INTERNATIONAL STANDARD

ISO 9211-7

Second edition
2021-09

Optics and photonics — Optical coatings —

Part 7: Minimum requirements for neutral beam splitter coatings

Optique et photonique — Traitements optiques —

Partie 7: Exigences minimales pour les traitements optiques séparateurs de faisceaux neutres

Reference number
ISO 9211-7:2021(E)

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Published in Switzerland

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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.

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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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*.

This second edition cancels and replaces the first edition (ISO 9211-7:2018), which has been technically revised.

The main changes compared to the previous edition are as follows:

— correction of existing errors.

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 terminology databases for use in standardization at the following addresses:

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

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

3.1
neutral beam splitter coating
coating, which divides the incident radiation with a constant ratio within an allowed tolerance in a given wavelength range

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

Note 2 to entry: Polarization 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:

BS ISO 9211-7 - xx

Base name for minimum requirements of BS coatings

Code number of neutral beam splitter coating type

EXAMPLE

BS ISO 9211-7 – M2

5 Indication in drawings

The indication in drawings shall be in accordance with ISO 10110-9 in conjunction with the designation defined in Clause 4.

6 Minimum requirements

The minimum requirements shall apply to unstressed neutral beam splitter coatings. The minimum requirements that apply to all types of BS coatings are given in Table 1. Table 2 lists additional minimum requirements of coatings types D1 to D4 and Table 3 gives the additional minimum requirements of coating types M1 and M2.

Reflectance and transmittance of the neutral beam splitter coatings are given in Table 4.

Table 1 — Minimum requirements for all types of unstressed beam splitter coatings

No.	Property	Minimum requirements for all BS coating types
1	Scattered light	TS ≤ 0,005 on measurements in accordance with ISO 13696 at 633 nm. The component is measured with and without beam splitter coating.
2	Adhesion[a]	After conditioning method 02 with degree of severity 01 in accordance with ISO 9211-4.
3	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.
4	Coating imperfections	Referred to a test area with a diameter of 50 mm: 5/C10 × 0,16 in accordance with ISO 10110-7.
[a] This requirement is only valid for beam splitter coatings that are not cemented.		

Table 2 — Minimum requirements for the unstressed coating types D1 to D4

No.	Property	Minimum requirements for BS coatings D1 to D4	
5	Spectral absorptance	≤ 0,01 The absorptance limit applies for the coating only.	
6	Abrasion resistance[a]	Conditioning method 01 with degree of severity 01 in accordance with ISO 9211-4.	
7	Resistance to water in accordance with ISO 9211-4[a]	In accordance with conditioning method 04, degree of severity 01 in accordance with ISO 9211-4. The adhesion in accordance with conditioning method 02 with degree of severity 01 in accordance with ISO 9211-4 shall persist.	
8	Chemical durability in accordance with ISO 9211-3[a]	Required for chemicals that do not affect the substrate. The solvent solubility in accordance with conditioning method 12-3, degree of severity 01. The adhesion in accordance with conditioning method 02 with degree of severity 01 in accordance with ISO 9211-4 shall persist.	
9	Environmental durability in accordance with ISO 9022-2[a]	Conditioning method	Degree of severity
		12: Damp heat	06
		14: Slow temperature change	02
		In accordance with these conditioning methods the coating shall comply with the minimum requirements of the optical properties. The adhesion in accordance with conditioning method 02 with degree of severity 01 in accordance with ISO 9211-4 shall persist.	
[a] This requirement is only valid for beam splitter coatings that are not cemented.			

Table 3 — Minimum requirements for the unstressed coatings M1 and M2

No.	Property	Minimum requirements BS coatings M1 and M2	
10	Environmental durability in accordance with ISO 9022-2[a]	Conditioning method	Degree of severity
		10: Cold	05
		11: Dry heat	03
		In accordance with these conditioning methods the coating shall comply with the minimum requirements of the optical properties. The adhesion in accordance with conditioning method 02 with degree of severity 01 in accordance with ISO 9211-4 shall persist.	

[a] This requirement is only valid for beam splitter coatings that are not cemented.

Table 4 — 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
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