ICS 07.120
CCS L04

NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/Z 43998-2024

Nanotechnologies - Assessment of the concentrations of carbon black and amorphous silica in nanoscale in a mixed dust manufacturing environment

纳米技术 混合粉尘制造环境空气中纳米级炭黑和无定形二氧化硅浓度的测量方法

Issued on: April 25, 2024 **Implemented on: November 1, 2024**

Issued by: State Administration for Market Regulation;
Standardization Administration of the PRC

Table of Contents

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: This document is equivalent to ISO /T S21361:2019 "Carbon black and The document type was changed from ISO technical specification to my country's national standardization specification: Guidance technical documentation: The following minimal editorial changes were made to this document:

--- Change the name of the standard to "Measurement of the concentration of nano-scale carbon black and amorphous silicon dioxide in the air of the nanotechnology mixed dust manufacturing environment Measurement Methods:

--- Correct Table 2 mentioned in 8:3 to Table 3: Please note that some of the contents of this document may involve patents: The issuing organization of this document does not assume the responsibility for identifying patents: This document was proposed by the Chinese Academy of Sciences: This document is under the jurisdiction of the National Nanotechnology Standardization Technical Committee (SAC/TC279): This document was drafted by: Institute of Basic Medicine, Chinese Academy of Medical Sciences, National Center for Nanoscience and Technology, Zaozhuang University, Qingdao Metrology and Technology Institute, Beijing Academy of Science and Technology Analysis and Testing Institute (Beijing Physical and Chemical Analysis and Testing Center): The main drafters of this document are: Wen Tao, Meng Jie, Liu Jian, Wu Xiaochun, Ji Yinglu, Bai Ru, Liu Jianbo, Zou Yaxiong, Liu Wei and Gao Yuan:

Nanomaterials are already widely used in industrial settings in the manufacturing of consumer products: Carbon black and/or amorphous silica are often used in rubber These nanomaterials usually exist in the form of aggregates larger than the nanometer scale, but they are not easily found in the production and consumption process: During the process of nanomaterials, people may also be exposed to air containing these nanomaterials: Although such nanomaterials are widely used, they are still not suitable for mixed dust environments: Measuring the air concentration of specific nanomaterials in environments such as manufacturing has been a technical challenge and has become a major challenge in developing nano-related professional skills: This document describes a method for identifying and differentiating materials by size in an industrial manufacturing environment: and (based on air concentration) measurement of carbon black and amorphous silica particles: Silicon, but the basic principles can be applied to other nanomaterials in a variety of manufacturing environments: This document provides a method to distinguish specific materials and Quantitative information of exposure,Existing methods only provide quantitative information of nanoparticle exposure, but cannot distinguish the type of material,,hence the superiority: This document describes the procedures for collecting air samples in a manufacturing environment and the test protocol for analyzing the samples to obtain the target material The information needed to measure the air concentration of the sample is given in [4]: This document describes the measurement of carbon black and/or amorphous silica particles in air samples collected from mixed dust industrial manufacturing environments: This document describes methods for the collection of air samples and the characterization of particle size and elemental composition in air samples: Particles in the air sample are collected at different levels of the cascade impactor, where the median particle size distribution at the cut point of the cascade impactor is The particle size distribution of the particles is between 6nm and 10μm: The impact sampler determines the real-time particle size distribution of the particles based on the aerodynamic diameter of the particles: Offline analysis of particles collected at different impact layers using TEM and EDS can identify amorphous dioxide Silicon and carbon black particles: TEM-EDS detection provides the elemental composition and origin of the particles in each impact layer: TEM in the TEM-EDS combination Scanning electron microscopy (SEM) can also be used instead: The concentration of target nanoparticles (particles/cm3) in a specific size range is determined by sampling from the cascade impactor: The total particle concentration (particles/cm3) of the sample obtained by the sampler in this size range and the target material (such as carbon black) in the particles by TEM-EDS The method described in this document is applicable to carbon black and amorphous silica: The particle size of the particles ranges from 6nm to 2:5μm, and can be observed by TEM/SEM and chemically characterized by EDS: This document: The high sensitivity of the method described in this paper makes it a representative approach for quantifying nanoparticles by size in chemical exposure environments: Existing methods for identifying and measuring chemical exposure particles in the nanometer size range are mostly based on the characterization of mass concentration: In this size range, the sensitivity of the method

described in this document is superior to mass concentration measurements: In addition, although other sampling methods may be applicable The methods described in this document are intended for the quantification of specific nanoparticles in an exposure environment: This method can be used as a higher-level method for nanoscale measurements when the exposed areas have been identified by other methods: The sampling and assessment of occupational exposure of materials is carried out to further understand the nature of exposure: The analysis results can be compared with the baseline values of the healthy environment to In addition, this approach also helps to select appropriate individuals as needed at an early stage in the production process: Protective equipment: Nanotechnology mixed dust manufacturing ambient air Nanoscale carbon black and amorphous silica concentration Measurement methods

1 Scope

GB/Z 43998-2024 addresses an occupational hygiene problem that ordinary dust monitoring cannot solve. Carbon black and amorphous silica are made and handled in enormous tonnages - for tyres, rubber goods, coatings and fillers - and both consist of nanoscale primary particles. Measuring workplace exposure to them means measuring a nanoscale fraction in air that also contains everything else the factory produces, and the conventional gravimetric approach is blind to exactly the part that matters: the nanoscale fraction contributes almost nothing to the mass on the filter while dominating the particle number and surface area, which are the metrics toxicology points to. Distinguishing two amorphous carbon and silica materials from each other and from background dust adds a second difficulty. This document provides guidance for quantifying carbon black and amorphous silica in air on the basis of particle size, in samples collected in mixed dust industrial manufacturing environments. As a GB/Z it is a guiding technical document. Under ICS 07.120 and CCS L04, it is written for occupational hygienists, for the producers and users of these materials, and for the laboratories doing workplace air analysis.

This document provides a description of the presence of carbon black and/or amorphous particles in air, based on particle size, in air samples collected in mixed dust industrial manufacturing environments: A guide for quantitative analysis and identification of the number concentration (particles/cm3) of shaped silica particles: This document describes the use of an ELPCI (Charged Low Pressure Cascade Impactor) to collect air samples on a 25 mm diameter polycarbonate membrane: This document is applicable to sampling of air containing various types of particles in manufacturing environments: Aerosols composed of particles with different physical properties or environments with controlled interference factors (such as diesel sources): Although other sampling methods May also be applicable, but this document is limited to describing methods relevant to ELPCI: The particle morphology and elemental composition of the samples collected by ELPCI were analyzed by TEM and EDS to determine the particle type: The information is combined with the size-particle concentration information determined by ELPCI to obtain the concentration of

the target material in the air:

2 Normative references

The contents of the following documents constitute the essential clauses of this document through normative references in this document: For referenced documents without a date, only the version corresponding to that date shall apply to this document; for referenced documents without a date, the latest version (including all amendments) shall apply to This document:

ISO 4225 Air quality-General aspects-Vocabulary

GB/T 6919-1986 Air quality vocabulary (eqv ISO 4225:1980)

ISO 10312 Ambient air - Determination of asbestos fibres - Direct transmission electron microscopy ISO /T S10798 Nanotechnology Characterization of single-walled carbon nanotubes using scanning electron microscopy and energy dispersive X-ray spectroscopy

GB/T 32869-2016 Nanotechnology Single-walled carbon nanotubes - Scanning electron microscopy and energy dispersive X-ray spectroscopy characterization method (ISO / TS10798:2011,MOD)

ISO 22309 Microbeam analysis - Quantitative analysis of elements with atomic number greater than or equal to 11 (Na) by energy spectrometry

GB/T 17359-2023 Microbeam analysis of elements with atomic number not less than 11 - Quantitative analysis by energy dispersive spectrometry (

ISO 22309:2011, MOD) ISO /T S80004-

3 Terms and definitions

For this document, the terms and definitions defined in ISO 4225 and ISO /T S80004-1 and the following apply: