

ICS 07.030; 07.120
CCS F 19



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

GB/T 41232.8-2024

**Nanomanufacturing - Key control characteristics - Nano-enabled
electrical energy storage - Part 8: Determination of water content in
electrode nanomaterials - Coulometric Karl Fisher titration method**

纳米制造 关键控制特性 纳米储能 第8部分：纳米电极材料中水分含量的测定 卡
尔·费休库仑滴定法

(English Translation)

Issued on: October 26, 2024

Implemented on: May 1, 2025

**Issued by: State Administration for Market Regulation, China National
Standardization Administration**

Table of Contents

Preface	
Introduction	
1 Scope	
2 Normative references	
3 Terms and Definitions	
4 Principle	
5 Reagent	
5.1 Coulometric Karl Fischer Reagent	
5.2 Anhydrous methanol	
5.3 Carrier Gas	
5.4 Karl Fischer Coulometric Titration Standard Sample	
6 Instruments	
6.1 Karl Fischer Coulometric Titrator	
6.2 Evaporator	
6.3 Analytical Balance	
6.4 Sample container	
6.5 Microsyringe	
6.6 Dew point meter	
7 Sample handling and sampling	
7.1 Sample Processing	
7.2 Sampling	
8 Operation Step	
8.1 Test Preparation	
8.2 Test Step	
8.3 Moisture content	
9 Precision	
9.1 Overview	
9.2 Repeatability	
9.3 Reproducibility	
10 Test Report	
Appendix A (Informative) Example of Determination and Analysis of Moisture Content in Nano-Lithium Iron Phosphate Samples	

Reference

Foreword

This document is in accordance with the provisions of GB/T 1.1-2020 "Guidelines for standardization work Part 1: Structure and drafting rules for standardization documents".

Drafting is required.

This document is part 8 of GB/T 41232 "Nanomanufacturing Key Control Characteristics Nano Energy Storage". GB/T 41232 has been published.

The following parts.

- Part 2: Density test of nano cathode materials;
- Part 3: Test of contact resistivity and coating resistivity of nanomaterials;
- Part 6: Determination of carbon content in nanoelectrode materials - Infrared absorption method;
- Part 8: Determination of water content in nanoelectrode materials - Karl Fischer coulometric titration method.

This document is equivalent to IEC TS62607-4-8:2020 "Critical control characteristics of nanomanufacturing Part 4-8.Nano-energy storage nanomaterials" the document type was adjusted from IEC technical specification to my country's national standard.

The following minimal editorial changes have been made to this document.

- To coordinate with the existing standards, the name of the standard is changed to "Key Control Characteristics of Nanomanufacturing Nano Energy Storage Part 8: Nanoelectromagnetic Determination of water content in electrode materials-Karl Fischer coulometric titration.

Introduction

Compared with general materials, nano energy storage materials have shown superior performance. In order to accelerate the healthy development of the emerging industry of nano energy storage, with the development of nano-energy storage materials, standardization of performance testing methods has become an urgent task in the industry.

The System Nanotechnology Committee (IEC/TC113) has issued eight standardized documents on the performance testing of nano energy storage materials.

GB/T 41232 "Key Control Characteristics of Nanomanufacturing Nano-Energy Storage" refers to the method standard for testing the physical and chemical properties of

nano-conductive energy storage materials is planned to consist of eight parts.

--- Part 1: Electrochemical performance test of nano cathode materials - two-electrode battery method. The purpose is to establish the use of two-electrode battery Relevant regulations for testing the electrochemical properties of nano cathode materials.

--- Part 2: Density test of nano cathode materials. The purpose is to establish relevant regulations for testing the density of nano cathode materials.

--- Part 3: Test of contact resistivity and coating resistivity of nanomaterials. The purpose is to establish the measurement of contact resistivity of nano-electrode materials.

Relevant regulations on resistivity and coating resistivity.

--- Part 4: Thermal properties test of nanomaterials by needle puncture method. The purpose is to establish the use of needle puncture method to test the thermal properties of nano energy storage devices.

Regulations on out-of-control levels.

--- Part 5: Electrochemical performance test of nano cathode materials - three-electrode cell method. The purpose is to establish the three-electrode cell method.

Relevant regulations for testing the electrochemical properties of nano cathode materials.

--- Part 6: Determination of carbon content in nanoelectrode materials by infrared absorption method. The purpose is to establish the use of infrared spectroscopy absorption method Regulations for determining the carbon content of nanoelectrode materials.

--- Part 7: Determination of magnetic impurities in nano-cathode materials ICP-OES method. The purpose is to establish the use of inductively coupled plasma Regulations on the determination of magnetic impurities in nano cathode materials by ICP-OES.

--- Part 8: Determination of water content in nanoelectrode materials by Karl Fischer coulometric titration.

Regulations on the determination of water content in nanoelectrode materials by coulometric titration.

Nano energy storage technology has been widely used in many fields such as portable electronic devices, electric vehicles and energy storage systems.

The rapid development has put forward higher requirements on the performance of nano energy storage devices. The performance of energy storage devices mainly depends on the nano electrode materials.

The moisture content of nanoelectrode materials is an important quality control indicator. Moisture can significantly affect the electrical properties of nano energy storage devices.

Energy, cycle performance and safety performance. Excessive moisture content in

electrode materials will have a significant impact on both active materials and batteries, and may affect their performance or safety features.

There are many methods for determining the water content. The Karl Fischer method is suitable for direct determination of the water content in gaseous, liquid or solid samples.

There are two methods for determination. Karl Fischer volumetric titration and Karl Fischer coulometric titration.

This is an absolute method that determines the moisture content based on the amount of electricity consumed during the test. This method can detect moisture content as low as 0.0001%.

Used for determination of trace moisture content in nanoelectrode materials.

This document aims to compare the performance of carbon nanomaterials without any additives [e.g. carbon black (CB), carbon nanotubes or carbon fibers] or organic binders.

raw materials [e.g., lithium cobalt oxide (LCO), lithium nickel cobalt aluminum oxide (LCO)] of the agent [e.g., polyvinylidene fluoride (PVDF) or styrene butadiene rubber (SBR)] the characteristics of lithium manganese phosphate (LCA), lithium nickel cobalt manganese oxide (NCM), lithium iron phosphate (LFP) and lithium iron manganese phosphate (LFMP)] guide the selection of these raw materials.

It is not suitable for selection and as a quality control method for fully formulated electrode materials, but is not suitable for evaluating electrode materials in end products.

Key Control Characteristics of Nanomanufacturing Nano-Energy Storage Part 8:
Determination of water content in nanoelectrode materials Karl Fischer coulometric titration

1 Scope

This document describes a method for determining the water content of nanoelectrode materials in nanoenergy storage devices using Karl Fischer coulometric titration.

method.

This document contains sample preparation, experimental procedures for determining the properties of nanoelectrode materials, and data analysis methods.

Note: This method has an accuracy of up to 0.0001%. The optimal measurement range is 0.01% to 1%.

This document does not apply to samples that can react with the main components of Karl Fischer reagents to produce water or react with elemental iodine or iodide ions.

Samples that react.