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Lasers and laser-related equipment — Test methods for laser-induced damage threshold —

Part 4: Inspection, detection and measurement

Lasers et équipements associés aux lasers — Méthodes d'essai du seuil d'endommagement provoqué par laser —

Partie 4: Inspection, détection et mesurages

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Contents

Page

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.

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The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard (“state of the art”, for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

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.

ISO/TR 21254-4 was prepared by Technical Committee ISO/TC 172, *Optics and photonics*, Subcommittee SC 9, *Electro-optical systems*.

ISO 21254 consists of the following parts, under the general title *Lasers and laser-related equipment — Test methods for laser-induced damage threshold*:

— *Part 1: Definition and general principles*

— *Part 2: Threshold determination*

— *Part 3: Assurance of laser power (energy) handling capabilities*

— *Part 4: Inspection, detection and measurement*

Introduction

Detection programmes for laser-induced damage threshold always involve sensitive techniques for the inspection of surfaces and the detection of damage. In a typical detection protocol, each sample is inspected prior to the test by microscopic methods to evaluate the surface quality and to assess imperfections. During the irradiation of the sample in S-on-1, damage testing, a variety of online-monitoring schemes is applied to detect damage.

Examples of these methods include the detection of light scattered by the test area, the collection of plasma radiation, or photothermal detection schemes. In most cases, the detection system is directly linked to the laser to interrupt the irradiation of the sample promptly at the first instance of damage. In this way catastrophic damage of the component can be avoided, and the number of pulses until the appearance of first damage can be determined precisely. Also, this direct information on the state of damage can be processed in the course of the running test to determine energy levels for the following interrogations optimised to minimise detection uncertainties. For the same reason, sophisticated detection schemes based on direct imaging and online image processing can be often found in 1-on-1 detection facilities. The irradiation sequence on the samples is followed by inspection using an appropriate technique to identify the damaged sites and to gain information on the contributing damage mechanisms. This inspection of the interrogated sites is essential for an accurate determination of the damage thresholds because it is the final and most sensitive assessment of the state of damage.

This Technical Report describes selected techniques for the inspection of optical surfaces prior to and after damage testing, and damage detection techniques integrated in detection facilities. The described damage detection methods are examples of practical solutions tested and often applied in detection facilities. The application of other schemes for the detection or inspection of damage in optical components is not excluded by this Technical Report.