PROCEEDINGS OF SPIE

Smart Photonic and Optoelectronic Integrated Circuits XXII

Sailing He
Laurent Vivien
Editors

3–6 February 2020
San Francisco, California, United States

Sponsored and Published by
SPIE

Volume 11284

Proceedings of SPIE 0277-786X, V. 11284

Smart Photonic and Optoelectronic Integrated Circuits XXII, edited by Sailing He, Laurent Vivien, Proc. of SPIE
Vol. 11284, 1128401 · © 2020 SPIE · CCC code: 0277-786X/20/$21 · doi: 10.1117/12.2569991

The papers in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. Additional papers and presentation recordings may be available online in the SPIE Digital Library at SPIEDigitalLibrary.org.

The papers reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from these proceedings:
Author(s), "Title of Paper," in *Smart Photonic and Optoelectronic Integrated Circuits XXII*, edited by Sailing He, Laurent Vivien, Proceedings of SPIE Vol. 11284 (SPIE, Bellingham, WA, 2020) Seven-digit Article CID Number.

ISSN: 0277-786X
ISSN: 1996-756X (electronic)

ISBN: 9781510633315
ISBN: 9781510633322 (electronic)

Published by
SPIE
P.O. Box 10, Bellingham, Washington 98227-0010 USA
Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445
SPIE.org

Printed in the United States of America by Curran Associates, Inc., under license from SPIE.

Publication of record for individual papers is online in the SPIE Digital Library.

SPIEDigitalLibrary.org

Paper Numbering: *Proceedings of SPIE* follow an e-First publication model. A unique citation identifier (CID) number is assigned to each article at the time of publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online and print versions of the publication. SPIE uses a seven-digit CID article numbering system structured as follows:

- The first five digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B … 0Z, followed by 10-1Z, 20-2Z, etc. The CID Number appears on each page of the manuscript.

Contents

Authors

Numbers in the index correspond to the last two digits of the seven-digit citation identifier (CID) article numbering system used in Proceedings of SPIE. The first five digits reflect the volume number. Base 36 numbering is employed for the last two digits and indicates the order of articles within the volume. Numbers start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B...0Z, followed by 10-1Z, 20-2Z, etc.

Conference Committee

Symposium Chairs

Sailing He, KTH Royal Institute of Technology (Sweden) and Zhejiang University (China)
Yasuhiro Koike, Keio University (Japan)

Symposium Co-chairs

Connie J. Chang-Hasnain, University of California, Berkeley (United States)
Graham T. Reed, Optoelectronics Research Centre, University of Southampton (United Kingdom)

Program Track Chairs

Yakov Sidorin, Quarles & Brady LLP (United States)
Jean-Emmanuel Broquin, IMEP-LAHC (France)

Conference Chairs

Sailing He, KTH Royal Institute of Technology (Sweden) and Zhejiang University (China)
Laurent Vivien, Centre de Nanosciences et de Nanotechnologies, CNRS, Université Paris-Sud, Université Paris-Saclay (France)

Conference Program Committee

Pavel Cheben, National Research Council Canada (Canada)
Ray T. Chen, The University of Texas at Austin (United States)
Louay A. Eldada, Quanergy Systems, Inc. (United States)
Chennupati Jagadish, The Australian National University (Australia)
Stefan A. Maier, Imperial College London (United Kingdom)
Lorenzo Pavesi, Università degli Studi di Trento (Italy)
Joachim Piprek, NUSOD Institute LLC (United States)
David V. Plant, McGill University (Canada)
Andrew W. Poon, Hong Kong University of Science and Technology (Hong Kong, China)
Ali Serpengüzel, Koç University (Turkey)
Bertrand Szelag, CEA-LETI (France)
Augustine M. Urbas, Air Force Research Laboratory (United States)
Dries Van Thourhout, Universiteit Gent (Belgium)
Alan X. Wang, Oregon State University (United States)
Jian Wang, Huazhong University of Science and Technology (China)

Qian Wang, Huawei Technologies Co., Ltd. (China)
Michael R. Watts, Massachusetts Institute of Technology (United States)
Lin Yang, Institute of Semiconductors, CAS (China)
Rui Q. Yang, The University of Oklahoma (United States)

Session Chairs

1 Photonics Based on Artificial Intelligence I
Alan X. Wang, Oregon State University (United States)

2 Photonics Based on Artificial Intelligence II
Lorenzo Pavesi, Università degli Studi di Trento (Italy)

3 Integration, Manufacturing and Photonic Circuits
Bertrand Szelag, CEA-LETI (France)

4 Design and Material of Photonic Integrated Devices I
Pavel Cheben, National Research Council Canada (Canada)

5 Light Modulation
Bertrand Szelag, CEA-LETI (France)

6 Hyperbolic Metamaterials
Augustine M. Urbas, Air Force Research Laboratory (United States)

7 Plasmonic and Metasurfaces
Laurent Vivien, Centre de Nanosciences et de Nanotechnologies, CNRS, Université Paris-Sud, Université Paris-Saclay (France)

8 Mid-Infrared Optoelectronics I
Rui Q. Yang, The University of Oklahoma (United States)

9 Mid-Infrared Optoelectronics II
Rui Q. Yang, The University of Oklahoma (United States)

10 Design and Material of Photonic Integrated Devices II
Pavel Cheben, National Research Council Canada (Canada)

11 Control, Manipulation, and Detection of Photons
Quentin Wilmart, CEA-LETI (France)

12 New Light-Induced Properties
Laurent Vivien, Centre de Nanosciences et de Nanotechnologies, CNRS, Université Paris-Sud, Université Paris-Saclay (France)

13 Sensing
Ashok Maliakal, Acacia Communications, Inc. (United States)

14 Reconfigurable Systems and Light Switching
Samuel Serna, Bridgewater State University (United States) and Massachusetts Institute of Technology (United States)

15 Lidar Approaches
Laurent Vivien, Centre de Nanosciences et de Nanotechnologies, CNRS, Université Paris-Sud, Université Paris-Saclay (France)