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Determination of particle density by sedimentation methods —

Part 1: Isopycnic interpolation approach

Détermination de la densité de particules par méthodes de sédimentation —
Partie 1: Approche par interpolation isopycnique

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

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Foreword

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A list of all parts in the ISO 18747 series can be found on the ISO website.

Introduction

Dispersions are widely used in industry and everyday life. There is a need to understand the density of dispersed particles or droplets, e.g. for physico-chemical calculations like kinematic viscosity of dispersions (ISO 3105), determination of particle size distribution by separation techniques[4][5][7], characterization of core/shell or capsule-like particles, determination of particle compressibility[10] or optimization of dispersion stability by density matching[11].

The density of a body is its mass divided by its volume. This is straightforward for the mass of a larger body or particle. However, experimental determination of the volume of a macroscopic body is difficult. The geometrical volume (length, width and thickness) and the volume relevant for the determination of density can differ due to surface irregularities, fractures, fissures and open and closed pores or the measuring techniques employed.

Density determination of micro-particles, in particular nanoparticles dispersed in a liquid, raises issues, not only for the determination of mass and volume due to the small size but also, and mainly, because of the boundary between the liquid and the particle, which is fuzzy. Molecules in the continuous phase are partially immobilized at the surface. Physico-chemical properties (e.g. viscosity, ion concentration) in the fuzzy coat differ from bulk. This is especially important for small microparticles and nanoparticles which are dispersed in a polymer or biological fluid[12]. The so-called corona can be interpreted as an integral part of the particle and increases the effective/apparent volume compared to the space occupied by the dry material. The thickness of this layer ranges between a few to tens of nanometres and the effective/apparent volume deviates increasingly from the “geometrical” volume, if the particles become smaller. As a consequence, density determination by traditional methods is affected.