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Electro-optical systems — Cavity ring-down technique for high-reflectance measurement

Systèmes électro-optiques — Technique d'alternance de la cavité pour le mesurage du facteur de réflexion

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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 on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information.

The committee responsible for this document is ISO/TC 172, *Optics and photonics*, Subcommittee SC 9, *Electro-optical systems*.

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Introduction

With the development of film-deposition technology, the performance of optical thin films, especially the highly reflective coatings which are widely used in large high-power laser systems, interferometric gravitational-wave detectors, laser gyroscopes, and cavity-enhanced and cavity ring-down spectroscopy applications, has been substantially improved in recent years. Laser-based optical systems require some optical components with extremely high reflectance characteristic. It is necessary to be able to measure this reflectance characteristic precisely. The measurement procedures in this International Standard have been optimized to allow the measurement of high reflectance (larger than 99 %, theoretically up to 100 %) of optical laser components using the cavity ring-down technique which provides reflectance data with high accuracy, high repeatability and reproducibility, and high reliability.

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Electro-optical systems — Cavity ring-down technique for high-reflectance measurement

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1 Scope

This International Standard specifies measurement procedures for the precise determination of the high reflectance of optical laser components. Up to now, the ISO standardized testing methods for reflectance of optical laser components have the accuracy limit of approximately 0,01 % (for measurement of absolute reflectance) which are not appropriate for measuring the reflectance higher than 99,99 % or, in some cases, measurement accuracy better than 0,01 % is required. The range of application of this standardized test method is reflectance 99 % and higher (theoretically up to 100 %).

The methods given in this International Standard are intended to be used for the testing and characterization of high reflectance of both concave and plane mirrors used in laser systems and laser-based instruments. The reflectance of convex mirrors can also be tested by taking into consideration the radius of curvature of the mirror surface.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 11145, *Optics and photonics — Lasers and laser-related equipment — Vocabulary and symbols*

ISO 14644-1, *Cleanrooms and associated controlled environments — Part 1: Classification of air cleanliness by particle concentration*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11145 and the following apply.

3.1
reflectance
<for incident radiation of given wavelength, polarization, and angle of incidence> ratio of the reflected radiant or luminous flux to the incident flux in the given conditions

4 Symbols used and units of measure

Table 1 — Symbols used and units of measure

Symbol	Unit	Term
c	m/s	speed of light in measurement environment
c_0	m/s	speed of light in vacuum
$h(t)$		impulse response of the ring-down cavity
$h_0(t)$		instrumental response function
L_0, L	m	lengths of the initial and test cavities
ΔL_0, ΔL	m	measurement errors of the initial and test cavity lengths
n		refractive index of air in measurement environment

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