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INTERNATIONAL ISO

Third edition
2019-10

Corrected version
2020-01

Optics and photonics — Lasers and laser-related equipment — Test method for absorptance of optical laser components

Optique et photonique — Lasers et équipements associés aux lasers — Méthode d'essai du facteur d'absorption des composants optiques pour lasers

Reference number
ISO 11551:2019(E)

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CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@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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This document was prepared by Technical Committee ISO/TC 172, *Optics and photonics*, Subcommittee 9, *Laser and electro-optical systems*.

This third edition cancels and replaces the second edition ISO 11551:2003 which has been technically revised.

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

a) Introduction: The assumptions were revised in the second paragraph. Minor wording and example adjustment in third paragraph.

b) Clause 4: Table for symbols and units was corrected.

c) Clause 5: More detailed specification of environmental conditions for UV- and IR applications are provided in the second paragraph. ISO 7 specification was deleted.

   In the fourth paragraph, Annex A is explicitly mentioned for the dependence of absorption on other test parameters.

   In the fifth paragraph, Annex B is explicitly mentioned to account for the critical issue of finite heat conductivity.

d) In 7.2.3: In the first paragraph, the calibration procedure is specified in more detail, including the consideration of the heating scheme for thick samples.

   Note 1 is complemented by the restriction for thin samples.

   Note 2 is complemented with the consideration of heating scheme for finite heat conduction.

e) In 7.3: In the first paragraph the specifications for the ambient temperature drift were clarified.

   The requirements to the total temperature rise during heating were generalized.

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In the third paragraph the terminology “pre-irradiation” was replaced by “drift record”. The description of the duration of the cooling period was complemented.

f) In 8.1: In the first paragraph “heat capacity” was replaced by “specific heat capacity”.

g) In A.1: “irradiation dose” added as influencing parameter.

h) In A.3: Generalization of nonlinear absorption dependencies.

i) In B.3: More detailed comments on the convergence of the temperature curves in Figure B.1. Correction of Formulae (B.2) and (B.3). An additional paragraph with explanations for thick test samples, including two references.

This corrected version of ISO 11551:2019 incorporates the following corrections:

— In 7.2.3, Formulae (B.1), (B.2) and (B.3), the symbol "α" has been changed into "a";

— Two signs have been corrected in Formula (C.4) to read "$-B\exp$" and "$-t_k$" instead of "$B\exp$" and "t_k".

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Introduction

To characterize an optical component, it is important to know its absorptance. When radiation impinges upon a component, a part of that radiation is absorbed, increasing the temperature of the component. In this document only the part of the absorbed power/energy, that is converted into heat, is measured. If enough energy is absorbed, the optical properties of the component can change, and the component can even be destroyed. Absorptance is the ratio of the radiant flux absorbed to the radiant flux of the incident radiation.

In the procedures described in this document, the absorptance is determined calorimetrically as the ratio of power or energy absorbed by the component to the total power or energy, respectively, impinging upon the component. The assumption is made that the absorptance of the test sample is constant within the temperature fluctuations experienced by the component during the measurement.

For most optical bulk materials, the absorptance depends on the position of the irradiating beam on the sample surface. Several infrared materials exhibit a strong dependence of absorptance on temperature, especially at high temperatures.

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