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Optics and photonics — Optical coatings —

Part 7:
Minimum requirements for neutral beam splitter coatings

Optique et photonique — Traitements optiques —

Partie 7: Exigences minimales pour revêtements séparateurs de faisceaux neutres

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Foreword

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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 documents 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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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by ISO/TC 172, *Optics and photonics*, Subcommittee SC 3, *Optical materials and components*.

A list of all parts in the ISO 9211 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.

Optics and photonics — Optical coatings —

Part 7:
Minimum requirements for neutral beam splitter coatings

1 Scope

This document specifies minimum requirements on the optical effects and the mechanical, chemical and environmental properties of neutral beam splitter coatings. This document applies to neutral beam splitter coatings for optical applications. Thereby the user is able to rely on defined numerical data while the manufacturer of thin films has the choice for the materials and production method.

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 9211-1, *Optics and photonics — Optical coatings — Part 1: Vocabulary*

ISO 9211-3, *Optics and photonics — Optical coatings — Part 3: Environmental durability*

ISO 9211-4, *Optics and photonics — Optical coatings — Part 4: Specific test methods*

ISO 9022-2, *Optics and photonics — Environmental test methods — Part 2: Cold, heat and humidity*

ISO 10110-7, *Optics and photonics — Preparation of drawings for optical elements and systems — Part 7: Surface imperfections*

ISO 10110-8, *Optics and photonics — Preparation of drawings for optical elements and systems — Part 8: Surface texture*

ISO 10110-9, *Optics and photonics — Preparation of drawings for optical elements and systems — Part 9: Surface treatment and coating*

ISO 13696, *Optics and optical instruments — Test methods for radiation scattered by optical components*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 9211-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
neutral beam splitting coating
coating, which divides the incident radiation with a constant ratio within a given wavelength range

Note 1 to entry: The term “neutral” refers to colour.

Note 2 to entry: Polarisation states of reflected and transmitted light may differ from the incident light.

3.2
neutral beam splitter coating D1
dielectric, absorptance free beam splitter coating, which divides nonpolarized optical radiation in a wavelength range of 450 nm to 650 nm at an angle of incidence of 45° with a ratio of 50 % reflectance to 50 % transmittance

3.3
neutral beam splitter coating D2
dielectric, absorptance free beam splitter coating, which divides nonpolarized optical radiation in a wavelength range of 450 nm to 650 nm at an angle of incidence of 45° with a ratio of 70 % reflectance to 30 % transmittance

3.4
neutral beam splitter coating D3
dielectric, absorptance free beam splitter coating, which divides nonpolarized optical radiation in a wavelength range of 450 nm to 650 nm at an angle of incidence of 45° with a ratio of 20 % reflectance to 80 % transmittance

3.5
neutral beam splitter coating D4
dielectric, absorptance free beam splitter coating, which divides nonpolarized optical radiation in a wavelength range of 400 nm to 700 nm at an angle of incidence of 45° with a ratio of 50 % reflectance to 50 % transmittance

3.6
neutral beam splitter coating M1
absorbing beam splitter coating, which divides nonpolarized optical radiation in a wavelength range of 380 nm to 780 nm at an angle of incidence of 45° with a ratio of 30 % reflectance to 30 % transmittance

3.7
neutral beam splitter coating M2
absorbing beam splitter coating, which divides nonpolarized optical radiation in a wavelength range of 450 nm to 700 nm at an angle of incidence of 45° with a ratio of 45 % reflectance to 45 % transmittance

4 Designation

Designation of a neutral beam splitter coating of type M2:

BS ISO 9211-7 – M2

5 Indication in drawings

When applying this document, Ⓛ (the symbol for optical coating in accordance with ISO 10110-9) shall be indicated in conjunction with the designation in accordance with Clause 4.

6 Minimum requirements

The minimum requirements shall apply to unstressed neutral beam splitter coatings (see Table 1). Reflectance and transmittance of the neutral beam splitter coatings are given in Table 2.

Table 1 — Minimum requirements for unstressed neutral beam splitter coatings

No.	Property	Minimum requirements	Remarks
1	Spectral transmittance	In accordance with Table 2.	Generally, the declaration is valid for a coating on a transparent substrate with a refractive index of around 1,5.
2	Spectral reflectance	In accordance with Table 2.	

Table 1 *(continued)*

No.	Property	Minimum requirements	Remarks
3	Spectral absorptance	≤0,01 for coating types D1 to D4.	
4	Scattered light	TS ≤ 0,005 on measurements in accordance with ISO 13696 in conjunction with a substrate surface P3 in accordance with ISO 10110-8 and surface imperfections 5/3 × 0,16 in accordance with ISO 10110-7.	The component is measured with and without beam splitter coating.
5	Adhesion	After conditioning method 02 with degree of severity 01 in accordance with ISO 9211-4 the coating shall not peel off.	This requirement is only valid for beam splitter coatings that are not cemented.
6	Abrasion resistance	Conditioning method 01 with degree of severity 01 in accordance with ISO 9211-4.	This requirement is only valid for beam splitter coatings that are not cemented.
7	Solar radiation resistance in accordance with ISO 9211-3	Conditioning method 10 with degree of severity 01 in accordance with ISO 9211-3. In accordance with this conditioning method the coating shall comply with the minimum requirements of optical properties. The adhesion in accordance with conditioning method 02 with degree of severity 01 in accordance with ISO 9211-4 shall persist.	
8	Solvent solubility in accordance with ISO 9211-4	In accordance with conditioning method 04, degree of severity 01 in accordance with ISO 9211-3. Additionally this test can be applied using other solvents. The adhesion in accordance with conditioning method 02 with degree of severity 01 in accordance with ISO 9211-3 shall persist.	The manufacturer and the user shall agree on the solvents and chemicals for this test. The test is performed in accordance with ISO 9211-3. These requirements are only valid for beam splitter coatings that are not cemented.
9	Chemical durability in accordance with ISO 9211-3	Required for chemicals that do not affect the substrate. The solvent solubility in accordance with conditioning method 12-3, degree of severity 01 in where different types of solvents can be used the minimum requirements shall be fulfilled. The adhesion in accordance with conditioning method 02 with degree of severity 01 in accordance with ISO 9211-4 shall persist.	The manufacturer and the user shall agree on the solvents and chemicals for this test. The test is performed in accordance with ISO 9211-3. These requirements are only valid for beam splitter coatings that are not cemented.
10	Environmental durability in accordance with ISO 9022-2	Conditioning method — Degree of severity 10: Cold — 05 11: Dry heat — 04 13: Condensed water — 04 14: Slow temperature change — 02 In accordance with this conditioning method the coating shall comply with the minimum requirements of the optical properties. In accordance with ISO 9211-4 the adhesion shall persist in accordance with conditioning method 02 with degree of severity 01.	These requirements are only valid for beam splitter coatings that are not cemented.

Table 1 *(continued)*

No.	Property	Minimum requirements	Remarks
11	Coating imperfections	Referred to a test area with a diameter of 50 mm: 5/C10 × 0,1 in accordance with ISO 10110-7.	

Table 2 — Reflectance and transmittance of the neutral beam splitter coatings

Neutral beam splitter coating type	Reflectance	Transmittance	Wavelength range nm
D1	0,50 ± 0,05	0,50 ± 0,05	450 to 650
D2	0,70 ± 0,05	0,30 ± 0,05	450 to 650
D3	0,20 ± 0,05	0,80 ± 0,05	450 to 650
ng D4	0,50 ± 0,03	0,50 ± 0,03	400 to 700
M1	0,30 ± 0,05	0,30 ± 0,05	380 to 780
M2	0,45 ± 0,05	0,45 ± 0,05	450 to 700