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

YS/T 1006.1-2014

**Methods for chemical analysis of lithium nickel cobalt
manganese oxide. Part 1: Determination the total of nickel
cobalt manganese content. EDTA disodium salt titration**

(English Translation)

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1 Scope

This Part of YS/T 1006 specifies the method for the determination of the total content of nickel, cobalt and manganese in lithium nickel cobalt manganese oxide, which is the cathode material for lithium ion batteries.

This Part is applicable to the determination of the total content of nickel, cobalt and manganese in lithium nickel cobalt manganese oxide, which is the cathode material for lithium ion batteries. The range of determination is 57.00% ~ 61.00%.

2 Method Summary

Use hydrochloric acid to dissolve the specimen. In an alkaline solution with a pH value of 9 ~ 10, use murexide as an indicator; use EDTA standard titration solution to titrate it, until it turns fuchsia. In accordance with the volume of the consumed EDTA standard titration solution, calculate the total content of nickel, cobalt and manganese.

3 Reagents

Unless it is otherwise specified, only reagents that are confirmed to be analytically pure, and Grade-2 (and above) water are used in the analysis.

3.1

Murexide indicator

Take 0.4 g of murexide; add 50 g of potassium sulfate; in a mortar, thoroughly grind it into fine powder.

3.2

Hydrochloric acid (1 + 1).

3.3 Ammonia water-ammonium chloride buffer solution, pH value 9 ~ 10: weigh-take

54.5 g of ammonium chloride and dissolve it in water; add 200 mL of concentrated ammonia water; use water to dilute to 1,000 mL, then, mix it up.

3.4 Cobalt standard solution: weigh-take 1.0000 g of metallic cobalt (mass fraction $\geq$

99.99%) in a 400 mL beaker; add 50 mL of hydrochloric acid (3.2). After dissolving it at a low temperature, transfer it to a 1,000 mL volumetric flask; use water to dilute to the scale; mix it up. 1 mL of this solution contains 1.0 mg of cobalt.

Weigh-take 0.10 g of specimen, accurate to 0.0001 g.

5.2 Number of Determinations

Independently conduct two determinations; take the average value.

5.3 Blank Test

Conduct a blank test on the accompanying specimen.

5.4 Determination

5.4.1

Place the specimen (5.1) into a 100 mL beaker; add 25 mL of hydrochloric acid (3.2); heat it on a low-temperature electric hot plate, until it is completely dissolved.

After it cools down, transfer it into a 100 mL volumetric flask. Add water to dilute to the scale; mix it up.

5.4.2

Transfer-take 25.00 mL of test solution in a 250 mL Erlenmeyer flask. Add about 50 mL of water; add 10 mL of the buffer solution (3.3) and about 0.1 g of the indicator (3.1); use EDTA standard titration solution (3.5) to titrate it, until it turns fuchsia.

6 Calculation of Analysis Result

In accordance with Formula (2), calculate the mass fraction $w(\text{Ni} + \text{Co} + \text{Mn})$ of the total content of nickel, cobalt and manganese, expressed in (%):

Where, c ---the actual concentration of the EDTA standard titration solution, expressed in (mol/L);

V_2 ---the volume of the EDTA standard titration solution consumed in the titration of the test solution, expressed in (mL);

V_0 ---the volume of the EDTA standard titration solution consumed in the titration of the blank test solution, expressed in (mL);

M ---the average molar mass of nickel, cobalt and manganese, expressed in (g/mol);

V_4 ---the dilution volume of test solution, expressed in (mL);

m ---the mass of the specimen, expressed in (g);

V_3 ---the volume of divided test solution, expressed in (mL).

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