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Fine bubble technology — Characterization of fine bubbles —

Part 1: Evaluation of size and concentration indices by laser diffraction method

Technologie des fines bulles — Caractérisation des fines bulles —

Partie 1: Évaluation des indices de concentration et de taille par diffraction laser

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Contents

Page

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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For an explanation of 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 281, *Fine bubble technology*.

A list of all parts in the ISO 24218 series can be found on the ISO website.

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

Fine bubble technology has seen growth in its application to markets such as cleaning, water treatment, agriculture, aquaculture and biomedical fields. Now the methods to evaluate the characteristics of fine bubbles such as the size and concentration indices become necessary to clarify the performances of fine bubble generating systems used for various applications.

The shape of the size distribution of fine bubble dispersions (FBD) can be bimodal or multimodal, and this distribution can extend broadly from ultrafine bubble (UFB) range to microbubble (MB) range.

To evaluate the relationship between the characteristics of fine bubbles and their effects, it should be considered that the respective modes of multimodal size distribution can have their independent contributions to the total performance of fine bubbles.

The laser diffraction method can evaluate multimodal size distributions from the range of UFB (<1 μm) to that of MB (on the micron scale).

Due to the nature of number-based size distribution, any examination of a sample on a number basis which mixes populations of ultrafine and micro bubbles is unduly weighted to the fraction of smaller size bubbles (ultrafine bubbles). The important fraction of larger size bubbles (micro bubbles) can therefore be lost. At the viewing of size distribution data, the confirmation of its dimension (number basis or volume basis) is necessary. Moreover, the suitability of approach about the dimension of size distribution should be taken into consideration in terms of what it can do to the size distribution and what is the most appropriate approach for the application under evaluation.

This document is intended to specify the evaluation of fine bubbles size and concentration indices by combined use of number-based size analysis and volume-based size analysis by laser diffraction method. Both bimodal and multimodal samples are appropriate. It is applicable to fine bubbles with and without shell over a size range which includes UFB and MB dispersions and any combination thereof.

Fine bubble technology — Characterization of fine bubbles —

Part 1: Evaluation of size and concentration indices by laser diffraction method

1 Scope

This document specifies the evaluation of fine bubbles size and concentration indices applied to the combined use of number-based size analysis and volume-based size analysis by the laser diffraction method. The methodology described is appropriate to both bimodal and multimodal samples over a broad size range (from tens of nanometers to tens of micrometers) and applies to ultrafine bubble and microbubble dispersions (MBD) and mixtures thereof.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 20480-1, *Fine bubble technology — General principles for usage and measurement of fine bubbles — Part 1: Terminology*

ISO 20298-1:2018, *Fine bubble technology — Sampling and sample preparation for measurement — Part 1: Ultrafine bubble dispersion in water*

ISO 21910-1, *Fine bubble technology — Characterization of microbubbles — Part 1: Off-line evaluation of size index*

ISO 13320, *Particle size analysis — Laser diffraction methods*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 20480-1 and the following apply.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
fine bubble dispersion
FBD
liquid which contains fine bubbles

[SOURCE: ISO 20298-1:2018, 3.1]