AS ISO 14411.2:2026
ISO 14411-2:2020

Preparation of particulate reference materials

Part 2: Polydisperse spherical particles



AS ISO 14411.2:2026

This Australian Standard® was prepared by NT-001, Nanotechnologies. It was approved on behalf of Standards Australia's Standards Development and Accreditation Committee on 11 June 2026.

This Standard was published on 26 June 2026.

The following are represented on Committee NT-001:

Adelaide University
Australian Industrial Chemicals Introduction Scheme
Australian Institute of Health & Safety
Australian Nuclear Science and Technology Organisation
Consumers' Federation of Australia
Engineers Australia
National Association of Testing Authorities Australia
National Measurement Institute
Smart Energy Council

This Standard was issued for comment as DR AS ISO 14411.2:2026

Status of this document

Standards Australia publications are periodically reviewed to ensure their ongoing relevance and accuracy. This document may be withdrawn, revised, or superseded at any time. To verify this document's current status, visit:

www.standards.org.au

ISBN: 978 1 76175 849 2

AS ISO 14411.2:2026
ISO 14411-2:2020

Australian Standard®

Preparation of particulate reference materials

Part 2: Polydisperse spherical particles

First published as AS ISO 14411.2:2026.

© ISO 2026 — All rights reserved
© Standards Australia Limited 2026

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher, unless otherwise permitted under the Copyright Act 1968 (Cth).

Users must not use the content in this publication in combination with artificial intelligence (AI) tools for any purpose, unless they have the express prior written consent from Standards Australia.

How to read this Standard

This page explains the meaning of the language and structure of this Standard.

Refer to Standards Australia's Standardisation Guide 006 for more details about drafting rules.

Australian and Australian/New Zealand Standards are voluntary unless they are referenced in legislation or called up in contracts.

Requirements

To conform to a Standard, all requirements in the Standard need to be met.

A requirement is any statement in the Standard which uses the word "shall".

Recommendations, permissions and possibilities

The following words are commonly used in Standards, but statements using them do not have to be followed to conform to the Standard:

(a) "should" means that something is recommended.

(b) "may" means that something is permitted.

(c) "can" means that something is possible.

Structure of Standards

A Standard always has the following parts:

(i) The Preface states who developed the Standard, what the Standard is aiming to do, and how it relates to other documents.

(ii) The Scope states what the Standard is about, what it covers and what it does not cover.

(iii) The Normative references clause lists other documents that are referenced in the Standard as part of requirements.

(iv) The Terms and definitions clause defines important terms to help with understanding the Standard.

A Standard may also include other parts, such as the following:

(1) A normative appendix sets additional requirements that need to be conformed to.

(2) An informative appendix provides additional information or guidance. They usually do not contain requirements. If an informative appendix does contain requirements, the Standard will explain when those requirements apply.

(3) A Bibliography lists documents referenced in the Standard but not as part of requirements.

Many Standards include notes. Notes provide recommendations and/or guidance only. They never contain requirements.

Preface

This Standard was prepared by the Standards Australia Committee NT-001, Nanotechnologies.

The objective of this document is to describe the specifications for spherical polydisperse particulate reference materials with acceptable uncertainty in particle size distribution and describes protocols for their characterization. One potential use of these reference materials is the reliability test of the laser-diffraction instruments and other particle sizing methods.

This document expresses polydispersity and the related uncertainties in size. Small variations in size can imply large variations in cumulative distribution.

This document describes the requirements of particulate reference materials, which are intended to be used to test the reliability of various types of particle size measurement apparatus.

This document is identical to, and has been reproduced from, ISO 14411-2:2020, *Preparation of particulate reference materials — Part 2: Polydisperse spherical particles*.

© Standards Australia Limited 2026

Contents

Page

Preface ..... **v**
Foreword ..... **vii**
Introduction ..... **viii**
1 Scope **1**
2 Normative references **1**
3 Terms, definitions and symbols **1**
3.1 Terms and definitions 1
3.2 Symbols 2
4 Requirements for preparing polydisperse particles **3**
4.1 General description of a project for the production of a reference material 3
4.2 Requirements on the general properties of the material for polydisperse particles 4
4.3 Size distribution for polydisperse particles 4
5 Characterization of polydisperse particles **5**
5.1 Particle size distribution 5
5.2 Aspect ratio 5
5.3 Apparent particle density 5
5.4 Refractive index 5
6 Estimation of size measurement uncertainties **5**
6.1 Uncertainty from sampling 5
6.1.1 Uncertainty of the average value *N* replicate measurement 5
6.1.2 Uncertainty of a single measurement 6
6.2 Other uncertainty factors 7
6.3 Expanded uncertainty of size distribution 7
Annex A (informative) **Example calculation of the uncertainty estimation of particle size distribution determined by *N* replicate measurement** **8**
Annex B (informative) **Example calculation of the uncertainty estimation of number-based particle size distribution determined by a single measurement** **11**
Annex C (informative) **Example calculation of the uncertainty estimation for a volume-based cumulative size distribution transformed from the number-based size distribution having a log-normal size distribution** **14**
Bibliography **16**

© Standards Australia Limited 2026

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 24, *Particle characterization including sieving*, Subcommittee SC 4, *Particle characterization*.

A list of all parts in the ISO 14411 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

© Standards Australia Limited 2026

Introduction

The measurement of particle size distribution can be accomplished by a number of techniques which measure some characteristics of the particle and usually equate this to a circular or spherical equivalent. Each of these techniques measures different properties of an irregular particle and thus has particular requirements for reference materials and method standardization. Often, the methods that are employed for particle size distribution are indirect in nature which rely on measuring some other property and converting this to a particle size distribution by means of equations based on ideal shapes (usually spherical) and sizes to that of the equivalent particle size distribution. Thus, these techniques usually require or assume knowledge of some other constant in order to calculate the particle size distribution.

Even methods that do not require size calibration require reference materials for quality control and operation qualification. Such a reference material should be certified for its particle size distribution and the values should be traceable to the SI unit metre. This material allows instrument manufacturers to demonstrate proper calibration of all input factors and hence demonstrate that their instrument results are traceable to the SI unit metre. To achieve this, the reference material should be polydisperse and consist of spherical particles.

The heterogeneity of a particle size distribution poses statistical challenges for particle size analysis and therefore also for the production of reference materials for particle size analysis. This document therefore describes the production of particulate reference materials consisting of spherical particles.

© Standards Australia Limited 2026

Australian Standard®

Preparation of particulate reference materials

Part 2: Polydisperse spherical particles

1 Scope

This document describes the specifications for spherical polydisperse particulate reference materials with acceptable uncertainty in particle size distribution and describes protocols for their characterization. One potential use of these reference materials is the reliability test of the laser-diffraction instruments and other particle sizing methods.

This document expresses polydispersity and the related uncertainties in size. Small variations in size can imply large variations in cumulative distribution.

This document describes the requirements of particulate reference materials, which are intended to be used to test the reliability of various types of particle size measurement apparatus. The requirements for processing, homogeneity and stability assessment as well as for the preparation of certificates, which are not addressed in this document are described in ISO 17034.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 17034, *General requirements for the competence of reference material producers*

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1.1
aspect ratio
ratio of minimum Feret diameter to the maximum Feret diameter of a particle

[SOURCE: ISO 26824:2013, 4.5, modified.]

3.1.2
apparent density
mass per unit volume of the material

Note 1 to entry: It is expressed in g/cm ^{3}.

[SOURCE: ISO 5755:2012, 3.10]

© Standards Australia Limited 2026