SLOVENSKI STANDARD
SIST EN ISO 14880-2:2007

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Optika in fotonska tehnologija - Vrste mikroleļ - 2. del: Preskusne metode za ugotavljanje odstopanja valovne fronte (ISO 14880-2:2006)

Optics and photonics - Microlens arrays - Part 2: Test methods for wavefront aberrations (ISO 14880-2:2006)

Optik und Photonik - Mikrolinsenarrays - Teil 2: Prüfverfahren für Wellenfrontaberrationen (ISO 14880-2:2006)

Optique et photonique - Réseaux de microlentilles - Partie 2: Méthodes d'essai pour les aberrations du front d'onde (ISO 14880-2:2006)

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31.260	Optoelektronika, laserska oprema	Optoelectronics. Laser equipment

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Optics and photonics - Microlens arrays - Part 2: Test methods for wavefront aberrations (ISO 14880-2:2006)

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This European Standard was approved by CEN on 12 November 2006.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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Foreword

The text of ISO 14880-2:2006 has been prepared by Technical Committee ISO/TC 172 "Optics and optical instruments" of the International Organization for Standardization (ISO) and has been taken over as EN ISO 14880-2:2006 by Technical Committee CEN/TC 123 "Lasers and photonics", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2007, and conflicting national standards shall be withdrawn at the latest by June 2007.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Endorsement notice

The text of ISO 14880-2:2006 has been approved by CEN as EN ISO 14880-2:2006 without any modifications.

INTERNATIONAL STANDARD

ISO 14880-2

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Optics and photonics — Microlens arrays —

Part 2: Test methods for wavefront aberrations

Optique et photonique — Réseaux de microlentilles —
Partie 2: Méthodes d'essai pour 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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 14880-2 was prepared by Technical Committee ISO/TC 172, *Optics and photonics*, Subcommittee SC 9, *Electro-optical systems*.

ISO 14880 consists of the following parts, under the general title *Optics and photonics — Microlens arrays*:

— *Part 1: Vocabulary*

— *Part 2: Test methods for wavefront aberrations*

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

— *Part 4: Test methods for geometrical properties*

Introduction

This part of ISO 14880 specifies methods of testing wavefront aberrations for microlens arrays. Examples of microlens array applications include three-dimensional displays, coupling optics associated with arrayed optical radiation sources and photo-detectors, enhanced optics for liquid crystal displays, and optical parallel processor elements.

The market in microlens arrays is generating an urgent need for agreement on basic terminology and test methods for a definition of the microlens array itself. Standard terminology and a clear definition are needed not only to promote applications but also to encourage scientists and engineers to exchange ideas and new concepts based on common understanding.

Microlenses are used as single lenses and in arrays of two or more lenses. The characteristics of the lenses are fundamentally evaluated with a single lens. Therefore, it is important that the basic characteristic of a single lens can be evaluated first. However, if a large number of lenses is formed on a single substrate, the measurement of the whole array will incur a lot of time and cost. Furthermore, methods for measuring lens shapes are essential as a production tool.

Appraisal methods of the characteristic parameters are defined by ISO 14880-1, *Vocabulary*. It has been completed by a set of three other International Standards, i.e. Part 2, *Test methods for wavefront aberrations*, Part 3, *Test methods for optical properties other than wavefront aberrations* and Part 4, *Test methods for geometrical properties*.

This part of ISO 14880 specifies methods for measuring wavefront quality. Wavefront quality is the basic performance characteristic of a microlens. Characteristics other than wavefront aberrations are specified in ISO 14880-3 and ISO 14880-4.

Optics and photonics — Microlens arrays —

Part 2:
Test methods for wavefront aberrations

1 Scope

This part of ISO 14880 specifies methods for testing wavefront aberrations for microlenses within microlens arrays. It is applicable to microlens arrays with very small lenses formed inside or on one or more surfaces of a common substrate.

2 Normative references

The following referenced documents are indispensable for the application 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 14880-1:2001, *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 apply.

4 Symbols and abbreviated terms

Table 1 — Symbols, abbreviated terms and units of measure

Symbol	Unit	Term
Φ	λ	wavefront aberration
$\Phi_{P\text{-}V}$	λ	peak-to-valley value of wavefront aberration
Φ_{rms}	λ	root-mean-square value of wavefront aberration
λ	µm	wavelength
Θ	degree	acceptance angle
NA	none	numerical aperture

5 Apparatus

5.1 General

The test system consists of a source of optical radiation, a collimator lens, a method of limiting the measurement aperture, a sample holding apparatus, imaging optics, an image sensor and an interference pattern analyser system.

5.2 Standard optical radiation source

A source of optical radiation shall be used, which is suitable for the testing of wavefront aberrations of microlenses. The aberrations of the wavefront at the operational wavelength impinging on the test equipment shall have a rms deviation of $\leqslant \lambda/10$ over the effective aperture of the microlens to be tested.

Properties of the source to be specified include centre wavelength, half-width of the spectrum, the type of optical radiation source, states of polarization (randomly polarized optical radiation, linearly polarized optical radiation, circularly polarized optical radiation, etc.), radiance angle (in mrad), spot size or beam waist parameters. Otherwise, the specification of the radiation source shall be described in the documentation of the experimental results.

NOTE 1 Usually, He-Ne gas lasers are used. Other gas lasers, solid-state lasers, semiconductor lasers (LD), and light emitting diodes (LED) are also used.

NOTE 2 LDs and LEDs are used together with a suitable optical wavefront aberration compensation system.

5.3 Standard lens

Where a standard lens is used as a reference or for generating an ideal spherical wave, the wavefront aberrations of the standard lens shall be smaller by at least one order of magnitude compared to that of the lens to be tested or shall be $\leqslant \lambda/10$ rms deviation.

The objective lens of an optical microscope used as the standard lens shall be specified with the effective numerical aperture. The following shall be given:

— effective aperture;

— effective focal length at the operational wavelength.

The test geometry for the measurement of the wavefront aberrations is restricted to the case ∞/f for the conjugates of the lens.

5.4 Collimator

The collimator optics shall have a numerical aperture greater than the maximum numerical aperture of the test sample sufficient to avoid effects due to diffraction. The wavefront aberrations shall be less than $\lambda/20$ rms deviation at the operational wavelength.

Otherwise the specification used should be described in the test report.

5.5 Beam reduction optical system

A telescopic system consisting of two positive lenses in an afocal arrangement is used for the adaptation of the beam cross-section to the array detector. The ratio of the focal lengths gives the reduction factor.

NOTE The diameter of the evaluated lens area can be set to the effective aperture by software to avoid additional diffraction at a physical aperture.