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## Particle size analysis — Dynamic light scattering (DLS)

*Analyse granulométrique — Dispersion lumineuse dynamique (DLD)*



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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](http://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](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on 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 the following URL: [www.iso.org/iso/foreword.html](http://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 of ISO 22412 cancels and replaces ISO 22412:2008 and ISO 13321:1996.

## Introduction

Particle size analysis in the submicrometre 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 mainly based on the fact that it provides estimates of the average particle size and size distribution within a few minutes, and that user-friendly commercial instruments are available. Nevertheless, proper use of the instrument and interpretation of the result require certain precautions.

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

- a) by the difference in raw data acquisition (autocorrelation, cross-correlation and frequency analysis);
- b) by the difference in optical setup (homodyne versus heterodyne mode);
- 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, NNLS, CONTIN, etc.).



# Particle size analysis — Dynamic light scattering (DLS)

## 1 Scope

This document specifies the application of dynamic light scattering (DLS) to the measurement of average hydrodynamic particle size and the measurement of the size distribution of mainly submicrometre-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 actually is one of the measurement techniques.

This document is applicable to the measurement of a broad range of dilute and concentrated suspensions. The principle of dynamic light scattering 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 required 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

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 9276-1, *Representation of results of particle size analysis — Part 1: Graphical representation*

ISO 9276-2, *Representation of results of particle size analysis — Part 2: Calculation of average particle sizes/diameters and moments from particle size distributions*

## 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:

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

### 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.

[SOURCE: ISO 26824:2013, 1.1, modified]