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| ICS 77.160H 71 | **YS** |

**Nonferrous Metals Industry Standard of the People's Republic of China**

YS/T 1377—2020

**Nickel-cobalt-aluminum composite oxide**

镍钴铝三元素复合氧化物

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Foreword

SAC/TC 243 is in charge of this English translation. In case of any doubt about the contents of English translation, the Chinese original shall be considered authoritative.

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

This standard is proposed and prepared by SAC/TC 243 (National Technical Committee 243 on Nonferrous Metals of Standardization Administration of China)

Nickel cobalt aluminum composite oxide

1 Scope

This standard specifies the technical requirements, test methods, inspection rules, label, packaging, transportation, storage, certificate of quality and order (or contract) content of nickel cobalt aluminum composite oxide.

This standard is applicable to nickel cobalt aluminum composite oxide product.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 1479.1 *Metallic powders--Determination of apparent density—Part 1：Funnal method*

GB/T 5162 *Metallic powders-Determination of tap density*

GB/T 5314 *Powders for powder metallurgical purposes--Sampling*

GB/T 6284 *Chemical products for industrial use--General method for determination of water content--The loss of mass on drying method*

GB/T 19077 *Particle size analysis-- Laser diffraction methods*

GB/T 19587 *Determination of the specific surface area of solids by gas adsorption using the BET method*

GB/T 20252--2014 *Lithium cobalt oxide*

GB/T 24533--2019 *Graphite negative electrode materials for lithium ion battery*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in GB/T 20252-2014 apply.

4 Technical requirements

4.1 Chemical composition

The chemical composition of the product shall meet the requirements of Table 1.

Table 1-Chemical composition

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| --- |
| Chemical composition(mass fraction)，% |
| Main elements | Impurities elements，not greater than |
| Ni | Co | Al | Cu  | Fe | Zn | Ca | Mg | Na | Mn | S | Cl- |
| 60.0～78.0 | 0.5～13.0 | 0.3～2.0 | 0.005 | 0.005 | 0.005 | 0.010 | 0.005 | 0.020 | 0.001 | 0.100 | 0.003 |

4.2 Moisture content

The moisture content of the product shall be no more than 0.6 %.

4.3 Magnetic Impurities content

The magnetic impurities content of the product shall be no more than 0.00001 %.

4.4 Physical properties

4.4.1 Apparent density

The apparent density of the product shall be no less than 0.7 g/cm3.

4.4.2 Tap density

The tap density of the product shall be no less than 1.0 g/cm3.

4.4.3 Particle size distribution

The particle size distribution of the product is normally distributed, and the required range of characteristic values is as follows:

*D10* shall be no less than 0.5 μm; *D50* shall be in the range of form 2.0 μm to 22.0 μm; *D90* shall be no more than 48.0 μm.

4.4.4 Specific surface area

The specific surface area of the product shall be no more than 45 m2/g.

4.4.5 Microstructure

The Microstructure of the product shall be spherical or spheroidal

4.5 Appearance quality

The appearance of the product shall be uniform in color, free of lumps and sundries.

4.6 Other requirements

The buyer may negotiate with the supplier if the buyer has special requirements.

5 Test methods

5.1 Chemical composition

The determination of the chemical composition shall be carried out according to the methods agreed by both the supplier and buyer.

5.2 Moisture content

The determination of the moisture content shall be carried out according to GB/T 6284.

5.3 Magnetic impurities content

The determination of the magnetic impurities content shall be carried out according to the provisions in Annex K of GB/T 24533-2019.

5.4 Physical properties

5.4.1 Apparent density

The determination of apparent density shall be carried out according to GB/T 1479.1.

5.4.2 Tap density

The determination of tap density shall be carried out according to GB/T 5162.

5.4.3 Particle size distribution

The determination of the particle size distribution shall be carried out according to GB/T 19077.

5.4.4 Specific surface area

The determination of the specific surface area shall be carried out according to GB/T 19587.

5.4.5 Microstructure

The determination of Microstructure shall be carried out by scanning electron microscope.

5.5 Appearance quality

The appearance quality shall be inspected visually.

6 Inspection rules

6.1 Inspection and acceptance

6.1.1 The supplier shall inspect the product and fill in the quality certificate to ensure that the quality of the product is in accordance with this document and the order (or contract ).

6.1.2 The received product shall be inspected by the buyer according to this document, and the supplier shall be notified within 3 months after receiving the product, in the case that the inspection results do not meet the requirements of this document or the contract (or order). The discordance shall be resolved through consultation. If any arbitration is needed, sampling at buyer’s site shall be jointly conducted by both sides.

6.2 Lot

The product shall be submitted for the acceptance in lots. Each lot shall be composed of continuously produced mixture from the same production line, with weight of no more than 5000 kg. If the buyer has special requirement, it shall be settled based on the negotiation between both sides.

6.3 Inspection items and sampling

6.3.1 The sampling of the product is carried out according to GB/T 5314. Lot sampling shall be no less than 3 kg.

6.3.2 Product inspection items and sampling shall conform as specified in Table 2.

Table 2-Inspection items and sampling

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| --- | --- | --- | --- |
| Inspection items | Sampling rules | Clause number for the requirements | Clause number for the test method |
| chemical composition | One per lot | 4.1 | 5.1 |
| Moisture content | One per lot | 4.2 | 5.2 |
| Magnetic impurities content | Three per lot | 4.3 | 5.3 |
| Apparent density  | Three per lot | 4.4.1 | 5.4.1 |
| Tap density | Three per lot | 4.4.2 | 5.4.2 |
| Particle size distribution | Five per lot | 4.4.3 | 5.4.3 |
| Specific surface area | Three per lot | 4.4.4 | 5.4.4 |
| Micromorphology | One per lot | 4.4.5 | 5.4.5 |
| Appearance quality | Each barrel/ bag | 4.5 | 5.5 |

6.4 Judgment of inspection results

6.4.1 If any of the chemical composition, the moisture content, the magnetic impurities content, the apparent density, the tap density, the particle size distribution, the specific surface area and the microstructure of the product is tested to be unqualified, the lot of the product will be judged as unqualified.

6.4.2 If the product appearance quality is tested to be unqualified, the whole barrel (bag) of the product will be judged as unqualified.

7 Label, packaging, transportation, storage and quality certificate

7.1 Label

The outer packaging of barrel/bag shall be accompanied by quality certificate with the following contents:

a) Supplier name;

b) Product name;

c)Lot number;

d) Net weight;

e) Protection mark;

f) Reference number of this standard;

g) Production date.

7.2 Packaging

The unit and method of package shall be conducted according to buyer’s requirements. Qualified products shall be packed with double-lined plastic bags sealed inside in barrels or bags.

7.3 Transportation and storage

The product can be transported in various ways.Damage to the packaging shall be avoided during transportation.

Products shall be sealed and protected from corrosion during storage. Guarantee period is one year from the production date.

7.4 Quality certificate

Quality certificate shall be attached to each lot of the products, which indicates:

1. Supplier name, address, telephone and fax;
2. Product name;
3. Lot number;
4. Quantity;
5. Series of analysis and test results; seal of the quality assurance department;

f) Reference number of this standard;

g) Production date.

8 Order (or contract) contents

The order (or contract) for the product listed in this standard shall include the following contents:

a) Product name;

b) Quantity;

c) Reference number of this standard;

d) Others.

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