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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 document 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](http://www.iso.org/directives)).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at [www.iso.org/patents](http://www.iso.org/patents). ISO shall not be held responsible for identifying any or all such patent rights.

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

This **third** edition cancels and replaces the **second** edition (ISO 9211-2:2010), which has been technically revised.

The main changes are as follows:

- —additional symbols (T, R, and A) for transmittance, reflectance and absorption added;
- —definitions have been provided for average spectral characteristics;
- —default wavelength units of nm added;
- —more examples are provided;
- —text added and modified for clarity;
- —the use of the symbols of **Annex A** have been generalized.

A list of all parts in the **ISO 9211 series** can be found on the ISO website.

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ISO 9211-2:2010, Optics and photonics — Optical coatings — Part 2: Optical properties

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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](http://www.iso.org/members.html).

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If the coating optical properties are required to be achieved at a specific temperature or range of temperatures, this shall be indicated with a note.

## 5 Measurement conditions

The measurement conditions for the spectrophotometric characterization shall be in accordance with ISO-15368, ISO-19962 or an equivalent method. These conditions depend on the principle of the measurement method and the instruments used, including the angle of incidence, the state of polarization, the spectral range and bandwidth of the measurement beam, etc. and shall be recorded in sufficient detail to enable verification of the measurement.

## 6 Numerical specification and graphical representation of spectral characteristics

### 6.1 General

This document defines the rules for the spectrophotometric characterization of optical coatings. If no units are given for wavelength, the units are assumed to be nanometres. The limit values of  $\tau$ ,  $\rho$  and  $\alpha$  are unitless.

### 6.2 Rules for the numerical specification of spectral characteristics

The general structure of a numerical specification, as distinguished from a graphical specification, of a spectral optical property shall follow the structure of an inequality with the following terms:

(lower limit term) < or  $\leq$  (spectral optical property term) < or  $\leq$  (upper limit term).

If both a lower limit term and an upper limit term are used, the lower limit will always come first. If a specific wavelength increment  $\Delta\lambda$  is to be used, this shall be specified in a note.

EXAMPLE 1  $0,85 < \rho(380 \text{ nm to } 450 \text{ nm}, 45^\circ) < 0,95$

The subscript "ave" or "avg" is used to denote the spectral characteristic average across the spectral band. If no subscript is used, the spectral characteristic is required to meet the specification at all wavelengths in the specified spectral band.

EXAMPLE 2  $1,9 \leq D_{\text{ave}}(350 \text{ nm to } 1\ 100 \text{ nm}) \leq 2,1$

If a range of angles is indicated, the spectral characteristic is required to meet the specification over all angles indicated. If a specific angle increment is to be used, this shall be specified in a note.

EXAMPLE 3  $0,45 \leq \tau(1,064 \mu\text{m}, 35^\circ \text{ to } 55^\circ) < 0,65$

The inequality may contain only two terms if the spectral optical property needs to be bounded only on one side. If no units are given for the wavelength range, the wavelengths are assumed to be in nm.

EXAMPLE 4  $R(400 \text{ to } 700, 0^\circ \text{ to } 35^\circ) \leq 0,02$

If only a lower limit term is used, the comparator sign may be reversed for clarity

EXAMPLE 5  $\tau_{\text{avg}}(0,4 \mu\text{m to } 0,65 \mu\text{m}) \geq 0,98$

If a range of angles is indicated with a spectral characteristic average, the spectral characteristic average is required to meet the specification over all angles. If the spectral characteristic is intended to be averaged over both wavelength and angle, this shall be indicated with a note.

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