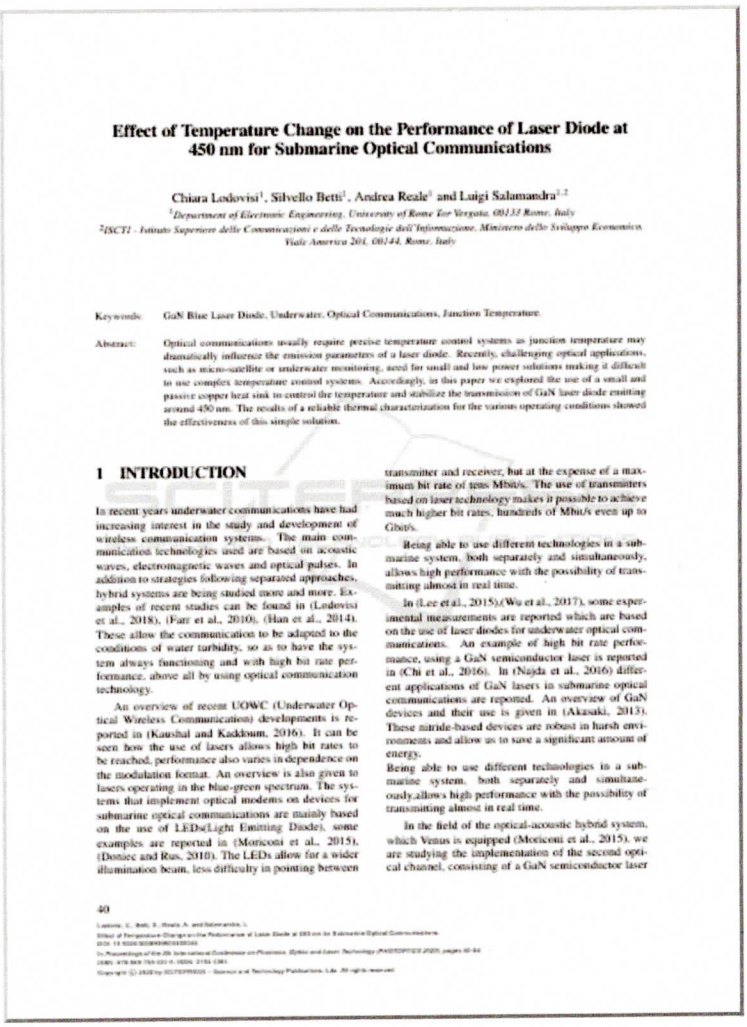
Paper

Effect of Temperature Change on the Performance of Laser Diode at 450 nm for Submarine Optical Communications

Topics: Fiber Lasers and Applications; Optical Materials and Devices; Photonic and Optoelectronic Materials and Devices; Semiconductor Lasers and Leds

In **Proceedings of the 8th International Conference on Photonics, Optics and Laser Technology - PHOTOPTICS,** 40-44, 2020 , Valletta, Malta



Effect of Temperature Change on the Performance of Laser Diode at 450 nm for Submarine Optical Communications

Chiara Lodovisi[1], Silvello Betti[2], Andrea Reale[1] and Luigi Salamandra[1,2]
[1]Department of Electronic Engineering, University of Rome Tor Vergata, 00133 Rome, Italy
[2]ISCTI - Istituto Superiore delle Comunicazioni e delle Tecnologie dell'Informazione, Ministero dello Sviluppo Economico, Viale America 201, 00144, Rome, Italy

Keywords: GaN Blue Laser Diode, Underwater, Optical Communications, Junction Temperature

Abstract: Optical communications usually require precise temperature control systems as junction temperature may dramatically influence the emission parameters of a laser diode. Recently, challenging optical applications, such as micro-satellite or underwater monitoring, need for small and low power solutions making it difficult to use complex temperature control systems. Accordingly, in this paper we explored the use of a small and passive copper heat sink to control the temperature and stabilize the transmission of GaN laser diode emitting around 450 nm. The results of a reliable thermal characterization for the various operating conditions showed the effectiveness of this simple solution.

1 INTRODUCTION

In recent years underwater communications have had increasing interest in the study and development of wireless communication systems. The main communication technologies used are based on acoustic waves, electromagnetic waves and optical pulses. In addition to strategies following separated approaches, hybrid systems are being studied more and more. Examples of recent studies can be found in (Lodovisi et al., 2018), (Farr et al., 2010), (Han et al., 2014). These allow the communication to be adapted to the conditions of water turbidity, so as to have the system always functioning and with high bit rate performance, above all by using optical communication technology.

An overview of recent UOWC (Underwater Optical Wireless Communication) developments is reported in (Kaushal and Kaddoum, 2016). It can be seen how the use of lasers allows high bit rates to be reached, performance also varies in dependence on the modulation format. An overview is also given to lasers operating in the blue-green spectrum. The systems that implement optical modems on devices for submarine optical communications are mainly based on the use of LEDs(Light Emitting Diode), some examples are reported in (Moriconi et al., 2015), (Doniec and Rus, 2010). The LEDs allow for a wider illumination beam, less difficulty in pointing between transmitter and receiver, but at the expense of a maximum bit rate of tens Mbit/s. The use of transmitters based on laser technology makes it possible to achieve much higher bit rates, hundreds of Mbit/s even up to Gbit/s.

Being able to use different technologies in a submarine system, both separately and simultaneously, allows high performance with the possibility of transmitting almost in real time.

In (Lee et al., 2015),(Wu et al., 2017), some experimental measurements are reported which are based on the use of laser diodes for underwater optical communications. An example of high bit rate performance, using a GaN semiconductor laser is reported in (Chi et al., 2016). In (Najda et al., 2016) different applications of GaN lasers in submarine optical communications are reported. An overview of GaN devices and their use is given in (Akasaki, 2013). These nitride-based devices are robust in harsh environments and allow us to save a significant amount of energy.

Being able to use different technologies in a submarine system, both separately and simultaneously,allows high performance with the possibility of transmitting almost in real time.

In the field of the optical-acoustic hybrid system, which Venus is equipped (Moriconi et al., 2015), we are studying the implementation of the second optical channel, consisting of a GaN semiconductor laser

Authors: Chiara Lodovisi [1]; Silvello Betti [1]; Andrea Reale [1] and Luigi Salamandra [1;2]

Affiliations: [1] Department of Electronic Engineering, University of Rome Tor Vergata, 00133 Rome, Italy ; [2] ISCTI - Istituto Superiore delle Comunicazioni e delle Tecnologie dell'Informazione, Ministero dello Sviluppo Economico, Viale America 201, 00144, Rome, Italy

Keyword(s): GaN Blue Laser Diode, Underwater, Optical Communications, Junction Temperature.

Abstract: Optical communications usually require precise temperature control systems as junction temperature may dramatically influence the emission parameters of a laser diode. Recently, challenging optical applications, such as micro-satellite or underwater monitoring, need for small and low power solutions making it difficult to use complex temperature control systems. Accordingly, in this paper we explored the use of a small and passive copper heat sink to control the temperature and stabilize the transmission of GaN laser diode emitting around 450 nm. The results of a reliable thermal characterization for the various operating conditions showed the effectiveness of this simple solution.


CC BY-NC-ND 4.0

Guest: Register as new SciTePress user now for free.

SciTePress user: please login.

You are not signed in, therefore limits apply to your IP address 160.80.82.91

My Papers

In the current month:
Recent papers: 100 available of 100 total
2+ years older papers: 200 available of 200 total

Paper citation in several formats:

Harvard | Bibtex | EndNote

Lodovisi, C.; Betti, S.; Reale, A. and Salamandra, L. (2020). **Effect of Temperature Change on the Performance of Laser Diode at 450 nm for Submarine Optical Communications**. In *Proceedings of the 8th International Conference on Photonics, Optics and Laser Technology - PHOTOPTICS*, ISBN 978-989-758-401-5; ISSN 2184-4364, pages 40-44. DOI: 10.5220/0008939500400044

SCITEPRESS DIGITAL LIBRARY - SCIENCE AND TECHNOLOGY PUBLICATIONS, LDA.

RESOURCES

Proceedings

Papers

Authors

Ontology

CONTACTS

Science and Technology
Publications, Lda
Avenida de S. Francisco
Xavier, Lote 7 Cv. C,
2900-616 Setúbal, Portugal.

Phone: +351 265 520 185
Fax: +351 265 520 186
Email: info@scitepress.org

EXTERNAL LINKS

PRIMORIS

INSTICC

SCITEVENTS

CROSSREF

PROCEEDINGS SUBMITTED FOR INDEXATION BY:

dblp

Ei Compendex

SCOPUS

Semantic Scholar

Google Scholar

Microsoft Academic

© 2022 SciTePress, Science and Technology Publications, Lda - All rights reserved.