भारतीय मानक
Indian Standard

IS 17001 : 2018
ISO/TS 11937 : 2012

नैनोप्रौद्योगिकी — पाऊडर अवस्था में नैनोस्कैल टाइटेनियम डाइऑक्साइड — लक्षण एवं मापन

Nanotechnologies — Nanoscale Titanium Dioxide in Powder Form — Characteristics and Measurement

ICS 07.030

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June 2018 **Price Group 2**

NATIONAL FOREWORD

This Indian Standard which is identical with ISO/TS 11937 : 2012 'Nanotechnologies — Nanoscale titanium dioxide in powder form — Characteristics and measurement' issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on the recommendation of the Nanotechnologies Sectional Committee and approval of the Metallurgical Engineering Division Council.

The text of ISO Technical Specification has been approved as suitable for publication as an Indian Standard without deviations. Certain terminology and conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

In this adopted standard, reference appears to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards which are to be substituted in their respective places are listed below along with their degree equivalence for the editions indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
ISO 591-1 Titanium dioxide pigments for paints — Part 1: Specifications and methods of test	IS 411 : 1991 Titanium dioxide, anatase, for paints — Specification (*third revision*)	Technically Equivalent with ISO 591 : 1977
ISO/TS 80004-1[1)] Nanotechnologies — Vocabulary — Part 1: Core terms	IS/ISO/TS 80004-1 : 2010 Nanotechnologies — Vocabulary : Part 1 Core terms	Identical with ISO 80004-1 : 2010

The technical committee has reviewed the provisions of the following International Standards referred in this adopted standard and has decided that they are acceptable for use in conjunction with this standard:

International Standard	*Title*
ISO 9277 : 2010	Determination of the specific surface area of solids by gas adsorption using the BET method
ISO 13322-1 : 2014	Particle size analysis — Image analysis methods — Part 1: Static image analysis methods
ISO 14887 : 2000	Sample preparation — Dispersing procedures for powders in liquids
ISO 14488 : 2007	Particulate materials — Sampling and sample splitting for the determination of particulate properties
ISO/TS 27687 : 2008	Nanotechnologies — Terminology and definitions for nano-objects — Nanoparticle, nanofiber and nanoplate

In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'.

[1)] Since revised in 2015.

Indian Standard

NANOTECHNOLOGIES — NANOSCALE TITANIUM DIOXIDE IN POWDER FORM — CHARACTERISTICS AND MEASUREMENT

WARNING — Persons using this document should be familiar with normal laboratory practice, if applicable. This document does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to ensure compliance with any regulatory requirements.

1 Scope

This Technical Specification provides requirements to describe the basic characteristics of titanium dioxide in powder form relevant for applications in nanotechnology. It is intended to detail the materials specification necessary to use titanium dioxide in the applications related to nanotechonology.

It is limited to dry powders and does not include materials dispersed or suspended in water or solvents.

It does not cover characteristics for health and safety issue, and for specific application of titanium dioxide or for surface modification, if coated.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 591-1, *Titanium dioxide pigments for paints — Part 1: Specifications and methods of test*

ISO 9277:2010, *Determination of the specific surface area of solids by gas adsorption using the BET method*

ISO 13322-1, *Particle size analysis — Image analysis methods — Part 1: Static image analysis methods*

ISO 14887, *Sample preparation — Dispersing procedures for powders in liquids*

ISO 14488, *Particulate materials — Sampling and sample splitting for the determination of particulate properties*

ISO/TS 27687, *Nanotechnologies — Terminology and definitions for nano-objects — Nanoparticle, nanofibre and nanoplate*

ISO 80004-1, *Nanotechnologies — Vocabulary — Part 1: Core terms*

3 Terms and definitions

For the purposes of this document, the terms, definitions and abbreviated terms given in ISO 14488, ISO/TS 27687 and ISO/TS 80004-1 and the following apply.

3.1
transmission electron microscope (TEM)
instrument that produces magnified images or diffraction patterns of the sample by an electron beam which passes through the sample and interacts with it

[ISO 29301:2010, definition 3.37]

3.2
X-Ray diffraction (XRD)
scattering in which the incident radiation is a beam of x-rays. The elastic scattering of the x-rays from the electron clouds of atoms in a system produces a diffraction pattern that gives information about the crystallographic structure

3.3
specific surface area
absolute surface area of the sample divided by sample mass

[ISO 9277:2010, definition 3.11]

3.4
crystal structure
arrangement of a regular and repeating internal unit of atoms in three dimensions in which the atoms are set in space in a fixed relation to each other

3.5
primary particle
particle not formed from a collection of smaller particles

Note 1 to entry: The term typically refers to particles formed through nucleation from the vapour phase before coagulation occurs.

[ISO/TR 27628:2007, definition 2.16]

4 Basic characteristics and measurement methods

For titanium dioxide in powder form conforming to this Technical Specification the following basic characteristics should be measured and reported. The necessary characteristics and corresponding measurement method are listed in Table 1.

The requirements for magnitudes of measured characteristics shall be agreed upon between interested parties and test results should be reported complying with the requirement of Clause 6.

Table 1 — Basic characteristics with corresponding measurement methods

Characteristics	Unit	measurement methods
Mass fraction of titanium dioxide	% (kg/kg)	Aluminium reduction method/ Chromium(II) chloride reduction method (ISO 591-1) or other chemical analysis methods upon the agreement between interested parties
Ratio of crystalline phases	%	XRD
Average crystallite size	nm	XRD (Scherrer formula)
Average primary particle size	nm	TEM
Specific surface area	m^2/g	BET method

NOTE 1 The set of basic characteristics is evaluated in order to represent the nanoscale titanium dioxide in powder form in terms of nano size-related features and its main ingredient.

NOTE 2 Additional characteristics relevant to specific applications may be specified depend on the intended application and other related international standards.

NOTE 3 The detailed procedures for these measurement methods are not provided in this Technical Specification. In order to obtain the measurement results required by the interested parties, the measurement methods should be applied and managed under a well recognized quality system.

5 Sampling

Take a representative sample of the product to be tested, as described in ISO 14488.

6 Reporting

The test report should contain at least the following information:

6.1 A reference to this Technical Specification, i.e. ISO/TS 11937.

6.2 Identification of material tested (product name, chemical name).

6.3 Samples description (manufacturer of nanoscale titanium dioxide, batch number or lot number, country of origin).

6.4 Laboratory (name of testing laboratory).

6.5 Results.

6.5.1 Measurement results of basic characteristics, and their measurement methods required in Table 1 (for TEM, also report the number of particles used in the determination of the average size, standard deviation of measurement results and details on measurement method for TEM method).

6.5.2 Measurement uncertainty (subject to the agreement between users, suppliers and regulators).

6.6 Additional information (if any).

Bibliography

[1] CAN/CSA-Q850-97 — *Risk Management: Guideline for Decision Makers*

[2] *Consumer Product Safety Commission, Handbook for Manufacturing Safer Consumer Products*. July 2006, www.cpsc.gov/businfo/intl/handbookenglishaug05.pdf

[3] *Consumer Product Safety Commission, Recall Handbook*, May 1999, www.cpsc.gov/BUSINFO/8002.html

[4] EC Guidelines for the notification of Dangerous Consumer Products to the Competent Authorities of the Member States by Producers and Distributors in Accordance with Article 5(3) of Directive 2001/95/EC ec.europa.eu/consumers/cons_safe/prod_safe/guidelines_documents.pdf

[5] European Commission, *Risk Assessment Guidelines for Non-Food Consumer Products*, Draft for Consultation, August 2008

[6] http://ec.europa.eu/consumers/ipm/risk_assesment_guidelines_non_food.pdf

[7] IEC's Advisory Committee on Safety — *Development of a standard for safety related risk assessment in the area of low voltage*

[8] ISO/TR 12885:2008, *Nanotechnologies — Health and safety practices in occupational settings relevant to nanotechnologies*

[9] ISO/IEC Guide 51 — *Safety aspects — Guidelines for their inclusion in standards*

[10] ISO/IEC Guide 50 — *Safety aspects — Guidelines for child safety*

[11] ISO/IEC Guide 71 — *Guidelines for standards developers to address the needs of older persons and persons with disabilities*

[12] ISO Guide 73 — *Risk management — Vocabulary*

[13] EN 13925-1:2003, *Non-destructive testing — X-ray diffraction from polycrystalline and amorphous materials — Part 1: General principles*

[14] ISO/TS 11931, *Nanotechnologies — Nanoscale calcium carbonate in powder form —Characteristics and measurement*

[15] EN 13925-2:2003, *Non-destructive testing — X-ray diffraction from polycrystalline and amorphous materials — Part 2: Procedures*

[16] ISO 29301:2010, *Microbeam analysis — Analytical transmission electron microscopy — Methods for calibrating image magnification by using reference materials having periodic structures*

[17] ISO/TR 27628:2007, *Workplace atmospheres — Ultrafine, nanoparticle and nano-structured aerosols — Inhalation exposure characterization and assessment*

[18] EN 13925-3:2005, *Non-destructive testing — X-ray diffraction from polycrystalline and amorphous materials — Part 3: Instruments*

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Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

This Indian Standard has been developed from Doc No.: MTD 33 (11109).

Amendments Issued Since Publication

Amendment No.	Date of Issue	Text Affected

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Published by BIS, New Delhi