INTERNATIONAL STANDARD

ISO 10110-2

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Optics and optical instruments — Preparation of drawings for optical elements and systems —

Part 2: Material imperfections — Stress birefringence

Optique et instruments d'optique — Indications sur les dessins pour éléments et systèmes optiques —

Partie 2: Imperfections des matériaux — Biréfringence sous contrainte

Reference number
ISO 10110-2:1996(E)

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.

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.

International Standard ISO 10110-2 was prepared by Technical Committee ISO/TC 172, *Optics and optical instruments*, Subcommittee SC 1, *Fundamental standards*.

ISO 10110 consists of the following parts, under the general title *Optics and optical instruments — Preparation of drawings for optical elements and systems*:

— *Part 1: General*

— *Part 2: Material imperfections — Stress birefringence*

— *Part 3: Material imperfections — Bubbles and inclusions*

— *Part 4: Material imperfections — Inhomogeneity and striae*

— *Part 5: Surface form tolerances*

— *Part 6: Centring tolerances*

— *Part 7: Surface imperfection tolerances*

— *Part 8: Surface texture*

— *Part 9: Surface treatment and coating*

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— *Part 10: Table representing data of a lens element*

— *Part 11: Non-toleranced data*

— *Part 12: Aspheric surfaces*

— *Part 13: Laser irradiation damage threshold*

Annexes A and B of this part of ISO 10110 are for information only.

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Optics and optical instruments — Preparation of drawings for optical elements and systems —

Part 2:
Material imperfections — Stress birefringence

1 Scope

ISO 10110 specifies the presentation of design and functional requirements for optical elements and systems in technical drawings used for manufacturing and inspection.

This part of ISO 10110 specifies the indication of the tolerance for stress birefringence in optical elements made of isotropic material.

2 Definition

For the purposes of this part of ISO 10110, the following definition applies.

2.1 stress birefringence: The result of residual stresses within a glass blank following differential cooling during the forming and/or annealing process, or of certain fabrication processes carried out on the optical element.

NOTE 1 The birefringence produces a difference in index of refraction in the glass for light polarized parallel or perpendicular to the residual stress. This can affect the wavefront quality or optical path difference of the light transmitted by the optical element.

3 Permissible stress birefringence

The optical path difference (OPD) Δs between orthogonal polarizations of transmitted light over the thickness of the sample is a measure of birefringence. It is given in nanometres by

$$\Delta s = a \cdot \sigma \cdot K$$

where

a is the sample path length, in centimetres;

σ is the residual stress, in newtons per square millimetre;

K is the difference between the photoelastic constants, in units of 10^{-7} square millimetres per newton ($10^{-7}\,mm^2 \cdot N^{-1}$).

The residual stress-induced birefringence is specified in terms of optical path difference per unit path length, in nanometres per centimetre. A retardation of more than 20 nm/cm sample thickness generally corresponds to "coarse" annealed glass while a retardation of less than 10 nm/cm sample thickness refers to a "fine" anneal and is usually specified for precision optical elements.

4 Indication in drawings

4.1 The specification of the tolerance for stress birefringence is given by a code number, and a value for the maximum permissible OPD per unit path length.

4.2 The code number for stress birefringence is 0 (zero).

4.3 The indication is given in the form: $0/A$.

4.4 A is the maximum permissible stress birefringence in nanometres per centimetre of optical path length.

4.5 The indication shall be entered near the optical element to which it refers. If necessary, the indication may be connected to the element by a leader. It should be preferably associated with the other indications of material imperfections (bubbles, inhomogeneity, and striae; see ISO 10110-3 and ISO 10110-4).

(Examples are given in clause 5 and in ISO 10110-1:1996, annex A.)

Alternatively, for lens elements, the indication may be given in a table in accordance with ISO 10110-10.

5 Example

(see also ISO 10110-1:1996, annex A)

Figure 1 shows, as an example, the indication of a maximum permissible stress birefringence of 10 nm/cm for a lens element.

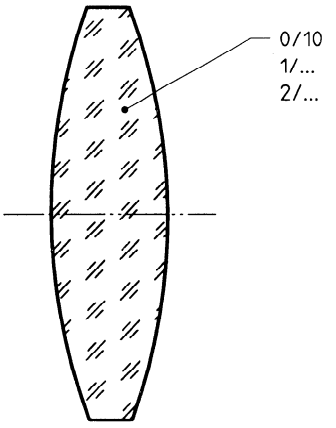

Figure 1 — Example of stress birefringence tolerance indication

Annex A
(informative)

Birefringence tolerance

This annex does not define rules for the selection of tolerances.

Table A.1 gives examples of birefringence tolerances with corresponding typical applications.

Table A.1 — Examples of birefringence tolerances and typical applications

Permissible optical path difference (OPD) per cm glass path	Typical applications
< 2 nm/cm	Polarisation instruments Interference instruments
5 nm/cm	Precision optics Astronomical optics
10 nm/cm	Photographic optics Microscope optics
20 nm/cm	Magnifying glasses View finder optics
Without requirement	Illumination optics

Annex B
(informative)

Bibliography

[1] ISO 10110-1:1996, *Optics and optical instruments — Preparation of drawings for optical elements and systems — Part 1: General.*

[2] ISO 10110-3:1996, *Optics and optical instruments — Preparation of drawings for optical elements and systems — Part 3: Material imperfections — Bubbles and inclusions.*

[3] ISO 10110-4:—[1], *Optics and optical instruments — Preparation of drawings for optical elements and systems — Part 4: Material imperfections — Inhomogeneity and striae.*

1) To be published.

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