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Particle size analysis— Dynamic light scattering (DLS)

Analyse granulométrique— Dispersion lumineuse dynamique (DLD)

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CP 401 • ~~Ch. de Blandonnet 8~~
CH-1214 Vernier, Geneva
Phone: + 41 22 749 01 11

~~Email:~~

~~E-mail:~~ copyright@iso.org
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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 document 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 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 third edition cancels and replaces the second edition (ISO 22412:2017), which has been technically revised.

The main changes are as follows:

- inclusion of multi-angle **dynamic light scattering (DLS)**;
- inclusion of imaging DLS;
- addition of **Clause A.5** ~~Annex A5~~ on polarisation-separated backscatter photon cross-correlation spectroscopy;
- extension of **Annex B** ~~Annex B~~ on online measurements;
- incorporation of the content ~~off from~~ ISO TR 22814 **"Good practice for Dynamic Light Scattering (DLS) measurements"** ~~as Annex C into Annexes C and D. ISO/TR 22814 was subsequently withdrawn.~~

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.

Introduction

Particle size analysis in the sub micrometre size range is performed on a routine basis using the dynamic light scattering (DLS) method, which probes the hydrodynamic mobility of the particles. The ~~success of the~~ technique is successful because it provides estimates of the average particle size and size distribution within a few minutes, and ~~that because~~ user-friendly commercial instruments are available. Nevertheless, proper use of the instrument and interpretation of the result involve certain precautions.

The principle of DLS for a concentrated suspension is the same as for a dilute suspension. However, specific requirements for the instrument setup and specification of test sample preparation are specified for concentrated suspensions. At high concentrations, particle-particle interactions and multiple light scattering can become dominant and can result in apparent particle sizes that differ between concentrated and dilute suspensions.

DLS is also referred to as “quasi-elastic light scattering (QELS)” and “photon correlation spectroscopy (PCS)” although PCS is actually one of the measurement techniques.

Several methods have been developed for DLS. These methods can be classified in several ways:

- a) ~~a)~~ by the difference in raw data acquisition (autocorrelation, cross-correlation and frequency analysis, spatial correlation);
- b) ~~b)~~ by the difference in optical setup (homodyne mode versus heterodyne mode);
- c) ~~c)~~ by the angle of observation.

In addition, instruments show differences with respect to the type of laser source and often allow application of different data analysis algorithms ~~(e.g. cumulants, non-negative least squares (NNLS), CONTIN, etc.)~~.

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Particle size analysis — Dynamic light scattering (DLS)

1 Scope

This document specifies the application of dynamic light scattering (DLS) to the following:

- measurement of average hydrodynamic particle size;
- measurement of the size distribution of mainly sub micrometre-sized particles, emulsions or fine bubbles dispersed in liquids.

~~DLS is also referred to as “quasi-elastic light scattering (QELS)” and “photon correlation spectroscopy (PCS)”, although PCS is actually one of the measurement techniques.~~

~~This document is applicable to the measurement of a broad range of dilute and concentrated suspensions. The principle of DLS for a concentrated suspension is the same as for a dilute suspension. However, specific requirements for the instrument setup and specification of test sample preparation are specified for concentrated suspensions. At high concentrations, particle-particle interactions and multiple light scattering can become dominant and can result in apparent particle sizes that differ between concentrated and dilute suspensions.~~

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~~terminology databases for use in standardization at the following addresses:

- ~~IEC Electropedia: available at~~
- ISO Online browsing platform: available at <https://www.iso.org/obp>

~~IEC Electropedia: available at~~ <https://www.electropedia.org/3.1>

3.1 particle

minute piece of matter with defined physical boundaries

Note_1_to_entry: A physical boundary can also be described as an interface.

Note_2_to_entry: A particle can move as a unit.