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Optics and photonics — Measurement method of semiconductor lasers for sensing

Optique et photonique — Méthode de mesure des lasers semi-conducteurs pour la sensibilité

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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 SC 9, *Laser and electro-optical systems.*

This first edition cancels and replaces the Technical Specification ISO/TS 17915:2013, which has been technically revised.

The main changes compared to ISO/TS 17915:2013 are as follows:

— interband cascade semiconductor lasers have been included in 4.2.5.

— in A.3: Regarding the monitor photodiode, “option” has been inserted.

— Tables in Annex A have been separated for clarity.

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Introduction

Sensing technologies for materials related to the environment or wellness, etc., by using lasers have been researched and developed in academic and industrial fields. Semiconductor lasers including quantum cascade semiconductor lasers have been widely used in sensing applications because of their advantages of compactness and wide selectivity of lasing wavelengths. The tunable laser absorption spectroscopy, the cavity ring down spectroscopy and the photoacoustic spectroscopy are commonly used sensing techniques. In those sensing techniques, wavelength and/or spectrum analysis by changing temperature or injected current is the key for determining the composition or element of the material or the mixture to be examined. Therefore measuring methods of semiconductor lasers for sensing applications are described with an informative annex for an example of essential ratings and characteristics.

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Optics and photonics — Measurement method of semiconductor lasers for sensing

1 Scope

This document describes methods of measuring temperature and injected current dependence of lasing wavelengths, and lasing spectral line width in relation to semiconductor lasers for sensing applications.

This document is applicable to all kinds of semiconductor lasers, such as edge-emitting type and vertical cavity surface emitting type lasers, bulk-type and (strained) quantum well lasers, and quantum cascade lasers, used for optical sensing in e.g. industrial, medical and agricultural fields.

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 13695, *Optics and photonics — Lasers and laser-related equipment — Test methods for the spectral characteristics of lasers*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

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

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

4 Optical sensing using semiconductor lasers

4.1 General

The methods described in this document shall be followed in accordance with ISO 13695.

Optical sensing using tunable semiconductor laser spectroscopy has been widely used in various engineering fields. For example, optical sensing is being used for bio-sensing and environmental monitoring. Semiconductor lasers are key devices for those applications and are indispensable for building sensing equipment. Semiconductor lasers and sensing techniques are described in 4.2 to 4.6.

4.2 Semiconductor laser

4.2.1 General

A semiconductor laser is an optical semiconductor device that emits coherent optical radiation in a certain direction through stimulated emission resulting from electron transition when excited by an

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