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

**YS/T 281.17-2011**

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**Methods for chemical analysis of cobalt. Part 17: Determination of aluminum, manganese, nickel, copper zinc, cadmium, tin, antimony, lead and bismuth content. Inductively coupled plasma mass spectrometry**

钴化学分析方法 第17部分：铝、锰、镍、铜、锌、镉、锡、锑、铅、铋量的测定  
电感耦合等离子体质谱法

**(English Translation)**

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### Foreword

YS/T 281 "cobalt chemical analysis method" is divided into the following 20 parts.

Part 1. Determination of iron content - Sulfosalicylic acid spectrophotometric method Part 2. Determination of aluminum content - Chromazu S spectrophotometric method Part 3. Determination of silicon content - Molybdenum blue spectrophotometric method Part 4. Determination of arsenic content - Molybdenum blue spectrophotometric method - Part 5. Determination of phosphorus content - Molybdenum blue spectrophotometric method Part 6. Determination of magnesium content - Flame atomic absorption spectrometric method - Part 7. Determination of zinc content - Flame atomic absorption spectrometric method Part 8. Determination of cadmium content - Flame atomic absorption spectrometric method Part 9. Determination of lead content - Flame atomic absorption spectrometric method Part 10. Determination of nickel content - Flame atomic absorption spectrometric method - Part 11. Determination of copper and manganese - Flame atomic absorption spectrometric method - Part 12. Determination of arsenic, antimony, bismuth, tin and lead - Electrothermal atomic absorption spectrometry - Part 13. Determination of sulfur content - High frequency induction furnace combustion infrared absorption method - Part 14. Determination of carbon content - High frequency induction furnace combustion infrared absorption method - Part 15. Determination of arsenic, antimony and bismuth - Hydride generation - atomic fluorescence spectrometry - Part 16. Determination of the amount of arsenic, cadmium, copper, zinc, lead, bismuth, tin, antimony, silicon, manganese, iron, nickel, aluminum and magnesium.

#### Spectrum method

- Part 17. Determination of aluminum, manganese, nickel, copper, zinc, cadmium, tin, antimony, lead and bismuth inductively coupled plasma mass spectrometry - Part 18. Determination of sodium content - Flame atomic absorption spectrometric method - Part 19. Determination of calcium, magnesium, manganese, iron, cadmium and zinc - Inductively coupled plasma emission spectrometric method - Part 20. Determination of the amount of oxygen - Infrared absorption method this part is part 17 of YS/T 281.

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.

This standard is responsible for drafting units. Jinchuan Group Co., Ltd., Beijing Mining and Metallurgy Research Institute.

This part is responsible for drafting units. Beijing Mining and Metallurgy Research Institute.

This part participates in the drafting unit. Beijing Nonferrous Metals Research Institute, Jinchuan Group Co., Ltd.

## 1 Scope

This part of YS/T 281 specifies the determination method for the content of aluminum, manganese, nickel, copper, zinc, cadmium, tin, antimony, lead and bismuth in cobalt.

This part is applicable to the determination of aluminum, manganese, nickel, copper, zinc, cadmium, tin, antimony, lead and bismuth in cobalt. Measuring range. 0.0001% ~ 0.005%.

## 2 Method summary

The samples were dissolved in nitric acid and measured in a dilute nitric acid medium by ICP-MS-standard addition and on-line addition of scandium, rhodium and rhenium Cobalt, zinc, cadmium, tin, antimony, lead, bismuth 10 kinds of elements.

## 3 Reagent

The resistivity of the preparation solution and the analytical water is  $> 18 \text{ Mohm} \cdot \text{cm}$ . The containers used in the experiments were thoroughly soaked with nitric acid (19) and thoroughly washed with water Cleaning.

### 3.1

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

### 3.2

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

### 3.3

nitric acid (1 1).

### 3.4

Hydrochloric acid (1 1).

### 3.5

Hydrochloric acid (1 4).

### 3.6

nitric acid (19).

### 3.7

aluminum standard storage solution. Weigh 1.0000g metal aluminum ( $w_{Al} \geq 99.99\%$ ), placed in a 300mL beaker, add 20mL hydrochloric acid (3.2), drop 1mL ~ 2mL nitric acid (3.1), dissolve at low temperature, into 1000mL volumetric flask, add 80mL hydrochloric acid (3.2) with water Constant volume, mix. 1 mL of this solution contains 1 mg of aluminum.

### 3.8

Manganese standard storage solution. Weigh 1.0000 g of metal manganese ( $w_{Mn} \geq 99.95\%$ ), placed in 150mL beaker, add 150mL of nitrate Acid (3.6), heat dissolved, cooled, into the 1000mL volumetric flask, the water volume, mixing. 1 mL of this solution contains 1 mg of manganese.

### 3.9

copper standard storage solution. Weigh 1.0000g metal copper ( $w_{Cu} \geq 99.99\%$ ), placed in a 300mL beaker, add 10mL nitric acid (3.6), dissolved in low temperature, heated to remove nitrogen oxides, remove the cooling, into the 1000mL volumetric flask, add 100mL nitric acid (3.6), Water volume, mix. 1 mL of this solution contains 1 mg of copper.

### 3.10

nickel standard storage solution. Weigh 1.0000g metal nickel ( $w_{Ni} \geq 99.99\%$ ), placed in a 300mL beaker, add 10mL nitric acid (3.6), dissolved in low temperature, heated to remove nitrogen oxides, remove the cooling, into the 1000mL volumetric flask, add 100mL nitric acid (3.6), Water volume, mix. This solution 1mL containing 1mg nickel.