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Determination of particle size distribution — Differential electrical mobility analysis for aerosol particles

Détermination de la distribution granulométrique — Analyse de mobilité électrique différentielle pour les particules d'aérosol

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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).

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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*.

This second edition cancels and replaces the first edition (ISO 15900:2009), which has been technically revised.

The main changes compared to the previous edition are as follows:

— subclauses on particle losses due to Brownian diffusion, effects due to non-spherical particles, and measurement of particles below 10 nm have been added in Clause 5;

— traceability diagrams for DEMC and DMAS have been added in Clause 5;

— calibration for size measurement in Clause 8 has been refined;

— Clause 9 for “Using a DEMC at a fixed voltage to generate particles of a chosen size” has been added;

— Annex D for “Data inversion” has been rewritten completely;

— Annex F for “Example certificate for a DMAS particle size calibration” has been added;

— former Annex G for “Uncertainty” in the previous edition has been deleted;

— new Annex G for “Good practice for measurements at particle sizes below 10 nm” has been added;

— Annex H for “Examples for overall system tests” has been added;

— Annex I for “Comparison of different approaches to calculate diffusion loss in laminar tube flow” has been added;

— Annex J for “Corrections for effects due to non-spherical particles” has been added.

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.

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Introduction

Differential electrical mobility classification and analysis of airborne particles has been widely used to measure a variety of aerosol particles ranging from nanometre-size to micrometre-size in the gas phase. In addition, the electrical mobility classification of charged particles can be used to generate mono-disperse particles of known size for calibration of other instruments. One notable feature of these techniques is that they are based on simple physical principles. The techniques have become important in many fields of aerosol science and technology, e.g. aerosol instrumentation, production of materials from aerosols, contamination control in the semiconductor industry, atmospheric aerosol science, characterization of engineered nanoparticles, and so on. However, in order to use electrical mobility classification and analysis correctly, several issues, such as the slip correction factor, the ion-aerosol attachment coefficients, the size-dependent charge distribution on aerosol particles and the method used for inversion of the measured mobility distribution to the aerosol particle size distribution, need due caution.

There is, therefore, a need to establish an International Standard for the use of differential electrical mobility analysis for classifying aerosol particles. Its purpose is to provide a methodology for adequate quality control in particle size and number concentration measurement with this method.

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Determination of particle size distribution — Differential electrical mobility analysis for aerosol particles

1 Scope

This document provides guidelines and requirements for the determination of aerosol particle number size distribution by means of the analysis of electrical mobility of aerosol particles. This measurement is usually called "differential electrical mobility analysis for aerosol particles". This analytical method is applicable to particle size measurements ranging from approximately 1 nm to 1 µm. This document does not address the specific instrument design or the specific requirements of particle size distribution measurements for different applications but includes the calculation method of uncertainty. In this document, the complete system for carrying out differential electrical mobility analysis is referred to as DMAS (differential mobility analysing system), while the element within this system that classifies the particles according to their electrical mobility is referred to as DEMC (differential electrical mobility classifier).

NOTE This document does not include technical requirements and specifications for the application of DMAS, which are defined in application specific standards or guidelines, e.g. for road vehicle applications (ISO/TC 22), environmental measurements (ISO/TC 146) or nanotechnologies (ISO/TC 229).

2 Normative references

There are no normative references in this document.

3 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
aerosol
system of solid and/or liquid particles suspended in gas

3.2
attachment coefficient
attachment probability of ions and aerosol particles

3.3
bipolar charging
process which attains a conditioned charge distribution of both positive and negative charges on aerosol particles

3.4
bipolar charge conditioner
device which attains a conditioned charge distribution of both positive and negative charges on aerosol particles

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