

---

---

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

*Analyse granulométrique — Dispersion lumineuse dynamique (DLD)*



Reference number  
ISO 22412:2017(E)



**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2017, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office  
Ch. de Blandonnet 8 • CP 401  
CH-1214 Vernier, Geneva, Switzerland  
Tel. +41 22 749 01 11  
Fax +41 22 749 09 47  
copyright@iso.org  
www.iso.org

# Contents

Page

<b>Foreword</b>	<b>iv</b>
<b>Introduction</b>	<b>v</b>
<b>1 Scope</b>	<b>1</b>
<b>2 Normative references</b>	<b>1</b>
<b>3 Terms and definitions</b>	<b>1</b>
<b>4 Symbols and units</b>	<b>3</b>
<b>5 Principle</b>	<b>4</b>
<b>6 Apparatus</b>	<b>5</b>
<b>7 Test sample preparation</b>	<b>7</b>
7.1 General	7
7.2 Concentration limits	7
7.3 Checks for concentration suitability	7
<b>8 Measurement procedure</b>	<b>8</b>
<b>9 Evaluation of results</b>	<b>10</b>
9.1 General	10
9.2 Correlation analysis	11
9.2.1 Cumulants method	11
9.2.2 Distribution calculation algorithms	11
9.3 Frequency analysis	12
<b>10 System qualification and quality control</b>	<b>13</b>
10.1 System qualification	13
10.2 Quality control of measurement results	13
10.3 Method precision and measurement uncertainty	14
<b>11 Test report</b>	<b>14</b>
<b>Annex A (informative) Theoretical background</b>	<b>16</b>
<b>Annex B (informative) Guidance on potential measurement artefacts and on ways to minimize their influence</b>	<b>25</b>
<b>Annex C (informative) Online measurements</b>	<b>28</b>
<b>Annex D (informative) Recommendations for sample preparation</b>	<b>29</b>
<b>Bibliography</b>	<b>33</b>

## 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.).

