



BSI Standards Publication

Good practice for dynamic light scattering (DLS) measurements

National foreword

This Published Document is the UK implementation of ISO/TR 22814:2020.

The UK participation in its preparation was entrusted to Technical Committee LBI/37, Particle characterization including sieving.

In reading or applying this report, it is important to consider the following:

Section 4:

Forward angle measurements may require more scrupulous sample preparation, for example the removal of particle contamination from the cuvette.

Note: article contamination on the cuvette, or transferred from the cuvette to the sample, can cause an increase in scattering into forward angles.

The sample concentration must be appropriate for all measured angles:

- a) Multiple scattering effects are mitigated in backscatter therefore requiring less dilution than side- or forward-scattering measurements.
- b) The correct sample concentration should be determined with a dilution titration.

Section 4.2.1:

Many instruments report a size distribution, in addition to a cumulant result, from a multi-component fit to the correlogram.

Section 4.2.1:

DLS measures the hydrodynamic particle size, which includes the electrical double layer surrounding the particle. Other measurement techniques, for example laser diffraction, measure the volume equivalent particle size based on the physical dimensions of the particle itself. Hence DLS measurements are influenced by state of the suspending medium and hence sample dependant [ISO 13099-1, 2012].[1]. Therefore it should be noted that non-negligible differences in results may occur for weak ionic strengths and small particle sizes.

Section 4.2.1

Care is needed in the storage of DLS samples. It is good practice to store samples in a stable refrigerator and to securely stopper sample bottles with a minimal air-gap above the sample to avoid contamination by constituents of the surrounding air.

Section 4.2.2:

It should be noted that the scattering varies as the sixth power of the particle radius in the Rayleigh regime, where the particle diameter is $<1/10$ th of the laser wavelength.

Section 4.5.2.1:

Uncertainty in the sample temperature contributes directly to the uncertainty in the reported particle size. For instruments without

removable temperature probes it is rigorous, common practice to use reference size standards to validate instrument thermal performance.

Section 4.6.1

External fluorescent light is random and uncorrelated and therefore reduces the correlogram intercept, widely interpreted as representing the measurement signal to noise.

Foreword References

[1] Hunter, R.J., 1981. Zeta Potential in Colloid Science: Principles and Applications, Academic Press, ISBN 978-0-12-361961-7 Available from Elsevier DOI: <https://doi.org/10.1016/C2013-0-07389-6>

A list of organizations represented on this committee can be obtained on request to its secretary.

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REPORT

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**Good practice for dynamic light
scattering (DLS) measurements**

*Bonnes pratiques pour l'analyse de la dispersion lumineuse
dynamique (DLD)*



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Foreword

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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).

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This document was prepared by Technical Committee ISO/TC 24, *Particle characterization including sieving*, Subcommittee SC 4, *Particle characterization*.

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

Dynamic light scattering (DLS) is a widely used technique for the characterization of particles with equivalent hydrodynamic diameters below a few micrometres. Modern instruments allow users with minimal training or background to use this technique. The downside is that not all users are familiar with the potential pitfalls, limitations and proper interpretation of results for DLS.

Therefore, this document has been developed as a guidance for good practice in DLS and complements ISO 22412:2017.

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Good practice for dynamic light scattering (DLS) measurements

1 Scope

This document provides practical guidance for performing and interpreting measurements using dynamic light scattering (DLS) that goes beyond the treatment of measurement artefacts in ISO 22412:2017.

This document is intended to help users with experiments planning, in particular with respect to obtaining the necessary information on the sample and deciding whether DLS is the most appropriate method. It provides information on how to prepare samples in an appropriate way, verify the proper functioning of the instrument and interpret the data correctly, including ways to assess data quality.

This document focuses on the practical steps required to obtain DLS results of good quality, rather than on theoretical considerations, and covers not only the measurement of solid particles, but also emulsions and bubbles.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

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

4 Instrument types

4.1 General

A discussion on what constitutes good practices requires knowledge of the instrument type being considered. Different optical configurations require different adjustment to control the optical layout; different signal processing techniques require different techniques to allow for background conditions; different analysis techniques require different conditioning parameters of the processed signal. Two commonly applied variants are homodyne detection with correlation function processing (see ISO 22412:2017, 9.2) and heterodyne detection with frequency spectrum processing (see ISO 22412:2017, 9.3).

Additionally, good practice, as it relates to instrument type, also depends on the scattering angle used for the measurement. For instance large spurious particles generally scatter more power into forward angles than higher angles, so that samples measured in forward-scatter typically require significantly more care regarding the cleanliness of the cuvette used, prior to filling with sample, the filtering of the sample between the particle size distribution (PSD) of interest and unwanted large size fractions and the dispensing to waste of the first few drops of sample from a syringe filter to remove filter spoil. Additionally, the single-scattering relaxation time is known to be well approximated by higher order scattering from concentrated samples as the scattering angle approaches 180°, thereby allowing the characterization in backscatter of concentrated samples, so long as bulk scattering losses through