

ICS 77.150.40

CCS H 40



**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 26029-2023

Replacing GB/T 26029-2010

Nickel cobalt manganese ternary composite oxide

镍钴锰三元素复合氧化物

Issued on: November 27, 2023

Implemented on: June 1, 2024

**Issued by: State Administration for Market Regulation;
Standardization Administration of China**

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1 Scope

China's national product standard for nickel cobalt manganese ternary composite oxide. It specifies the designations and codes, the technical requirements, the test methods, the inspection rules, the packaging, marking, transport, storage and accompanying documents, and the contents of the order form. This is the cathode material of the lithium-ion battery - NCM, the layered oxide in which nickel, cobalt and manganese share the transition metal site, and the material on which most of the electric vehicle industry outside the iron phosphate camp depends. The three metals divide the work. Nickel supplies the capacity, and the drive to raise its fraction from a third to sixty, eighty and ninety per cent is what has increased energy density over the last decade. Cobalt stabilises the layered structure and improves the rate capability, and it is the expensive, supply-constrained element everyone is trying to reduce. Manganese is cheap and electrochemically inactive in this role, and it holds the structure together, which is what allows the cobalt to come down. The ratio is therefore a commercial and engineering choice rather than a chemical constant, which is why the standard is built around designations and codes: the material is specified by its stoichiometry first. What has to be controlled beyond composition is what determines cell performance and safety. The particle size distribution and the morphology, because the material is made as spherical secondary particles agglomerated from primary crystallites and the packing determines the electrode density; the specific surface area; the tap density; the residual lithium on the surface, which causes gassing and gelation in the electrode slurry; the moisture; and the magnetic and metallic impurities, which at parts per billion

cause internal short circuits. Issued on 27 November 2023 and in force since 1 June 2024, it replaces GB/T 26029-2010.

This document specifies the designations and codes, technical requirements, test methods, inspection rules, packaging, marking, transportation, storage, accompanying documents, order forms of nickel cobalt manganese ternary composite oxides. This document applies to nickel cobalt manganese ternary composite oxides.

2 Normative references

The contents of the following documents constitute the essential terms of this document through normative references in the text. Among them, for dated references, only the version corresponding to that date applies to this document; for undated references, the latest version (including all amendments) applies to this document.

GB/T 1479.1 Metallic powders - Determination of apparent density - Part

3 Definition of terms

There are no terms and definitions that need to be defined in this document.

4 Designations and codes

4.1 Designations The product chemical formula is $\text{Ni}_x\text{Co}_y\text{Mn}_{1-x-y}\text{O}_z$ (where $x + y < 1$, $1 \leq z \leq 2 - x$). The product designation name consists of the capital letters NCMO and 6 digits, wherein N stands for Ni, C stands for Co, M stands for Mn, O stands for oxide. The first two digits represent the molar fraction of the nickel element; the middle two digits represent the molar fraction of the cobalt element; the last two digits represent the molar fraction of the manganese element. If the molar fraction is a single digit, add 0 before the single digit. If there are non-integer index requirements in the molar fractions of the three elements Ni, Co, Mn, it will be determined by negotiation between the supplier and the buyer. Example. Designation NCMO402040 indicates that the ratio of the amount of nickel cobalt manganese is 40.20.40; its chemical formula is $\text{Ni}_{0.40}\text{Co}_{0.20}\text{Mn}_{0.40}\text{O}_z$ ($1 \leq z \leq 1.6$). The designation NCMO900505 indicates that the ratio of the amount of nickel cobalt manganese is 90.05.05; its chemical formula is $\text{Ni}_{0.90}\text{Co}_{0.05}\text{Mn}_{0.05}\text{O}_z$ ($1 \leq z \leq 1.1$).

4.2 Code The product code is divided into 3-digit and 4-digit. When the amount fraction of nickel cobalt manganese in the product is an integer multiple of 10, a 3-digit code is used. The 3 digits are the values of the amount fraction of nickel cobalt manganese divided by 10, followed by -O to represent the oxide.

5.5.2 The appearance of the product is black or gray-black powder; the color of the same batch of products shall be consistent.

5.6 Other requirements If the buyer has special requirements for the

nickel-cobalt-manganese ternary composite oxide, it can be determined by negotiation between the supplier and the buyer and indicated in the order form.

6.1 Chemical composition

6.1.1 The mass fraction of nickel cobalt manganese in the product is first measured in accordance with the provisions of YS/T 928.3; then the mass fraction of nickel cobalt manganese is calculated. The calculation method is in accordance with the provisions of Appendix A of GB/T 26300-2020.

6.1.2 The determination of the total amount of nickel cobalt manganese in the product is carried out in accordance with the provisions of YS/T 1006.1.

6.1.3 The determination of the content of copper, iron, sodium, zinc, calcium, magnesium, aluminum in the product is carried out in accordance with the provisions of YS/T 928.4.

6.1.4 The determination of the chromium content in the product is carried out in accordance with the method agreed upon by the supplier and the buyer.

6.1.5 The determination of the lead content in the product is carried out in accordance with the provisions of YS/T 928.5.

6.1.6 The determination of the sulfate content in the product is carried out in accordance with the method agreed upon by the supplier and the buyer.

6.2 Physical properties

6.2.1 The bulk density of the product shall be determined in accordance with the provisions of GB/T 1479.1.

6.2.2 The tap density of the product shall be determined in accordance with the provisions of GB/T 5162.

6.2.3 The median diameter (D50) of the laser particle size of the product shall be determined in accordance with the provisions of GB/T 19077.

6.2.4 The specific surface area of the product shall be determined in accordance with the provisions of GB/T 19587.

6.2.5 The microscopic morphology of the product particles shall be observed in accordance with the provisions of JY/T 0584.

6.3 Magnetic foreign matter The content of magnetic foreign matter in the product shall be determined in accordance with the provisions of GB/T 41704.

6.4 Moisture content The method for determining the moisture content in the product shall be negotiated by the supplier and the buyer.

6.5 Appearance quality The appearance quality of the product shall be visually inspected.

7.1 Inspection and acceptance

7.1.1 The product shall be inspected by the supplier; the product quality shall comply with the provisions of this document and the requirements of the order form.

7.1.2 The purchaser may inspect the received products in accordance with the provisions of this document. If the inspection results do not comply with the provisions of this document and the requirements of the order form, the purchaser may submit the matter to the supplier within 15 days from the date of receipt of the product; the supplier and purchaser shall negotiate to resolve the issue. If arbitration is required, the arbitration sampling shall be conducted at the purchaser and joined by the supplier and purchaser.

7.2 Group-batching The products shall be submitted for inspection in batches; each batch shall consist of nickel-cobalt-manganese composite oxides of the same production cycle, designation, specification; the weight of a single batch shall not exceed 10 t.

7.3 Inspection items Each batch of products shall be inspected for chemical composition, physical properties, moisture content, magnetic foreign matter, appearance quality.

7.4 Sampling and specimen preparation

7.4.1 The inspection items and sampling methods for each batch of products shall comply with the provisions of Table 3. The product packaging shall be printed with trademarks and labels, which shall indicate.

- a) Supplier name and address;
- b) Product name;
- c) Batch number;
- e) Production date;
- f) This document number;
- g) Moisture-proof words or signs.

8.3 Transportation and storage The products shall be stacked in a ventilated and dry place. During transportation and storage, the packaging shall be prevented from cracking and caking due to moisture. The shelf life of the product is 1 year from the date of production.

8.4 Accompanying documents Each batch of products shall be accompanied by accompanying documents, which shall include supplier information, product information, this document number, exit-factory date or packaging date, as well as the following contents.

- a) Product quality guarantee, the contents are as follows: - Main performance and technical parameters of the product; - Product characteristics (including manufacturing process and