# INTERNATIONAL STANDARD



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# Particle size analysis — Image analysis methods —

Part 1: Static image analysis methods

Analyse granulométrique — Méthodes par analyse d'images — Partie 1: Méthodes par analyse d'images statiques



Reference number ISO 13322-1:2004(E)

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## Contents

Forewo	ord	iv
Introdu	iction	v
1	Scope.	1
2	Normative references	1
- 3 3.1 3.2 4 4.1 4.2 5 5.1 5.2 5.3	Terms, abbreviated terms, definitions, and symbols Terms, abbreviated terms and definitions Symbols Sample preparation demands for method description General recommendations Suggested preparation methods Image capture General Procedures Operating conditions for an image capture instrument	1 3 4 4 5 6 7 7
6 6.1 6.2 6.3	Microscopy and image analysis General Size classes and magnification	8 8 9 9
7	Calculation of the particle size results	13
8 Annex	Test report	13
AIIIIGA	diameter	15
Annex	B (normative) Operating magnification	34
Annex	C (normative) Resolution and sizing limits for typica objective lenses	35
Annex	D (informative) Flow chart showing a typical image analysis method	36
Annex	E (informative) Statistical tests of mean and variance — Analysis of variance and multiple comparisons	37
Bibliog	jraphy	39

### 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 Maison 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 convertees 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 applora 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 13322-1 was prepared by Technical Committee ISO/TC 24, Sieves, sieving and other sizing methods, Subcommittee SC 4, Sizing by methods other than sieving.

s gen. Fruiew Oeneration by the office of th C ISO 13322 consists of the following parts, under the general title Particle size analysis - Image analysis methods: methods:

- Part 1: Static image analysis methods
- Part 2: Dynamic image analysis methods

### Introduction

The purpose of this part of ISO 13322 is to give guidance for a measurement description and its validation when determining particle size by image analysis.

Image analysis is technique used in very different applications on image material with variations in material properties. Hence is not relevant to describe an exact standard method for determination of particle size by image analysis. The aim of this part of ISO 13322 is limited to give a standardized description of the technique used and a standardized validation.

This part of ISO 1332 bcludes methods of calibration verification using a certified standard graticule as a reference or by using certified standard particles. It is sensible to make some measurements on particles, or other reference objects, of known size so that the likely systematic uncertainties introduced by the equipment can be calculated.

This part of ISO 13322 gives a recommendation for a precise description of the distribution including the number of analyzed particles and an analysis window to make sure that the obtained information is valid.

Measurement of particle-size distributions by microscopy methods is apparently simple, but because only a small amount of sample is examined, considerable care has to be exercised in order to ensure that the analysis is representative of the bulk sance. This can be demonstrated by splitting the original sample and making measurements on three or more parts. Statistical analysis of the data, for example using the Student's *t*-test, will reveal whether the samples are truly to presentative of the whole.

 $\mathbf{O}$ Errors introduced at all stages of the analysis from sub-division of the sample to generation of the final result add to the total uncertainty of measurement and it is important to obtain estimates for the uncertainty arising from each stage. Indications where this is required are given at the appropriate point in the method.

Because of the diverse range of equipment and sample or paration expertise available, it is not intended to give a prescriptive procedure where use of individual methods does not jeopardize the validity of the data. However, essential operations are identified to ensure that measurements made conform to this part of ISO 13322 and are traceable.

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# Particle size analysis — Image analysis methods —

# Part 1: Static image analysis methods

#### 1 Scope

This part of ISO 13322 is applicable to the analysis of images for the purpose of determining particle size distributions. The particles are appropriately dispersed and fixed on an optical or electron microscope sample stage such as glass slides, stubs, filters, etc. Image analysis can recover particle images directly from microscopes or from photomicrographs.

Even though automation of the analysis is possible, this technique is basically limited to narrow size distributions of less than an order of magnitude. A standard deviation of 1,6 of a log-normal distribution corresponds to a distribution of less than 10:1 in size. Such a narrow distribution requires that over 6 000 particles be measured in order to obtain a repeatable volume-mean diameter. If reliable values are required for percentiles, e.g.  $D_{90}$  or other percentiles, at least 61 000 particles must be measured. This is described in Annex A.

#### 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undate perferences, the latest edition of the referenced document (including any amendments) applies.

ISO 9276-1, Representation of results of particle size analysis wart 1: Graphical representation

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

#### 3 Terms, abbreviated terms, definitions and symbols

#### 3.1 Terms, abbreviated terms and definitions

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

#### 3.1.1

#### view field

field which is viewed by a viewing device, e.g. optical microscope or electron scanning microscope

#### 3.1.2

#### measurement frame

field in a view field in which particles are counted for image analysis

NOTE The set of measurement frames composes the total measurement field.