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

YS/T 928.3-2013

**Methods for chemical analysis of nickel cobalt manganese composite
hydrogenoxide. Part 3: Determination of nickel, cobalt, manganese
content. Inductively coupled plasma atomic emission spectrometric**

**镍、钴、锰三元素氢氧化物化学分析方法 第3部分：镍、钴、锰量的测定电感耦
合等离子体原子发射光谱法**

(English Translation)

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Foreword

YS/T 928 Methods for Chemical Analysis of Nickel Cobalt Manganese Composite

Hydrogenoxide includes the following six parts.

---Part 1.Determination of Chloride Ion Contents - Silver Chloride Turbidimetry;

---Part 2.Determination of Nickel Contents - Dimethylglyoxime Gravimetric;

---Part 3.Determination of Nickel, Cobalt, Manganese Content - Inductively Coupled Plasma Atomic Emission Spectrometric;

---Part 4.Determination of Iron, Calcium, Magnesium, Copper, Zinc, Silicon, Aluminum, Sodium Contents - Inductively Coupled Plasma Atomic Emission Spectrometric;

---Part 5.Determination of Lead Contents - Inductively Coupled Plasma Mass Spectrometry;

---Part 6.Determination of Sulfate Ion Contents - Ion Chromatography.

This is Part 3 of YS/T 928.

This Part was drafted in accordance with the rules provided in GB/T 1.1-2009.

This Standard shall be under the jurisdiction of National Technical Committee 243 on Nonferrous Metals of Standardization Administration of China (SAC/TC 243).

The responsible drafting organizations of this Standard. Jinchuan Group Co., Ltd.; Foshan

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The drafting organizations of this Part. Jinchuan Group Co., Ltd.; Foshan BRUNP Recycling Technology Co., Ltd.

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Ltd.; Tianjin Maolian Technology Co., Ltd.

1 Scope

This Part of YS/T 928 specifies the method for the determination of nickel, cobalt and manganese content in nickel cobalt manganese composite hydrogenoxide.

This Part is applicable to the determination of nickel, cobalt and manganese content in nickel

cobalt manganese composite hydrogenoxide. See Table 1 for the determination scope.

Table 1 -- Determination Scope

2 Method Summary

Use hydrochloric acid to dissolve the test portion, use yttrium as the internal standard, and adopt

an inductively coupled plasma atomic emission spectrometer to determine the elements to be

analyzed.

3 Reagents

Unless it is otherwise stated, only reagents confirmed to be analytically pure and pure water

with an electrical resistivity of not less than 18.2 Mohm - cm shall be used in the analysis.

3.4 Nitric acid (1 + 1).

Element Determination Scope/%

3.7 Nickel standard stock solution. weigh-take 2.0000 g of pure nickel ($w_{Ni} \geq 99.99\%$) in a 300

mL beaker, add 40 mL of hydrochloric acid (3.1) and 5 mL of nitric acid (3.2); heat to dissolve

it. Boil to remove nitrogen oxides, remove and cool it, then, use water to wash the watch glass

and beaker wall. Transfer to a 500 mL volumetric flask, use water to dilute to the scale and mix

it well. 1 mL of this solution contains 4 mg of nickel.

3.10 Nickel cobalt manganese standard solution 955.accurately transfer-take 15.00 mL, 20.00

mL and 30.00 mL of nickel standard stock solution (3.7), and 2.00 mL, 3.00 mL and 5.00 mL

of cobalt standard stock solution (3.8) and manganese standard stock solution (3.9) in a group

of 200 mL volumetric flasks. Respectively add 2.00 mL of yttrium internal standard solution A

(3.5), use water to dilute to the scale and mix it well.

3.11 Nickel cobalt manganese standard solution 811.accurately transfer-take 15.00 mL, 20.00

mL and 25.00 mL of nickel standard stock solution (3.7), and 5.00 mL, 7.00 mL and 10.00 mL

of cobalt standard stock solution (3.8) and manganese standard stock solution (3.9) in a group

of 200 mL volumetric flasks. Respectively add 2.00 mL of yttrium internal standard solution A

(3.5), use water to dilute to the scale and mix it well.

3.12 Nickel cobalt manganese standard solution 523.accurately transfer-take 10.00 mL, 15.00

mL and 18.00 mL of nickel standard stock solution (3.7), and 10.00 mL, 12.00 mL and 15.00

mL of cobalt standard stock solution (3.8), and 10.00 mL, 15.00 mL and 20.00 mL of manganese

standard stock solution (3.9) in a group of 200 mL volumetric flasks. Respectively add 2.00 mL

of yttrium internal standard solution A (3.5), use water to dilute to the scale and mix it well.

3.13 Nickel cobalt manganese standard solution 424.accurately transfer-take 10.00 mL, 12.00

mL and 15.00 mL of nickel standard stock solution (3.7) and cobalt standard stock solution (3.8), and 15.00 mL, 25.00 mL and 30.00 mL of manganese standard stock solution (3.9) in a

group of 200 mL volumetric flasks. Respectively add 2.00 mL of yttrium internal standard solution A (3.5), use water to dilute to the scale and mix it well.

4 Instrument

The working parameters of the inductively coupled plasma atomic emission spectrometer are

shown in Table 2.

5.1 Test Portion

Weigh-take two portions of 0.20 g of specimen, accurate to 0.0001 g.

5.2 Blank Test

Along with the specimen, conduct the blank test.

5.3 Treatment of Test Portion

Place the test portion (5.1) in a 300 mL beaker, add 20 mL of hydrochloric acid (3.3), use a watch glass to cover it; completely dissolve it at low temperature. Remove and cool it, then, use water to wash the watch glass and beaker wall.

5.4 Drawing of Working Curve

On the ICP optical spectrometer, in accordance with the condition parameters provided in Table