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Surface chemical analysis -- Characterization of nanostructured materials

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Table of Contents

Foreword

This standard is drafted in accordance with the rules given in GB/T 1.1-2009.

This standard uses the translation method equivalent to ISO /T R14187..2011 "Surface Chemistry Analysis of Nanostructured Materials Characterization".

Introduction

As many types of engineering nanomaterials play an increasingly important role in many different technical fields [1], international organizations [including

International Organization for Standardization (ISO), American Society for Testing and Materials (ASTM), International Bureau of Metrology/Substances Advisory Committee. Chemical Metrology

(BIPM/CCQM) and the Organization for Economic Co-operation and Development (OECD) [1] are committed to ensuring that the inherent nature of the materials used is fully

Recognize the key properties of materials that must be recognized [2] with measurements. Most of the material is related to the surface or interface, which is any nanostructured material (none

On the inherent properties of particles, fibers or other objects). Thus, the surface composition and chemistry have been identified as essential for the characterization of nanomaterials

Part of the chemical parameters, and many of the existing surface characterization techniques can of course be used or should often be applied to nanomaterials. But two

Different problems limit the role of traditional surface analysis techniques in certain fields of nanoscience and nanotechnology. First of all, many techniques are not enough

Enough three-dimensional spatial resolution, can not meet the needs of analyzing individual nanostructured materials (or equivalent to changes in material composition). So do it

These techniques often provide very important information, and some researchers still do not consider using them. Second, surface analysis (and its

He) technology is often used for the characterization of nanostructured materials, but without due consideration of these materials will bring some analytical problems or problems.

These problems include the ability of the nanoparticles to be altered by the environment (including the effects measured under vacuum conditions), the nanostructured material over time

The characteristics of the change, the effect of the particle shape on the analytical results, and the incident radiation (usually electrons, X-rays or ions) during the analysis

The possibility of a change in the structure or composition of the nanomaterials increases. This standard provides a lot of information about these important issues. First, the description

The types of information that can be obtained from nanostructured materials, including information that can be obtained using analytical methods other than these standard applications

Class; second, the analysis of the use of surface analysis technology (and other commonly used technology) characterization of nanostructured materials usually encountered technical problems to

And the use of each technology will encounter specific problems.

With the application of nanostructured materials in research, development and commerce, and their natural presence in air and groundwater,

The need to understand the properties and properties of nanostructured materials when they are synthesized or evolved in a particular environment. Nanostructure material is novel and unusual

Has attracted the attention of scientists, technical experts and the public. However, the amazing nature of many materials is sometimes also given to analysts, scientists

And product engineers bring unexpected analysis or characterization problems [3 ~ 5].

Materials with unusual or unique properties can cause potential health and environmental problems, and there is a growing need to understand that these materials are

Its chemical, physical and biological properties throughout its life cycle. It has been recognized that some of the properties of nanoparticles and other nanostructures

Quality (including toxicity and environmental stability) of the early reports based on the lack of characterization [6]. In some cases, the nanostructure material is of a material

Important representations have not been tried or reported [7,8]. March.2006 "SmalTimes" magazine published a text on a seminar

The seminar aims to clarify the obstacles to the commercialization of nanobotechnology [6]. At this seminar, several experts reported that.

Many of the important physical properties required for the physical and chemical properties of the rice particles have not been reported, and even apparently have not been measured,

Sex assessment process. This article further states that when these particles are exposed to their storage or use of the environment, the changes in these particles

Particularly important and often unrecognized. In many cases, the surface of the nanoparticles is covered with surfactants or contaminants, which are usually not available

To a good characterization, sometimes not fully confirmed. In this way, the validity of the conclusions may be problematic. The surface chemistry of nanoparticles is not obtained

Fully characterized, which has been identified as a field that often lacks proper characterization [4,8]. One definition of nanostructured material is an object or

The structure has at least one dimension of not more than 100 nm. At present, nanostructures (particles, rods or other shapes) that may be released into the environment

), While clarifying the minimum characterization requirements required for the use of nanoparticles for toxicological research [2]. On the computer

(As sensors), batteries or fuel cells, and many other applications of nanostructured materials, the same need for nano-materials

Characterization. Nevertheless, the minimum characterization required for nanoparticles can be extended to many of the materials and potential applications shown in Table 1.

Various surface analysis methods can provide information for the elements listed in Table 1, which include both obvious elements (such as surface composition and chemistry),

It also includes the size of particles or components, the presence of surface impurities, the nature of surface functionalization (including acidity), surface structure/morphology,

(Including transverse and depth directions), the thickness of the cover/film, and the electronic properties of the nanostructures/films.

Surface characterization is only part of the current nanomaterial analysis needs. This standard gives information that is available through such analysis

(And through which technology), and analyzes some of the problems and challenges faced by these analyzes.

Table 1 Physical and chemical properties of nanostructured materials

Nature Category Physical and chemical properties

The appearance of the material

Particles, grain, film, structural unit size and size distribution

Grain, particle, film morphology (shape, layer, roughness, topography)

Aggregate state, agglomeration (for example, whether particles are glued together)

Material composition

Body composition (including chemical composition and crystal structure)

Body purity (including impurities)

Elements, chemical and/or phase distribution (including surface composition and surface impurities)

Material and its surroundings

interaction

Influencing factors

Surface area

Surface chemistry, including reactivity, hydrophobicity

Surface charge

Characterization of engineering nanomaterials (for

Toxicological research and other applications)

The primary consideration

Stability - material properties (especially the surface composition, particle aggregation, etc.) how with the time (dynamic stability), storage, at

Management, preparation, transportation, etc., including the solubility of the material and the release rate of dissolution

Environment/medium - how the material properties change in different media or processes (environmental impact), for example,

The material is transformed into a material that is dispersed in different biological matrices (the "specified" characterization project is particularly important)

If possible, the material should be adequately characterized as if it were to explain its functional properties. For toxicological studies, request is obtained