
**Fine bubble technology — Storage
and transportation of ultrafine bubble
dispersion in water**

*Technologie des fines bulles — Conservation et transport d'ultrafines
bulles en dispersion dans l'eau*



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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).

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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*.

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 applications have grown steadily in recent years. They now embrace a diverse range of industrial activities from enhancing the growth rates of plants in agriculture to the separation peel-off of solar panel silicon wafers in semiconductor manufacturing process.

Improved advanced cleaning purification of waste water and enhanced high throughput removal of lubricant oil on machined works and of salt stains from a surface of traffic infrastructures, have also been demonstrated.

Most of these applications are currently limited to the site where the generating system of fine bubble water is installed close to the application objects and operated simultaneously to the application. Expansion for applications where the site of bubble application is different from that of generation is being implemented by some innovative industries, but there are currently no concrete guidelines for storage and transportation of fine bubble water, as typical ultrafine bubbles (UFB) are known to have high stability once generated. The purpose of this document is to expand the scope of application of initial measurements of fine bubble quality downstream in the supply chain.

This document specifies the requirements related to the planning, equipment and operation process necessary to store and transport ultrafine bubble dispersions without significant deterioration in terms of number concentration index. This document is intended to help assessing the acceptable conditions and periods for storage and transportation that guarantee integrity of ultrafine bubble quality.

Fine bubble technology — Storage and transportation of ultrafine bubble dispersion in water

1 Scope

This document describes the procedures and equipment for storage and transportation of ultrafine bubble dispersions in water and specifies the related requirements in order to maintain such bubble characteristics as size and number concentration.

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*

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 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/>

3.1

water diluent

homogeneous water which is used for the dilution without causing any deleterious effects and whose number concentration of ultrafine bubbles is known

Note 1 to entry: Water diluent is used to decrease the number concentration of ultrafine bubbles in a dispersion without changing their total number, state of aggregation with particles, size or surface chemistry.

Note 2 to entry: Water diluent is called blank water when its number concentration of ultrafine bubbles is known to be zero and when it is used for the evaluation of ultrafine bubbles.

3.2

ultrafine bubble dispersion

UFBD

liquid which contains ultrafine bubbles

4 Substance for storage and transportation

The liquid to be stored and transported shall be UFBD in water with long intrinsic bubble number concentration stability sufficient for storage and transportation. The water shall not contain any chemically active compound that could damage containers under specified conditions nor any bacterial objects that would change the chemical or physical characteristics of UFBD. The water is recommended to be Grade 1, 2 or 3 defined by ISO 3696. The gas shall not be any chemically and physically active medium that could damage containers under specified conditions.