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BSI Standards Publication

Preparation of particulate reference materials

Part 1: Polydisperse material based on picket fence of monodisperse spherical particles

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National foreword

This Published Document is the UK implementation of ISO/TS 14411-1:2017.

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A list of organizations represented on this committee can be obtained on request to its secretary.

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Part 1: Polydisperse material based on picket fence of monodisperse spherical particles

Préparation des matériaux de référence à l'état particulaire —

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Foreword

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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).

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For an explanation on 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 the following URL: www.iso.org/iso/foreword.html.

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

Introduction

The measurement of the particle size distribution can be accomplished by a number of techniques which measure some 1-D characteristic of the particle and usually equate this to an equivalent size assuming ideal shapes (usually spherical). Thus, these techniques usually require or assume knowledge of some other constant in order to calculate the particle size distribution. Each of these techniques measures different properties which makes the equivalent particle size a method-defined measurand. Comparability of results therefore requires application of the same methods, which in turn requires standardization.

This unsatisfactory situation of fundamental lack of comparability could be improved by a better understanding of the effects influencing the various methods. Since the sample material represents the link between the different methods, it is of central importance that it should meet as many physical assumptions of the considered methods as possible. A feasible approach is mixing known amounts of spherical, monodisperse particle fractions to create a polydisperse mixture ("picket fence distribution").

The individual particles should be spherical, as many sizing methods assume the particles to be spherical. Using particles that are in fact spherical fulfils this assumption, so the results of the various methods should be the same as far as the particle shape is concerned. A further advantage of spherical particles is that their size can be described by a single parameter only, the particle diameter.

The individual fractions of the mixture need to be monodisperse, as only then it is possible to trace the particle diameter back to the standard meter with an acceptable uncertainty and to get mixtures of theoretically known particle size distributions in the end.

These materials should be used as follows.

The monodisperse particle fractions can be used to demonstrate equivalence of results with these ideal particles. If a method gives deviating results, the method is not yet fully understood and further investigation of the deviation is needed. The polydisperse mixtures can be used to challenge measurement methods to see what the output is. Final outcome should be a comprehensive understanding of the methods including particle dispersion, particle transport, physical principle and evaluation leading to better comparability of results. The approach described in this document is based on Reference [22] and Reference [23].

A second approach is developing a theoretical framework for more accurate measurement of particle size distributions. Also, this approach is fundamentally limited to spherical particles of equal density, to be applicable to different methods.

This document describes preparation protocols of picket fence distributions of spherical, quasi-monodisperse particulate reference materials.

Preparation of particulate reference materials —

Part 1: Polydisperse material based on picket fence of monodisperse spherical particles

1 Scope

This document describes the preparation of polydisperse spherical particles based on a picket fence of quasi-monodisperse reference materials, the characterization of its monodisperse components with acceptable uncertainty and the estimation of the uncertainty of the mixture of these particles. This type of material is normally suitable for all particle characterization methods within the appropriate limits of the techniques. An example of using these reference materials in a reliability calculation for a mass-based cumulative size distribution is provided.

This document limits itself to the technical specificities of preparation beyond the general requirements for certified and non-certified reference materials as described in ISO Guide 30, ISO Guide 31, ISO Guide 35 and ISO 17034.

2 Normative references

There are no normative references in this document.

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:

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

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

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
pycnometry
method wherein particle density is obtained from the measured mass of sample with a given calibrated volume

[SOURCE: ISO 26824:2013, 2.4]