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NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 29022-2021

Particle size analysis - Dynamic light scattering (DLS)

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foreword

This document is in accordance with the provisions of GB/T 1:1-2020 "Guidelines for Standardization Work Part 1: Structure and Drafting Rules of Standardization Documents"

drafted:

This document replaces GB/T 29022-2012 "Dynamic Light Scattering (DLS) for Particle Size Analysis": Compared with GB/T 29022-2012,

In addition to structural adjustments and editorial changes, the main technical changes are as follows:

--- Changed the documents in the normative reference documents (see Chapter 2, Chapter 2 of the:2012 edition);

--- Increase the terms and definitions of particles, average hydrodynamic particle size, reference materials, certified reference materials (see Chapter 3);

--- Added the description of the names and units of I0, M, Gammamax, Gammamin (see Table 1);

---In the "Principle" chapter, the description of the upper limit of particle size measurement and the measurement of flow samples has been added (see Chapter 5);

--- Added the description of "Cross-correlation detection method", and gave the light path diagram (see 6:2);

--- Added calculation methods for autocorrelation function, signal power spectrum and cross-correlation method (see 6:6);

--- Changed the requirements for the dispersion medium, and added the method of compressing or reducing the electric double layer (see 7:1, 8:2 of the:2012 edition);

--- Added general requirements for upper and lower limits of sample concentration (see 7:2);

--- Added routine inspection methods for the suitability of sample concentrations, providing guidance on the selection of sample concentrations (see 7:3);

---The measurement steps were refined and the following contents were added: the selection method of the sample measurement cell, the sample cavity temperature sensorless instrument

Sample temperature control and measurement methods, information to be recorded, method for checking the average scattering intensity of the sample (see Chapter 8);

--- Delete the calculation of average particle size and polydispersity index (see Chapter 6 of the:2012 edition), and perform several existing standardization algorithms:

Inductive summary (see Chapter 9);

--- Changed the system confirmation method, and added the method example of system confirmation (see Chapter 10 of 10:1,:2012 edition);

--- Added the item "Quality Control of Measurement Results", and gave the corresponding technical method (see 10:2);

--- Increased the "method precision and measurement repeatability" entry, and gave the repeatability and reproducibility requirements (see 10:3):

This document is equivalent to ISO 22412:2017 "Dynamic Light Scattering (DLS) for Particle Size Analysis":

Please note that some content of this document may be patented: The issuing agency of this document assumes no responsibility for identifying patents:

Introduction

Dynamic light scattering (DLS) has become a routine method for measuring particle hydrodynamic diameters in the submicron range: this technology

The main success of the application lies in the introduction of convenient commercial instruments that can obtain the average particle size and its distribution in a few minutes: Although if

Therefore, it is still necessary to take relevant measures to ensure the correct use of the instrument and the reasonable interpretation of the measurement results:

Various measurement methods have been developed for the principle of dynamic light scattering, which can be divided into the following categories:

0:1 Different raw data acquisition methods (autocorrelation method, cross-correlation method, spectrum analysis method)

0:2 Different optical path designs (homodyne and heterodyne)

0:3 Different detection angles

In addition, due to the type of laser light source and the operation processing method [cumulant method, non-negative least squares (NNLS), normalization method

(CONTIN), etc:], there are also some differences between different types of instruments:

Particle Size Analysis Dynamic Light Scattering (DLS)

1 Scope

This document specifies the use of Dynamic Light Scattering (DLS) for the measurement of submicron particles, emulsions or fine air bubbles dispersed in a liquid:

The mean hydrodynamic particle size and particle size distribution method: DLS is also known as "Quasi-Elastic Light Scattering (QELS)" and "Photon Correlation Spectroscopy"

method (PCS)", although Photon Correlation Spectroscopy is actually one of the measurement techniques:

This document applies to the measurement of diluted and concentrated suspensions over a wide concentration range: When measuring high and low concentration samples, DLS uses the same

However, high-concentration samples have special requirements on instrument structure and sample preparation: At high concentrations, particle-to-particle interactions

The dominant effect of multi-scattering and high-concentration samples appears, which can lead to significant differences in particle size measurement results between high and low concentration samples:

2 Normative references

The contents of the following documents constitute essential provisions of this document through normative references in the text: Among them, dated citations

documents, only the version corresponding to that date applies to this document; for undated references, the latest edition (including all amendments) applies to

this document:

ISO 9276-1 Representation of particle size analysis results - Part 1: Graphical characterization (Representationofresultsofparticlesize

analysis-Part 1:Graphicalrepresentation)

Note: GB/T 15445:1-2008 Representation of Particle Size Analysis Results Part 1: Graphical Characterization (ISO 9276-1:1998, IDT)

ISO 9276-2 Representation of the results of particle size analysis - Part 2: Calculation of

mean particle size/diameter and individual moments (Repre-

sentationofresultsofparticlesizeanalysis-Part 2:Calculationofaverageparticlesizes/diameters

andmomentsfromparticlesizedistributions)

Note: GB/T 15445:2-2006 Representation of the results of particle size analysis Part 2: Calculate the average particle size/diameter and the moments of each order from the particle size distribution (ISO 9276-

2:2001, IDT)

3 Terms and Definitions

The following terms and definitions apply to this document:

3:1

particle

Tiny matter with well-defined physical boundaries:

Note 1: Physical boundaries can also be described as interfaces:

Note 2: Particles can move as a whole:

Note 3: Also known as particles:

[Source: ISO 26824:2013, 1:1, with modifications]

3:2

average hydrodynamic diameter

xDLS

The hydrodynamic diameter reflecting the median of the particle size distribution:

Note 1: The average particle size is directly determined, either without calculating the particle size distribution, or from the intensity-weighted distribution, volume-weighted distribution or number-weighted distribution, and the

Calculated from the combined (transformed) density function: The exact meaning of the mean particle size of the particles depends on the calculation method: