International Standard

ISO 14880-4

Second edition
2024-11

Optics and photonics — Microlens arrays —

Part 4: Test methods for geometrical properties

Optique et photonique — Réseaux de microlentilles —

Partie 4: Méthodes d'essai pour les propriétés géométriques

Reference number
ISO 14880-4:2024(en)

© ISO 2024



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
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword ..... **iv**
Introduction ..... **v**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **1**
4 Coordinate system **3**
5 Test methods **3**
5.1 Pitch and surface modulation depth measurement 3
5.1.1 Use of stylus instrument 3
5.1.2 Use of confocal microscope 5
5.2 Physical thickness 8
5.2.1 Principle 8
5.2.2 Set-up and preparation 8
5.3 Radius of curvature 8
5.3.1 Principle 8
5.3.2 Measurement arrangement and test equipment 9
5.4 Surface preparation of microlens array for measurement 11
6 Procedure **11**
6.1 Measurement of pitch and surface modulation depth (lens sag) 11
6.1.1 Preliminary measurements 11
6.2 Making measurements and interpreting the results 11
6.3 Measurement of physical thickness 12
6.4 Measurement of radius of curvature 12
7 Results and uncertainties **12**
8 Test report **13**
Annex A (informative) **Measurement with a Fizeau interferometer system** **14**
Annex B (informative) **Uniformity of array spacing** **17**
Bibliography **20**

© ISO 2024 – All rights reserved

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).

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. 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.

This document was prepared by Technical Committee ISO/TC 172, *Optics and Photonics*, Subcommittee SC 9, *Laser and electro-optical systems*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 123, *Lasers and photonics,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 14880-4:2006), which has been technically revised.

The main changes are as follows:

— Introduction revised;

— Updated the references to terms defined in 14880-1;

— Figure 8 replaced;

— References updated.

A list of all parts in the ISO 14880 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.

© ISO 2024 – All rights reserved

Introduction

Examples of applications for microlens arrays include three-dimensional displays, coupling optics associated with arrayed light sources and photo-detectors, enhanced optics for liquid crystal displays, and optical parallel processor elements.

The market in microlens arrays has generated a need for agreement on basic terminology and test methods. Standard terminology and clear definitions are needed not only to promote applications but also to encourage scientists and engineers to exchange ideas and new concepts based on common understanding.

This document contributes to the purpose of the series of ISO 14880 standards, which is to improve the compatibility and interchangeability of lens arrays from different suppliers and to enhance development of the technology using microlens arrays.

Characteristic parameters are defined and examples of applications given in ISO 14880-1. It has been completed by a set of three other International Standards, i.e. ISO 14880-2, ISO 14880-3 and ISO 14880-4.

The measurement of physical characteristics of pitch and surface modulation depth can be made using a stylus instrument and non-contact optical probe system. Physical thickness can be measured with a micrometer. The measurement processes are described in the body of this document.

© ISO 2024 – All rights reserved

Optics and photonics — Microlens arrays —

Part 4: Test methods for geometrical properties

1 Scope

This document specifies methods for testing geometrical properties of microlenses in microlens arrays. It is applicable to microlens arrays with very small lenses formed on one or more surfaces of a common substrate and to graded-index microlenses.

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 14880-1, *Optics and photonics — Microlens arrays — Part 1: Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 14880-1 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/

NOTE 1 The symbols adopted for this document are chosen for clarity in this application to microlens arrays but some may not be those commonly used for surface texture measurement.

NOTE 2 The parameters P_x, P_y and h are used in this document to describe geometrical parameters encountered in the measurement of surface texture. P_x, P_y are spacing parameters and are defined as the average value of the length of the mean line section containing a profile peak and adjacent valley. An amplitude parameter, h, is defined as the average difference between peak of the lens profile and the rim. Figure 1 illustrates the geometrical properties of microlens arrays which are to be measured.

3.1
pitch
P_x, P_y
distance between the centres of adjacent lenses which may vary across the array and will vary with direction

Note 1 to entry: See Figure 1.

Note 2 to entry: The pitch is expressed in millimetres.

[SOURCE: ISO 14880-1:2019, 3.4.1.5]

Note 3 to entry: For a stylus instrument this will generally equate to the mean width of the profile elements, Rsm, calculated from the roughness profile (see ISO 21920-2:2021, 3.1.14.3).

© ISO 2024 – All rights reserved