



**BSI Standards Publication**

# **Fine bubble technology — Evaluation method for determining surface tension of ultrafine bubble dispersions**

---

# National foreword

This British Standard is the UK implementation of ISO 7392:2024.

The UK participation in its preparation was entrusted to Technical Committee LBI/50, Fine Bubble Technology (FBT).

A list of organizations represented on this committee can be obtained on request to its committee manager.

## Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient's own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

© The British Standards Institution 2024  
Published by BSI Standards Limited 2024

ISBN 978 0 539 22654 6

ICS 07.030

**Compliance with a British Standard cannot confer immunity from legal obligations.**

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 April 2024.

## Amendments/corrigenda issued since publication

| Date | Text affected |
|------|---------------|
|------|---------------|



**International  
Standard**

**ISO 7392**

**Fine bubble technology —  
Evaluation method for determining  
surface tension of ultrafine bubble  
dispersions**

**First edition  
2024-04**

Reference number  
ISO 7392:2024(en)

© ISO 2024  **Documents**  
Document Sharing Hub



**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2024

All rights reserved. Unless otherwise specified, or required in the context of its implementation, 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  
CP 401 • Ch. de Blandonnet 8  
CH-1214 Vernier, Geneva  
Phone: +41 22 749 01 11  
Email: [copyright@iso.org](mailto:copyright@iso.org)  
Website: [www.iso.org](http://www.iso.org)

Published in Switzerland

© ISO 2024 – All rights reserved

# 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 Apparatus</b>                                                                                 | <b>2</b>  |
| 4.1 General                                                                                        | 2         |
| 4.2 Wilhelmy method                                                                                | 2         |
| 4.3 du Noüy method                                                                                 | 2         |
| 4.4 Pendant drop method                                                                            | 2         |
| <b>5 Procedure</b>                                                                                 | <b>2</b>  |
| 5.1 Testing environment                                                                            | 2         |
| 5.2 Temperature measurement                                                                        | 2         |
| 5.3 Handling of the sample                                                                         | 3         |
| 5.4 Cleaning of the measuring unit                                                                 | 3         |
| 5.4.1 Cleaning of the plate and ring                                                               | 3         |
| 5.4.2 Cleaning of the measuring cup and syringe                                                    | 3         |
| 5.5 Determination                                                                                  | 3         |
| 5.6 Measurement of blank water                                                                     | 3         |
| <b>6 Calculation and expression of results</b>                                                     | <b>3</b>  |
| <b>7 Test report</b>                                                                               | <b>4</b>  |
| <b>Annex A (informative) Specifications for commercially available measurement instruments</b>     | <b>5</b>  |
| <b>Annex B (informative) Feature of the measurement methods</b>                                    | <b>6</b>  |
| <b>Annex C (informative) Measurement results under various measuring conditions</b>                | <b>12</b> |
| <b>Annex D (informative) Variation in surface tension of surfactant solution diluted with UFBD</b> | <b>16</b> |
| <b>Bibliography</b>                                                                                | <b>20</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 document 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)).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at [www.iso.org/patents](http://www.iso.org/patents). ISO shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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](http://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](http://www.iso.org/members.html).

## Introduction

Ultrafine bubble (UFB) dispersion in water has been used to take advantage of UFB's ability to slip into narrow space in various technologies such as desalting from the surface of concrete structure, scrubbing a stain on the floor of restroom, since the early period in the development of UFB technology. Recently some appliances such as showerhead and washing machine have installed a nozzle to generate UFBs. The mechanism of removing substances by UFBs is still under investigation, however, squeezing of bubbles between substrate and substances to be removed is presumed to play an important role. Surface tension is inferred to be one of the basic characteristics pertinent to such behaviour of UFBs.

The standardization of measuring method for surface tension is necessary to evaluate the performance of those products using UFBs. The application of measurement technique of surface tension to UFB dispersion in water requires however, special attention to the fact that the change in surface tension caused by UFBs is rather small compared to that caused by surface active agent. Furthermore, UFB dispersion in water is a mixture of water, UFBs and impurities in water, and hence its surface tension can behave in a different manner compared to that of pure material or homogeneous solution.

This document is intended to specify the evaluation method of surface tension of UFB dispersion in water using three measurement methods, Wilhelmy, du Noüy and the pendant drop method, which have been chosen from those widely used in industries. The standardized evaluation method also enables to measure the surface tension of liquid containing UFB dispersion in dilute surfactant water such as detergent or machining coolant, leading to an easy choice for surfactant matching to UFBs.



# Fine bubble technology — Evaluation method for determining surface tension of ultrafine bubble dispersions

## 1 Scope

This document specifies evaluation methods for surface tension of ultrafine bubble (UFB) dispersion in water.

Three test methods, Wilhelmy, du Noüy and the pendant drop method, are adopted because of their advantages to detect small change in surface tension by UFB dispersion in water and the high accessibility to commercially available instruments.

This document can be used to measure the surface tension of liquid containing UFB dispersion in dilute surfactant water solution such as detergent or machining coolant as well as UFB dispersion in water.

NOTE Measurement data of liquid containing UFB dispersion in dilute surfactant water solution are summarized in [Annex D](#).

## 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 304:1985, *Surface active agents — Determination of surface tension by drawing up liquid films*

ISO 19403-3:2017, *Paints and varnishes — Wettability — Part 3: Determination of the surface tension of liquids using the pendant drop method*

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 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

#### UFB dispersion

UFBD

liquid which contains ultrafine bubbles

[SOURCE: ISO 21255:2018, 3.2<sup>[1]</sup>]