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British Standard Methods for

Determination of particle size distribution

Part 7. Recommendations for single particle light interaction methods

Méthodes de détermination de la granulométrie
Partie 7. Recommandations relatives aux méthodes optiques d'analyse granulométrique des particules uniques

Verfahren zur Bestimmung der Korngrößenverteilung
Teil 7. Empfehlungen zur Bestimmung der Korngrößenverteilung am einzelnen Partikel mit Hilfe optischer Verfahren

BSI British Standards

Foreword

This new Part of BS 3406, Part 7, was prepared under the direction of the General Mechanical Engineering Standards Committee and is one of a series that recommends methods for determining the size distributions of particles. Current Parts of BS 3406, including this standard, are:

Part 1 Guide to powder sampling

Part 2 Recommendations for gravitational liquid sedimentation methods for powders and suspensions

Part 3 Air elutriation methods

Part 4 Optical microscope method

Part 5 Recommendations for electrical sensing zone method (the Coulter principle)

Part 6 Recommendations for centrifugal liquid sedimentation methods for powders and suspensions

Part 7 Recommendations for single particle light interaction methods

Particle size distribution is an important basic property. Vast quantities of powdered materials are sold or processed and specifications often include average particle size and/or particle size distribution. Even when other bulk properties are specified, compliance with the specification may be at times achieved only by varying the particle size distribution. Particle size analysis is also used extensively to monitor environmental conditions and in numerous areas of scientific research. In all these contexts the reproducibility and comparability of results is of paramount importance and the use of standardized procedures is essential.

Representative sampling and correct dispersion of particulate material are prerequisites for the determination of size distribution. The procedures described in BS 3406 : Part 1 have been selected to give test portions representative of the bulk.

The techniques used to measure particle size distribution are many and are varied both in principle and in their degree of sophistication and automation. In principle, any property that depends on particle size can be used to define particle size. In practice, the methods that are widely used are both experimentally convenient and based upon a physical principle having a well defined relationship to particle size.

The choice of the most suitable method will depend on the following considerations:

(a) the purpose for which the analysis is required, e.g. quality control, research, specification requirements;

(b) wherever possible, the dimension measured should relate to the purpose for which it is required, e.g. Stokes diameter for inertial separation;

(c) the size range and other properties of the particles, e.g. density, solubility, refractive index;

(d) aggregation and dispersion characteristics of the particulate matter;

(e) the amount of material available for analysis;

(f) the method by which the particulate matter has been sampled;

(g) the conditions under which the particulate matter will be used, for example the state of dispersion in the test should be related to the state of dispersion in the application;

(h) resources available.

The microscope method is the only method in which direct observation is made of the particles. Most methods of particle size measurement ascribe a single dimension to each particle, usually expressed as the diameter of the spherical particle equivalent to some aspect of its properties, such as volume, surface, settling velocity or light scattering. Physical properties of the particles, such as solubility, friability, refractive index and conductivity, preclude the use of some methods. Nevertheless the same particles can be analysed using a range of techniques and if different size parameters are determined different size distributions will result. The intercomparison of results can only be reliable if each laboratory is using a representative sample and is measuring the same parameter by reliable equipment and procedures. Standardization between laboratories is best established by the use of certified reference materials, for example those of the Community Bureau of Reference (BCR).

Single particle light interaction methods are widely used to define the concentration and size distribution of particles suspended in various fluids. Particles can be counted and sized rapidly. In the case of light extinction, the projected area of each particle in a suspension sample is measured and presented as the diameter of a sphere giving the same projected area. In the case of light scattering the diameter presented is that of a sphere giving equal scattered light intensity. Response is affected by the size of the particle and the optical properties of the particle and surrounding medium; the latter effects can be minimized by choice of optical geometry or by suitable calibration and data processing methods. A limitation to all single particle measuring systems is that the particle concentration must be low enough to minimize particle coincidence in the view volume and electronic saturation effects.

The numbers in square brackets used throughout the text of this standard refer to the bibliographic references given in appendix D.

It has been assumed in the drafting of this British Standard that the execution of its provisions is entrusted to appropriately qualified and experienced people.

WARNING. This British Standard calls for the use of substances and/or procedures that may be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage. Attention is drawn to the specific hazards described in clause **3.**

Compliance with a British Standard does not of itself confer immunity from legal obligations.

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