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Nanotechnology -- Carbon nanotube materials -- Sheet resistance

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Table of Contents

Foreword

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

This standard uses the translation method equivalent to IEC /T S62607-2-1.2012 "Nano Manufacturing Key Control Characteristics Part 2-1. Carbon

Nanotube material film resistance.

This standard has made the following editorial changes.

--- Change the standard name to "Nanotechnology carbon nanotube material sheet resistance".

This standard was proposed by the Chinese Academy of Sciences.

This standard is under the jurisdiction of the National Nanotechnology Standardization Technical Committee (SAC/TC279).

This standard was drafted by Shenzhen Standard Technology Research Institute,

Shenzhen Defang Nano Technology Co., Ltd., National Nano Science Center,

Shenzhen Institute of Metrology and Quality Inspection.

Introduction

New materials containing carbon nanotubes (CNTs) have two major trends in the next generation of industrial applications.

a) Conductive composites for field-emission displays (FEDs), flexible displays and printed electronics

material;

b) Nanocomposites for mechanical applications, making full use of their outstanding mechanical properties such as high Young's modulus, high elasticity and high tensile strength

And so on.

This standard mainly relates to the conductive composite material in the above a). At present, conductive composite materials are widely used in the electronics industry, so it is necessary

Establish test method standards to evaluate their electrical performance.

The electrical properties of CNTs used in conductive composites are very important to both manufacturers and users. This standard specifies the guide

A simple method for detecting the electrical properties of CNTs of electrical composites.

Nanotechnology carbon nanotube material sheet resistance

1 Scope

This standard specifies the standard method for the detection of thin-layer resistance of carbon nanotubes, so that users can choose the right combination of their own applications.

Choose. The purpose of this standard is to evaluate the consistent control of the conductivity of the final product of different batches of products manufactured by the same production procedure.

For each application, the relationship between the parameters measured according to the specified method and the performance parameters of the relevant product should be established. This standard includes the following

content.

a) the definition of the terms used in this document;

b) recommendations for the preparation of samples;

c) summary of experimental procedures for measuring the sheet resistance of carbon nanotubes;

d) results analysis and data discussion;

e) case analysis;

f) References.

2 Terms and definitions, abbreviations

Note. The more comprehensive series of nanotechnology terminology standards IEC /ISO /T S80004 is being prepared by the first joint working group of IEC TC113/ISO TC229.

Medium and will be included in different parts of IEC /ISO /T S80004. This standard will be used in conjunction with the terminology in the latest version of IEC /ISO /T S80004.

The definition is consistent. Unspecified terms are taken from the scientific literature.

2.1 Terms and definitions

The following terms and definitions apply to this document.

2.1.1

Single-walled carbon nanotubes single-walcarbonnanotube; SWCNT

A carbon nanotube formed by crimping a single layer of graphene sheets.

Note. Seamless nanoscale cylindrical honeycomb structure formed by crimping a single layer of graphene sheets.

[ISO /T S80004-3.2010, definition 4.4]

2.1.2

Multiwall carbon nanotubes multiwalcarbonnanotube; MWCNT

A carbon nanotube having a seamless casing structure obtained by crimping a coaxial or nearly coaxial multilayer graphene sheet.

Note. The structure is formed by nesting a plurality of single-walled carbon nanotubes. The smaller diameter is cylindrical, and the cross section tends to have a polygonal structure as the diameter increases.

[ISO /T S80004-3.2010, definition 4.6]

2.1.3

Carbon nanotube film CNTfilm

A single-walled or multi-walled carbon nanotube film formed by a substrate filtration method or the like.

See Figure 1 (c).

2.1.4

Sheet resistance sheetresistance

Rs

The sheet resistance of a semiconductor or thin metal film, the resistance of a film having substantially the same thickness as the current.

Note 1. Two-dimensional (xy) sheet resistance (Rs) can be used to determine the electrical resistance of a film with consistent electrical properties. In a geometric rectangle, Rs=R/(L/w), where R is

The resistance to be tested, R = V/I, L is the spacing of the parallel electrodes, the voltage difference across the electrodes is represented by V, and w is the length of the electrode. Current I must follow the membrane

The plane flows, not perpendicular to it (see Figure 4). The aspect ratio L/w is the number of squares of the film sample. The unit of the sheet resistance can be expressed in ohms (ohm), this

For ease of expression, in ohms per square (ohm/sq).

Note 2. See references [1~4].

2.1.5

Current-voltage characteristics I-Vcharacteristic

IV characteristics

There is a relationship between the current and the corresponding voltage (or potential difference).

2.1.6

Four probe measurement method 4-probemeasurement

A method of measuring the resistance of a material, and the measured resistance value is not affected by the probe resistance and contact resistance.

Note. In the method, the four probes in contact with the sample to be tested are arranged in a straight line, the voltage is measured by two probes located inside, and the current is passed through two external probes.

Come on. The sample resistance can be calculated from Ohm's law, and its resistivity can