International

ISO 13317-1

Determination of particle size distribution by gravitational liquid sedimentation methods —

Part 1: General principles, requirements and guidance

Détermination de la distribution granulométrique par les méthodes de sédimentation par gravité dans un liquide —

Partie 1: Principes généraux et orientation

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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 13317-1:2001), which has been technically revised.

The main changes are as follows:

— core terms and definitions have been revised;

— the explanation of measurement principle and techniques has been revised and expanded;

— sedimentation velocity as measurand has been included;

— a guide for the determination of measurement uncertainty has been included.

A list of all parts in the ISO 13317 series can be found on the ISO website.

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Gravitational sedimentation has been an established principle of particle size analysis for several decades. It is employed in various academic and industrial fields of application. Numerous national and international standards address gravitational sedimentation techniques and analytical methods.

Although manifold new particle sizing techniques have emerged during the last two decades, sedimentation techniques have been recently rediscovered. This is due to substantial technical advancements and the fact that they are based on a first-principle measurement of the particles' directed motion (migration) under gravity.

The measurands of gravitational sedimentation techniques are the distributions of sedimentation velocity and corresponding particle size. They are derived from observations of phase separation – either by monitoring the deposition of particles or the depletion of dispersion. The physical principles employed to determine the quantity of particles differ widely, whereas sedimentation velocity is in each case computed from the vertically migrated distance and measurement time. This computation does not demand essential preconditions and theoretical assumptions. Yet, the transformation of velocity into particle size relies on the applicability of Stokes' law. As fractionating technique, sedimentation analysis can distinguish between particle fractions of close sedimentation velocity. Accordingly, particle size distributions can be very finely resolved, which is an advantage compared to spectroscopic ensemble techniques.

The ISO 13317 series covers the methods to determine the distributions of sedimentation velocities and particle size of particulate materials by gravitation-induced particle migration in liquids. The direction of this motion depends on the density difference (density contrast) between dispersed and continuous phase. During the measurement, particles should not undergo any physical or chemical change in the continuous phase (liquid).

The primary measurand is the particle velocity distribution, which is converted into size distribution based on established sedimentation theory. The measurement techniques described in the ISO 13317 series are applicable to liquid dispersions, like suspensions and emulsions. The measurable particle size range depends on material properties and typically reaches from 200 nm to 100 µm for aqueous samples, whereas sedimentation velocity can be quantified in the range from 0,6 µm/s to 10 mm/s. Sedimentation analysis is conducted for low particle concentrations. The maximum permissible value depends on the measurement technique and the analysis theory. In general, the volume fraction of particles is well below 1 %.

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