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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 41869.4-2024

**Optics and photonics - Microlens arrays - Part 4: Test methods
for geometrical properties
(English Translation)**

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Foreword

This document is in accordance with the provisions of GB/T 1.1-2020 "Guidelines for standardization work Part 1: Structure and drafting rules for standardization documents" Drafting is required.

This document is part 4 of GB/T 41869 "Optics and Photonics Microlens Arrays". GB/T 41869 has published the following part.

Part 1: Terminology;-Part 2: Test methods for wavefront aberrations;

Part 3: Test methods for optical properties;

Part 4: Test methods for geometrical properties. -this document is modified to adopt ISO 14880-4:2006 "Optics and photonics microlens arrays Part 4: Geometric properties test method".

Compared with ISO 14880-4:2006, this document has made the following structural adjustments.

Chapter 5 corresponds to 5.4 of ISO 14880-4:2006; -6.2.1 corresponds to 5.1.1.1 of ISO 14880-4:2006; -6.2.2 corresponds to 5.1.1.2 and 5.1.1.3 of ISO 14880-4:2006; -6.2.3

corresponds to 5.1.1.2 of ISO 14880-4:2006; -6.3 corresponds to 5.1.2 of ISO 14880-4:2006; -6.4.1 corresponds to 6.1.1 of ISO 14880-4:2006; -6.4.2 corresponds to 6.1.2 of ISO 14880-4:2006; -7.1 corresponds to 5.2.1 of ISO 14880-4:2006; -7.2 and 7.3 correspond to 6.2 of ISO 14880-4:2006; -8.1 corresponds to 5.3.1 of ISO 14880-4:2006; -8.2.1 corresponds to 5.3.2.1 of ISO 14880-4:2006; -8.2.2 corresponds to 5.3.2.2 of ISO 14880-4:2006; -8.3 corresponds to 5.3.2.3 of ISO 14880-4:2006; -8.4 corresponds to 6.3 of ISO 14880-4:2006; -Chapter 9 corresponds to Chapter 7 of ISO 14880-4:2006; -Chapter 10 corresponds to Chapter 8 of ISO 14880-4:2006; -Appendix A corresponds to Appendix B of ISO 14880-4:2006; -Appendix B corresponds to Appendix A of ISO 14880-4:2006. -the technical differences between this document and ISO 14880-4:2006 and their reasons are as follows.

The normative reference GB/T 41869.1-2022 replaces ISO 14880-1 (see Chapter 3) to adapt to my country's technology condition;

The term "microlens array thickness" (see 3.3 of ISO 14880-4:2006) has been deleted to adapt to my country's technical conditions; -the requirements for interferometry methods were changed and the informative references ISO 14880-2 and ISO/TR 14999-1 were adjusted to normative references.

GB/T 41869.2 and ISO/TR 14999-1:2005 (see 8.2.1) are used to adapt to my country's technical conditions;

The temperature requirements have been changed (see Chapter 5), with an additional $\pm 2^{\circ}\text{C}$ range on the basis of 20°C , taking into account the temperature instruments used in actual tests.

The impact of errors on the results;

Added an overview of "Measurement of Pitch and Surface Relief Depth" (see 6.1), describing contact profilometers and confocal microscopy the applicable scenarios of the two test methods make it easier for readers to choose the corresponding test method according to actual conditions;

Added the test preparation of "Confocal Microscope Test Method" (see 6.3.5) to facilitate readers' understanding and operation; -Added the manufacturers and models of "Confocal microscopes and microscopes" in the test equipment (see Chapter 10) to accommodate the technology of our country condition;

Added interference optical test method (see Appendix B) to adapt to my country's technical conditions and increase operability;

Deleted the Shack-Hartmann device in the "Test method for radius of curvature based on Fizeau interferometer" (see ISO 14880-4.

2006), this equipment does not fall within the scope of interferometer test equipment.

The following editorial changes were made to this document.

Deleted Note 2 of 3.1; -Deleted Note 3 of 3.2; -Adjust the paragraph 6.1.1 of ISO 14880-4:2006 to a list format (see 6.4.1); -Adjust the paragraph 6.3 in ISO 14880-4:2006 to be expressed in item form (see 8.4). -

Introduction

Microlens array is an important optical element in array optical devices. It is widely used in the form of single lens, two or more lens arrays.

Widely used in three-dimensional displays, coupling optics related to array optical radiation sources and optical detectors, enhanced liquid crystal displays and optical parallel processor components.

With the continuous advancement of science and technology, it is necessary to formulate a set of national standards with technical content in line with international standards, which will not only help promote the development of micro-transmitters in my country, but also the mirror array industry can develop in a standardized and orderly manner, and can better promote trade, exchanges and technical cooperation in related fields.

The "Photonics Microlens Array" was drafted and formulated in this context. The microlens array standard is planned to consist of the following four parts.

Part 1: Terminology. The purpose is to facilitate the application of microlens array products by defining the basic terms of microlenses and their arrays.

It helps researchers and industry practitioners to exchange concepts based on a common understanding.

Part 2: Test method for wavefront aberration. The purpose is to clarify the basic Performance characteristics.

Part 3: Optical property test methods. The purpose is to improve the quality of optical properties of different suppliers by standardizing the test methods of the main optical property indicators.

The compatibility and interchangeability of products from other parties will promote the advancement of microlens array technology.

Part 4: Geometric property test methods. The purpose is to standardize the test methods of the main geometric property indicators and standardize the test methods of the different suppliers.

To ensure the consistency of supplier product performance and expand its application areas.

Optics and Photonics Microlens Arrays Part 4: Geometrical properties test methods

1 Scope

This document describes the test parameters, test principles, test equipment, test preparation, test procedures and test results report.

This document is applicable to the testing of geometric characteristics of microlens arrays with surface relief structures and gradient refractive index microlens arrays.

2 Normative references

The contents of the following documents constitute the essential clauses of this document through normative references in this document.

For referenced documents without a date, only the version corresponding to that date applies to this document; for referenced documents without a date, the latest version (including all amendments) applies.

in this document.

GB/T 41869.1-2022 Optics and photonics Microlens arrays Part 1: Terminology (GB/T 41869.1-2022, ISO 14880-1:2019, MOD) GB/T 41869.2 Optics and photonics Microlens arrays Part 2: Test method for wavefront aberration (GB/T 41869.2-2022, ISO 14880-2:2006, MOD) ISO/TR 14999-1:2005 Optics and photonics Interferometry of optical elements and optical systems Part 1: Terminology, definitions and Optics and photonics-Interferometric measurement of optical elements and optical systems terms-Part 1: Terms, definitions and fundamental relationships)

3 Terms and definitions

The terms and definitions defined in GB/T 41869.1-2022 and the following apply to this document.

NOTE 1 This document uses symbols to describe the geometrical properties of microlens arrays, some of which may not be commonly used to describe surface structure measurements.

Note 2: This document uses P_x , P_y and h to describe the geometric parameters in surface structure measurement. P_x , P_y are the spacings, as defined in 3.1. h is the surface relief depth, See 3.2 for definition. See Figure 1 for the geometrical parameters of the microlens array.

Index number description.

1 - substrate;

T_c - physical thickness;

R_c - radius of curvature;

P_x , P_y - spacing;