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Optics and photonics — Microlens arrays —

Part 3: Test methods for optical properties other than wavefront aberrations

Optique et photonique — Réseaux de microlentilles —

Partie 3: Méthodes d'essai pour les propriétés optiques autres que les aberrations du front d'onde

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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 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).

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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 14880-3:2006), which has been technically revised.

The main changes are as follows:

— Introduction revised;

— Reference documents and numbering 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.

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Introduction

This document specifies methods of testing optical properties, other than wavefront aberrations, of microlens arrays. 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[12][13][15][16].

The testing of microlenses is in principle similar to testing any other lens. The same parameters need to be measured and similar techniques used. However, in many cases the measurement of very small lenses presents practical problems which make it difficult to use the standard equipment that is available for testing normal size lenses[15][16].

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.

This document describes the measurement of 1) focal length, 2) coupling efficiency, 3) imaging quality and 4) focal spot positions.

The focal length of the microlens is defined more precisely in 14880-1 as effective back (front) focal length.

The measurement of effective back (front) focal length is described in the body of this part of ISO 14880 and the use of an alternative technique, interferometry, is described in Annex A.

Measurement of the focal length of an array of microlenses, using a confocal technique, is described in the main body and Annex B.

Coupling efficiency and imaging quality are discussed in Annex C.

Measurement of the focal spot positions of an array of microlenses in parallel, using the Shack-Hartmann technique, is described in Annex D.

Wavefront aberrations and characteristics other than optical properties are specified in ISO 14880-2 and ISO 14880-4 and ISO/TR 14880-5.

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Optics and photonics — Microlens arrays —

Part 3: Test methods for optical properties other than wavefront aberrations

1 Scope

This document specifies methods for testing optical properties, other than wavefront aberrations[1] 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*

ISO 10110-5, *Optics and photonics — Preparation of drawings for optical elements and systems — Part 5: Surface form tolerances*

3 Terms and definitions

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

4 Substrate test

The optical quality of the substrate contributes to the quality of the focal positions defined by the microlenses and shall be quantified in accordance with ISO 10110-5.

5 Microscope test method

5.1 Principle

The basic principle is to locate, by optical means, the surface of the microlens under test. The effective back (front) focal length is determined by measuring the axial displacement necessary to locate the focal position.

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