NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 45327-2025

Lithium-rich lithium iron oxide

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1 Scope

GB/T 45327-2025 is the Chinese material standard for lithium-rich lithium iron oxide. The material is a lithium supplement, a sacrificial cathode additive used to pre-lithiate a cell: it releases lithium irreversibly on the first charge, compensating the lithium consumed in forming the solid electrolyte interphase, and so recovers several per cent of the capacity that would otherwise be lost for good. It matters most in silicon anode and in high energy density cells, which is where the market is going. The standard sets the classification and designation, the requirements on the chemical composition and the impurities, the physical properties including particle size distribution, specific surface area, tap density, moisture and pH, the magnetic foreign matter limit, the electrochemical performance requirements, the test methods, the inspection rules and the marking, packaging, transport and storage. For a cathode material producer or a cell maker qualifying an additive in China, this is the specification the material is bought against.

This document specifies the product classification, technical requirements, test methods, inspection rules, marks, packaging, transportation, storage, accompanying documents, and purchase order content for lithium-rich lithium iron oxide. This document is applicable to lithium rich iron oxide, which is the lithium supplement additive for positive electrode materials used in lithium-ion batteries.

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 5162, Metallic powders -- Determination of tap density

GB/T 5211.6, General methods of test for pigments and extenders -- Part 6. Determination of pH value of an aqueous suspension

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

GB/T 6283, Chemical products -- Determination of water Karl-Fischer method (general method)

GB/T 6388, Transport package shipping mark

GB/T 8170, Rules of rounding off for numerical values and expression and judgement of limiting values

GB/T 19077, Particle size analysis by laser diffraction

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

GB/T 42161, Electrochemical performance test of lithium iron phosphate -- Test method for the initial discharge specific capacity and the initial efficiency

GB/T 44330, Lithium-ion battery cathode materials -- Determination of powder compaction density YS/T 1028.5, Methods for chemical analysis of lithium iron phosphate. Part 5. Determination of calcium, magnesium, zinc, copper, lead, chromium, sodium, aluminium, nickel, cobalt, manganese content. Inductively coupled plasma atomic emission spectrometry YS/T 1472.4, Methods for chemical analysis of lithium-rich manganese-based cathode materials - Part

4.Determination of lithium, nickel, cobalt, sodium, potassium, copper, calcium, iron, magnesium, zinc, aluminum, and silicon content - Inductively coupled plasma atomic emission spectrometry JCPDS1 (75-1253), Diffraction standard pattern of X-ray powder of lithium-rich lithium iron oxide

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 complementary specific capacity of the lithium supplement The difference between the first charge specific capacity and the first discharge specific capacity under specified conditions.

3.2 moisture resistance performance The ability to resist erosion from humid environments within a certain time and humidity range. NOTE. Expressed in terms of moisture absorption rate. The lower the moisture absorption rate, the stronger the material's ability to resist erosion from humid environments, that is, the better its moisture resistance.

4 Product classification

The products are divided into three categories based on the complementary specific capacity of the lithium supplement. LFO-I, LFO-II, and LFO-III.

5 Technical requirements

5.1 Chemical composition The chemical composition of the product shall comply with the provisions in Table 1. If doping or coating modification is required for the product, the doping or coating elements include but are not limited to one or more of Mg, Ti, Al, Co, Ni, Mn, Si, B, etc. The content of doped or coated elements shall be determined through negotiation between the supplier and the purchaser.

1 Joint Committee on Powder Diffraction Standards.

6.4 Moisture resistance performance The moisture resistance performance test of the product shall be conducted according to the method agreed upon by the supplier and the purchaser.

6.5 Appearance quality The appearance quality of the product is inspected by visual inspection.

6.6 pH value The determination of product pH value shall be carried out in accordance with the provisions of GB/T 5211.6.

6.7 Tap density The determination of product tap density shall be carried out in accordance with the provisions of GB/T 5162.

6.8 Powder compaction density The determination of compacted density of product powder shall be carried out in accordance with the provisions of GB/T 44330.

6.9 Specific surface area The determination of specific surface area of the product shall be carried out in accordance with the provisions of GB/T 19587.

6.10 Particle size distribution The determination of product particle size distribution shall be carried out in accordance with the provisions of GB/T 19077.

6.11 Complementary specific capacity of the lithium supplement The determination of complementary specific capacity of the lithium supplement of the product shall be carried out in accordance with the provisions of GB/T 42161.Each experimental step shall be conducted under environmental conditions with a relative humidity of no more than 10% and a temperature of 20°C~30°C. The charging and discharging system shall be as follows:

a) Static. not less than 6 hours;

b) Constant current charging current.

0.05 C;

c) Charging limit voltage.

7.1 Inspection and acceptance

7.1.1 The product shall be inspected by the supplier or a third party. Ensure that the product quality meets the requirements of this document and the purchase order, and fill in the accompanying documents.

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 purchase order, it shall be raised in writing to the supplier within two months from the date of receipt of the product, and resolved through consultation between the supplier and the purchaser. If arbitration is required, the arbitration sampling shall be jointly conducted by both the supplier and the purchaser at the purchaser.

7.2 Batching The products shall be submitted for acceptance in batches. Each batch shall consist of products of the same category produced in the same production cycle. The weight of each batch shall not exceed 2 t. When the purchaser has special requirements for the batch, they can be determined through negotiation between the supply and demand sides.

7.3 Inspection items and sampling

7.3.1 Inspection classification Inspection is divided into batch inspection and periodic inspection.

7.3.2 Batch by batch inspection Each batch of products shall be inspected batch by batch.

7.3.3 Periodic inspection Under normal production conditions, periodic inspection shall be conducted once within a determined period. Periodic inspection shall be conducted once a month. When the purchaser has special requirements, they can be determined through negotiation between the supplier and the purchaser. When there are significant changes in raw materials or production processes, or when production resumes after a long-term shutdown, all items shall be inspected.

7.3.4 Inspection items and sampling

7.4.2 When the appearance quality inspection result of the product is unqualified, the barrel (bag) product is judged as rejected.

7.4.3 Produce 6 test batteries according to the method specified in GB/T 42161.If the