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

GB/Z 124.1-2025

**Nanotechnologies - Structural characterization of graphene -
Part 1: Graphene from powders and dispersions**

纳米技术 石墨烯结构表征 第1部分：石墨烯粉末及分散系

(English Translation)

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Foreword

This document is a standard or guiding technical document.

This document complies with the provisions of GB/T 1.1-2020 "Standardization Work Guidelines Part 1: Structure and Drafting Rules of Standardization Documents". Drafting.

This document is Part 1 of GB /Z 124 "Characteristics of Graphene Structures in Nanotechnology". GB /Z 124 has already published the following parts.

---Part 1: Graphene Powders and Dispersions This document is equivalent to ISO /T S21356-1.2021 "Nanotechnology - Graphene structural characterization - Part 1: Graphene powder and its components".

The document type has been changed from ISO technical specifications to my country's national standardization guidance technical documents.

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

---Notes have been added to the range.

Introduction

Due to the many excellent properties of graphene and related two-dimensional materials, these materials have applications in flexible electronics, nanocomposites, sensing, and filtration.

It may have groundbreaking applications in fields such as membranes and energy storage.

The commercialization of graphene products has encountered several obstacles that need to be overcome. One key obstacle is answering the question, "This..." "What material is it?" End users of graphene products should be able to trust the properties of commercially available graphene advertised globally, gaining their trust and... Allowing for global trade. To address this challenge, reliable and repeatable testing specifications are needed.

This document provides a set of flowcharts for analysts to follow in determining the structural characteristics of graphene in powders and dispersions (suspensions).

Sexuality. First, a quick check should be performed to determine the presence of graphene or graphite materials. If present, further detailed analysis is required to confirm... Determine whether the sample contains a mixture of single-layer graphene, bilayer graphene, few-layer graphene, graphene nanosheets, and graphite flakes. Based on the method used... The method used typically involves depositing the sample onto a substrate before analysis. This document describes how to assess the necessary analysis based on the sample type.

Measurements are taken, and decision trees and flowcharts are included to assist the user. This document describes a set of selected physical quantities to be measured, namely.

- a) Number of layers/thickness of the sheet;
- b) The transverse dimensions of the sheet;
- c) Layer stacking method;
- d) Disorder degree;
- e) The percentage of graphene or few-layer graphene;
- f) Specific surface area of graphene-containing powder.

The aforementioned physical properties of the material can change during processing and service life; for example, the sample may become more aggregated, resulting in different properties.

Surface Function. The list of measurements for the initial materials defines their intrinsic properties, which, along with the chosen manufacturing process, will determine... In real-world product performance, different material properties can be important in different application areas, depending on the material's function. Role.

This document provides information on monolayer graphene, bilayer graphene, few-layer graphene, and graphene isolated from powder and/or liquid dispersions.

Methods for structural characterization of nanosheets and graphite flakes. It does not provide methods to determine whether powders and/or dispersions are solely composed of these materials.

Complete. No advice was provided on when or how often to measure samples, although it is not expected that measurements will be taken for every batch of the same material. (By the user)

Decide when, how long, and how to use the characterization route described in this document. As with all microscopy measurements, this is based on a representative sample. Statistical conclusions should be drawn with caution.

The appendix to this document provides sample procedures for preparing and analyzing samples, sources of uncertainty, and how to analyze the data. Methods used.

Including Raman spectroscopy, scanning electron microscopy (SEM), atomic force microscopy (AFM), transmission electron microscopy (TEM), and BET surface area test method (Brunauer-Emmett-Teller).

GB /Z 124 "Characterization of Graphene Structures in Nanotechnology" is proposed to consist of two parts.

---Part 1: Graphene Powders and Dispersions. This section aims to define the structural characterization methods and measurement specifications for graphene powders and dispersions.

---Part 2: Graphene prepared by chemical vapor deposition. The aim is to define the structural spectroscopy of graphene prepared by chemical vapor deposition. Methods of identification and measurement specifications.

1 Scope

This document describes a method for characterizing the structural properties of graphene, bilayer graphene, and graphene nanosheets in powders and dispersions. This method enables... A series of measurement techniques are used, typically after individual flakes

have been separated from a substrate. Test parameters include the number of flake layers/thickness, The lateral dimensions, disorder, stacking pattern, and specific surface area of the flakes are described. This document provides measurement specifications for characterizing graphene powders and dispersions. Sample preparation procedures and data analysis.

Note: Graphene powder is also called graphene powder body, and the dispersion system is also called dispersion liquid.

2 Normative references

The contents of the following documents, through normative references within the text, constitute essential provisions of this document. Dated citations are not included.

For references to documents, only the version corresponding to that date applies to this document; for undated references, the latest version (including all amendments) applies. This document.

GB/T 30544.13-2018 Nanotechnology Terminology Part 13: Graphene and Related Two-Dimensional Materials [ISO /T S80004-13.2017, IDT]

ISO /T S80004-1.2023 Nanotechnology Terminology Part 1: Core Terminology Part 1: Coreterms

Note: ISO /T S80004-1.2023 replaces ISO /T S80004-1.2015 and ISO /T S80004-2.2015, but the technical content remains unchanged. ISO /T S80004-6.2021 Nanotechnology Terminology Part 6: Characterization of Nanoobjects

Note: GB/T 30544.6-2016 Nanotechnology Terminology Part 6: Characterization of Nanomaterials (ISO /T S80004-6.2013, MOD)

3 Terms and Definitions

The terms and definitions in ISO /T S80004-1.2023, ISO /T S80004-6.2021, and GB/T 30544.13-2018, as well as the following terms and definitions, are as follows.

The definitions apply to this document. The International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) maintain a database of terms used for standardization, available at [address missing].

3.1 Graphene

graphene layer Single-layer graphene; monolayer graphene A single layer of carbon atoms with a honeycomb structure is formed by one carbon atom bonded to three neighboring carbon atoms.

Note 1: It is an important building block for many carbon nanomaterials.