilute it to the mark; MIX it uniformly. 1 mL of this solution contains 0.5 mg of magnesium.

4.11 Manganese standard stock solution: WEIGH 1.0000 g of metal manganese (w_{Mn} ≥ 99.95%); PLACE it in a 300 mL beaker; COVER the watch glass; slowly ADD 40 mL of nitric acid (4.4) to dissolve it at low temperature; DRIVE out the nitrogen oxide; REMOVE and COOL it to room temperature; USE water to rinse the watch glass and beaker's wall; TRANSFER it into a 1000 mL volumetric flask; USE water to dilute it to the mark; MIX it uniformly. 1 mL of this solution contains 1 mg of manganese.

4.12 Nickel standard stock solution: WEIGH 1.0000 g of metallic nickel (w_{Ni} ≥ 99.95%); PLACE it in a 300 mL beaker; COVER the watch glass; slowly ADD 40 mL of nitric acid (4.4) to dissolve it at low temperature; DRIVE out the nitrogen oxide; REMOVE and COOL it to room temperature; USE water to rinse the watch glass and beaker's wall; TRANSFER it into a 1000 mL volumetric flask; USE water to dilute it to the mark; MIX it uniformly. 1 mL of this solution contains 1 mg of nickel.

4.13 Phosphorus standard stock solution: WEIGH 0.4390 g of potassium dihydrogen phosphate (reference reagent); DISSOLVE it in water; TRANSFER it into a 1000 mL volumetric flask; USE water to dilute it to the mark; MIX it uniformly. 1 mL of this solution contains 0.1 mg of phosphorus.

4.14 Zinc standard stock solution: WEIGH 0.6224 g of zinc oxide (w_{ZnO} ≥ 99.95%, which is burnt in advance at 800 °C ± 50 °C to constant weight and cooled in a desiccator to room temperature); PLACE it in a 300 mL beaker; USE a small amount of water to wet it; COVER the watch glass; slowly ADD 30 mL of hydrochloric acid (4.2); DISSOLVE it at low temperature; REMOVE and COOL it to room temperature; USE water to rinse the watch glass and beaker's wall; TRANSFER it into a 1000 mL volumetric flask; USE water to dilute it to the mark; MIX it uniformly. 1 mL of this solution contains 0.5 mg of zinc.

ADD 20 mL of hydrochloric acid (4.1) to dissolve it at low temperature; then ADD 10 mL of nitric acid (4.3), 10 mL of hydrofluoric acid (4.5), 5 mL of perchloric acid (4.6); HEAT to decompose it until the white smoke is exhausted; TAKE it off and slightly COOL it; ADD 10 mL of hydrochloric acid (4.1); USE water to rinse the beaker's wall; HEAT to dissolve the salt; REMOVE and COOL it; USE water to rinse the beaker's wall; BOIL to dissolve it; USE the medium-speed filter paper to filter it into a 100 mL volumetric flask; USE water to dilute it to the mark; MIX it uniformly.

7.4.2 Respectively, TAKE the test solution (7.4.1) according to Table 3; PLACE it in a 100 mL volumetric flask; ADD 5 mL of hydrochloric acid (4.1); USE water to dilute it to the mark; MIX it uniformly.

Table 3 -- Volume of test solution taken

Mass fraction of determined element / %	Volume of test solution taken / mL
0.003 ~ 0.25	-
> 0.25 ~ 1.00	20.00
> 1.00	5.00

7.4.3 PLACE the test solution (7.4.1), (7.4.2) on the inductively coupled plasma spectrometer; DETERMINE the intensity of emitted light of the test solution and the accompanied blank solution (7.3). The instrument calculates the mass fraction of the determined element in accordance with the working curve.

7.5 Drawing of the working curve

On the inductively coupled plasma-atomic emission spectrometer, USE the series standard blank solution (4.17), mixed standard solution B (4.16), mixed standard solution A (4.15) to determine the intensity of emitted light of calcium, cobalt, copper, magnesium, manganese, nickel and phosphorus, zinc. Respectively USE the mass fraction of the determined elements as the abscissa, the intensity of emitted light as the ordinate, the instrument automatically draws the working curve.

8 Calculation of analytical results

The amount of the determined element is calculated by the mass fraction w_x of the determined element, the value is expressed in %, which is calculated according to formula (1) and formula (2):

$$w_x = \frac{(\rho_x - \rho_0) \times V \cdot V_2 \times 10^{-6}}{m \cdot V_1} \times 100 \times K \quad \cdots\cdots (1)$$

$$K = \frac{100}{100 - A} \quad \cdots\cdots (2)$$

Where:

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