
**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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 22412 was prepared by Technical Committee ISO/TC 24, *Particle characterization including sieving*, Subcommittee SC 4, *Sizing by methods other than sieving*.

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Introduction

Particle¹⁾ sizing in the submicrometer size range is nowadays performed on a routine basis using the dynamic light scattering (DLS) method. The success of the technique is mainly based on the fact that it provides estimates of average size and its distribution in a measurement time of a few minutes, and user-friendly commercial instruments are available. Nevertheless, proper use of the instrument and interpretation of the result require certain precautions.

To this end, ISO 13321 was developed. ISO 13321 provides the procedures necessary to allow determination of the correct particle size using the photon correlation technique. The instruments specified in ISO 13321 are restricted to low particle concentrations in order to avoid disturbances due to multiple scattering. Instruments that seek to minimize this restriction are now available. Therefore, there is a need for an International Standard for the determination of particle size by DLS suitable for a wide concentration range of dispersions that will enable users to obtain good interlaboratory agreement on accuracy and reproducibility.

Several techniques have been developed for DLS²⁾. These techniques can be classified in two ways:

- a) by the difference in data analysis (correlation method and frequency analysis method);
- b) by the difference in optical set-up (homodyne and heterodyne detection optics).

Instruments are now available with a range of fixed and movable cell options.

Although DLS allows the determination of particle size distribution, this International Standard is limited to the description of size distribution by means of only two robust descriptors: an average size and a polydispersity index. Many different methods for the calculation of full size distributions are used. However, reproducibility of the different methods of calculation for full distributions is, at present, not good enough to include in an International Standard. Therefore, today, there is no standardized algorithm that may be included in an International Standard.

1) The NIST definition of a particle is: "Any condensed-phase tridimensional discontinuity in a dispersed system may generally be considered a particle" (Reference [19]).

2) DLS probes the dynamics of time-dependent phenomena such as particle motions. DLS combined with the correlation method of data analysis is often referred to as photon correlation spectroscopy.

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Particle size analysis — Dynamic light scattering (DLS)

1 Scope

This International Standard specifies a method for the application of dynamic light scattering (DLS) to the estimation of an average particle size and the measurement of the broadness of the size distribution of mainly submicrometre-sized particles or droplets dispersed in liquids.

This International Standard is applicable to the measurement of a broad range of dilute and concentrated suspensions. The principle of DLS is the same as for a dilute dispersion. However, specific requirements for the instrument set-up and specification of test sample preparation, as well as some advice on the correct interpretation of the results of measurements for concentrated dispersions, are required.

NOTE A photon correlation spectroscopy method for dilute dispersions is specified in ISO 13321.

2 Normative references

The following referenced documents are indispensable for the application 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 13321:1996, *Particle size analysis — Photon correlation spectroscopy*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

average particle diameter

\bar{x}_{DLS}

(dynamic light scattering) harmonic intensity-weighted arithmetic average particle diameter

NOTE Average particle diameter is expressed in nanometres. Typical average particle diameters are in the range 1 nm to about 1 000 nm.

3.2

polydispersity index

PI

dimensionless measure of the broadness of the size distribution

NOTE 1 Adapted from ISO 13321:1996, 2.2.

NOTE 2 The PI typically has values less than 0,1 for a monodisperse test sample.

3.3

scattering volume

V

section of the incident laser beam viewed by the detector optics

NOTE Adapted from ISO 13321:1996, 2.3.