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Optics and optical instruments — Test methods for radiation scattered by optical components

Optique et instruments d'optique — Méthodes d'essai du rayonnement diffusé par les composants optiques

Reference number
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Contents

Page

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 3.

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 International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 13696 was prepared by Technical Committee ISO/TC 172, *Optics and photonics*, Subcommittee SC 9, *Electro-optical systems*.

Annexes A to D of this International Standard are for information only.

In this corrected version of ISO 13696:2002, the following changes have been incorporated:

page 10, equation (5) reads $S_{\text{for}} = \frac{1}{N}\sum_{i=1}^{N}\frac{V_{\text{s,for}}(r_i) - (\tau_{\text{s}} V_{\text{u}})}{V_{\text{c}}(r_i) - V_{\text{u}}}$

equation (6) reads $S_{\text{bac}} = \frac{1}{N}\sum_{i=1}^{N}\frac{V_{\text{s,bac}}(r_i) - (1+\rho_{\text{s}})V_{\text{u}}}{V_{\text{c}}(r_i) - V_{\text{u}}}$

equation (7) reads $S_{\text{for}}(r_i) = \frac{V_{\text{s,for}}(r_i) - (\tau_{\text{s}} V_{\text{u}})}{V_{\text{c}} - V_{\text{u}}}$

page 11, equation (8) reads $S_{\text{bac}}(r_i) = \frac{V_{\text{s,bac}}(r_i) - (1+\rho_{\text{s}})V_{\text{u}}}{V_{\text{c}} - V_{\text{u}}}$

page 19, equation (C2) reads $\sigma_{\text{s}} = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}\left(M_{\text{s}} - S_{\text{bac,sc}}(r_i)\right)^2}$

page 26, the year of publication of ISO 12005 has been inserted.

Introduction

In most applications, scattering in optical components reduces the efficiency and deteriorates the image-forming quality of optical systems. Scattering is predominantly produced by imperfections of the coatings and the optical surfaces of the components. Common surface features which contribute to optical scattering are imperfections of substrates, thin films and interfaces, surface and interface roughness, or contamination and scratches. These imperfections deflect a fraction of the incident radiation from the specular path. The spatial distribution of this scattered radiation is dependent on the wavelength of the incident radiation and on the individual optical properties of the component. For most applications in laser technology and optics, the amount of total loss produced by scattering is a useful quality criterion of an optical component.

This International Standard describes a testing procedure for the corresponding quantity, the total scattering (TS) value, which is defined by the measured values of backward scattering and forward scattering. The measurement principle described in this International Standard is based on an Ulbricht sphere as the integrating element for scattered radiation. An alternative apparatus with a Coblentz hemisphere, which is also frequently employed for collecting scattered light, is described in annex A. Currently, advanced studies on the comparability and the limitations of both light collecting elements are being performed (e.g. round robin tests, EUREKA-project EUROLASER: CHOCLAB).

Optics and optical instruments — Test methods for radiation scattered by optical components

1 Scope

This International Standard specifies procedures for the determination of the total scattering by coated and uncoated optical surfaces. Procedures are given for measuring the contributions of the forward scattering and backward scattering to the total scattering of an optical component.

This International Standard applies to coated and uncoated optical components with optical surfaces that have a radius of curvature of more than 10 m. The wavelength range includes the ultraviolet, the visible and the infrared spectral regions.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 11145, *Optics and optical instruments — Lasers and laser-related equipment — Vocabulary and symbols*

ISO 14644-1:1999, *Cleanrooms and associated controlled environments — Part 1: Classification of air cleanliness*

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this International Standard, the terms and definitions given in ISO 11145 and the following apply.

3.1.1
scattered radiation
fraction of the incident radiation that is deflected from the specular optical path

3.1.2
front surface
optical surface that interacts first with the incident radiation

3.1.3
rear surface
surface that interacts last with the transmitted radiation