# PROCEEDINGS OF SPIE

# **Optoelectronic Devices and Integration VII**

Xuping Zhang Baojun Li Changyuan Yu Xinliang Zhang Editors

11–13 October 2018 Beijing, China

Sponsored by SPIE COS—Chinese Optical Society

#### Cooperating Organizations

Tsinghua University (China) • Peking University (China) • University of Science and Technology of China (China) • Zhejiang University (China) • Tianjin University (China) • Beijing Institute of Technology (China) • Beijing University of Posts and Telecommunications (China) • Nankai University (China) • Changchun University of Science and Technology (China) University of Shanghai for Science and Technology (China) • Capital Normal University (China) • Huazhong University of Science and Technology (China) • Beijing Jiaotong University (China) • Shanghai Institute of Optics and Fine Mechanics (China) • Changchun Institute of Optics and Fine Mechanics (China) • Institute of Semiconductors (China) • Institute of Optics and Electronics (China) • Institute of Physics (China) • Shanghai Institute of Technical Physics (China) • China Instrument and Control Society (China) • Optoelectronics Technology Committee, COS (China) • Optical Society of Japan (Japan) • Optical Society of Korea (Korea, Republic of) • The Australian Optical Society (Australia) • Optics and Photonics Society of Singapore (Singapore) • European Optical Society

Supporting Organizations CAST—China Association for Science and Technology (China) NSFC—National Nature Science Foundation (China)

Published by SPIE

Volume 10814

Proceedings of SPIE 0277-786X, V. 10814

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

Optoelectronic Devices and Integration VII, edited by Xuping Zhang, Baojun Li, Changyuan Yu, Xinliang Zhang, Proc. of SPIE Vol. 10814, 1081401 · © 2018 SPIE · CCC code 0277-786X/18/\$18 · doi: 10.1117/12.2520909

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 Optoelectronic Devices and Integration VII, edited by Xuping Zhang, Baojun Li, Changyuan Yu, Xinliang Zhang, Proceedings of SPIE Vol. 10814 (SPIE, Bellingham, WA, 2018) Seven-digit Article CID Number.

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

ISBN: 9781510622265 ISBN: 9781510622272 (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 Copyright © 2018, Society of Photo-Optical Instrumentation Engineers.

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is \$18.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 0277-786X/18/\$18.00.

Printed in the United States of America.

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



**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

- vii Authors
- ix Symposium Committees
- xiii Conference Committee

### **OPTOELECTRONIC DEVICES I**

- 10814 05 Single mode Fabry-Pérot laser diode and its application on digital and microwave photonics (Invited Paper) [10814-4]
- 1081406 PbS quantum dot solids and quantum dot size gradient layers for photovoltaics [10814-5]

### NANOPHOTONIC AND METAMATERIAL DEVICES I

- 10814 09 Silicon based tunable Fano resonance with ultrahigh slope rate and extinction ratio [10814-9]
- 10814 0B Nanoparticles manipulation on plasmonic metasurface for determination of antibody in labon-a-chip devices [10814-11]

### NANOPHOTONIC AND METAMATERIAL DEVICES II

- 10814 0D Smart light touch and optical antennas: from optical manipulation to cellular exploration (Invited Paper) [10814-13]
- 10814 OE Cantilever-based microring lasers embedded in a flexible substrate for strain and index gauges [10814-14]
- 10814 OF Property optimization of hybrid plasmonic Bragg gratings through optical admittance matching analysis [10814-15]

### INTEGRATED OPTICAL DEVICES

10814 01 Broadband athermal devices and their applications (Invited Paper) [10814-18]

- 10814 0J Analysis of mode-selective coupling between few-mode fibers and waveguides with lateral misalignment [10814-19]
- 10814 0K Design of three-dimensional tapered SOI-based spot-size converter for C band [10814-20]
- 10814 OL Optimal design of a crystalline and integrated resonator coupled with optical fibre [10814-21]
- 10814 0M Modeling of waveguide AllnAs avalanche photodiodes for high-gain-bandwidth product [10814-22]
- 10814 0N Freestanding GaN-based integrated photonics chip with ultra-micro LED and straight waveguide for visible light communication [10814-23]

#### FIBER-BASED DEVICES FOR SENSING AND COMMUNICATION I

- 10814 OP Vital signs monitoring using few-mode fiber-based sensors [10814-25]
- 10814 0Q Implementing a temperature-resistant fiber hydrophone sensor using FBG [10814-26]
- 10814 OR Broad-range self-sweeping single-frequency Tm-doped fiber laser for sensing applications [10814-29]
- 10814 0S Characteristics of forward stimulated Brillouin scattering effect in silica fibers [10814-27]

#### FIBER-BASED DEVICES FOR SENSING AND COMMUNICATION II

10814 0V Numerical investigation on four-wave mixing in tellurite photonic crystal fiber [10814-28]

#### **OPTOELECTRONIC DEVICES II**

- 10814 0X Coherent control of femtosecond spin current and terahertz wave generation in ferromagnetic heterostructures (Invited Paper) [10814-34]
- 10814 0Z Analysis on the break-down voltage of 4H-SiC avalanche photodiodes [10814-36]
- 10814 10 A tunable SFP optical module based on DFB laser array integrated with an SOA [10814-37]
- 1081411 Highly photosensitive vertical photodetectors based on CsPbBr<sub>3</sub> and PbS quantum-dot-layered heterojunction [10814-38]

	POSTER SESSION
10814 12	Silicon photonics technology on 200mm CMOS platform for high-integration applications [10814-39]
10814 13	Zipper connection: an accurate positioning method of detachable optical components with electrical and/or optical links for darkroom work [10814-40]
10814 14	Topologically optimised mode-locked Er:fibre laser with record wide tunability of femtosecond pulses [10814-41]
10814 15	Optical design of budget objectives for mass production microscopes [10814-42]
10814 16	Surface passivation of 1550nm AlxInyAsSb avalanche photodiode [10814-43]
10814 17	Dedicated oven for optical resonator heating process [10814-44]
10814 18	Electronics improvements for optical resonators fabrication [10814-45]
10814 19	Digital ion trap mass spectrometry [10814-46]
10814 1C	Fabrication and performance of Ge-on-Si PIN photodetectors [10814-49]
10814 1D	All-dielectric metasurface lens based on multimode fiber [10814-50]
10814 1E	A high-capacity WDM-PON system compatible with radio-over-fiber [10814-51]
10814 1F	Numerical simulation on supercontinuum generation by different optical modes in AsSe <sub>2</sub> -As <sub>2</sub> S <sub>5</sub> microstructured optical fiber[10814-52]
10814 1G	The wideband design of anisotropic acousto-optic deflector under different frequency bands [10814-53]
10814 1H	Numerical investigation on cascaded linear-cavity Raman fiber laser based on tellurite fiber [10814-54]
10814 1J	Study on impact ionization in charge layer and multiplication layer of InAlAs/InGaAs SAGCM avalanche photodiodes [10814-56]
10814 1L	Influence of current mismatch on IV performance test of photovoltaic modules [10814-58]
10814 1M	Realization of periodic InAs QDs by in-situ four-beam laser-interference irradiation on the wetting layer [10814-59]

# 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.

Aleksandrov, A., 06 Bassir, David, OL, 17 Biao, Xuan, 1G Budarnykh, A. E., OR Cai, Chuan, 1L Cao, Minaxuan, 11 Che, Yongli, 11 Chen, Baomin, 1G Chen, Jian, 1J Chen, Jun, 0Z Chen, Kai Xin, OJ Chen, Li, 1F Chen, Liang, 0S, 0V, 1F, 1H Chen, Shuyang, OP Chen, Xiangfei, 10 Chen, Yilin, OF Chen, Zhiliang, 11 Chiang, Kin Seng, OJ Chistyakov, A., 06 Dai, Qian, 1J Dong, Fengxin, OK Dong, Yafan, OF Fang, Tao, 10 Fang, Xuan, OE Frolov, Dmitry N., 15 Gao, Panyun, OS, OV, 1F, 1H Gao, Weiging, OS, OV, 1F, 1H Gao, Yang, OX Goltyapin, Y., 06 Guan, Chunying, 1D Guo, Chunyan, 16 Guo, Pei, 1C Guo, Yuhao, Ol Hao, C., 05 Hao, Yue, 17 He, Jianqiang, 1C He, Liuqing, Ol He, Yingwei, 1L Hu, Wei-Ying, 1J Huang, Jingkai, OF Huang, Peng, 1D Huang, Zhenyu, OP Huo, Dayun, 1M Jiang, Dongwei, 16 Jiang, Min, OB Jiang, Yan, ON Jiang, Yi, OZ Jiang, Zhi, 16 Jin, Lufan, 11

Jing, Fanhua, 15 Kablukov, S. I., OR Kobtsev, Sergey, 14 Koliada, Natalia, 14 Kong, Deyin, 0X Lee, Luke P., 0D Lei, Renfang, 1C Li, Baojun, OD Li, Bin, 12 Li, Guifang, Ol Li, Qingyan, 11 Li, Renhao, 1C Li, Xin, ON Li, Yifan, 11 Li, Yutong, OX Li, Zhanming S., OM Li, Zhihua, 12 Li, Zhiqiang, OM Liao, Naiman, 1C Lin, Kanglong, 10 Liu, Anjin, OK Liu, Daogun, 12 Liu, Henan, Ol Liu, Ruonan, 12 Liu, Xiaolong, 09 Liu, Xiu, OE Lobach, I. A., OR Lu, Xinyi, OF Lv, Yuexi, 16 Ma, Piiie, OK Man, Shuai, 1L Matsuo, Takara, 13 Meng, Haifeng, 1L Meng, Ranzhe, OK Miao, Jungang, OX Miao, Lili, 1M Nakarmi, B., 05 Ni, Chenquan, 1H Ni, Shuvu, ON Nie, Tianxiao, OX Nikitenko, V., 06 Niu, Zhichuan, 16 Nyushkov, Boris, 14 Pandey, Chandan, 0X Pang, Zhaoguang, 1G Peng, Changsi, 1M Pivtsov, Victor, 14 Qi, Aiyi, OK Ruan, Cunjun, OX

Sakamoto, Kunio, 13 Salzenstein, Patrice, OL, 17, 18 Shen, Huifang, 1G Sheng, Yang, OM Shi, Jin Xia, OJ Shi, Zhenwu, 1M Shi, Zhu, 1J Shilong, P., 05 Song, Hai-Zhi, 1J Sun, Yaoyao, 16 Tameev, A., 06 Tan, Fengze, OP Tan, Yue, OF Tang, Bo, 12 Tian, Jinshou, 16 Tong, Jing, 1J Tu, Jiajing, OP Vinogradova, Olga A., 15 Vladimirskaya, A. D., OR Wang, Bo, OX Wang, Dong, 1L Wang, Feng, OB Wang, Guanghui, OB Wang, Guowei, 16 Wang, Jing, Ol Wang, Li, 0X Wang, Mingjie, 1D Wang, Mingjin, OK Wang, Peng, 0S, 0V, 1F, 1H Wang, Si-Xun, 1J Wang, Tao, 16 Wang, Yingying, 10 Wang, Yongjin, ON Wen, Lianggong, OX Wen, Liyun, 15 Wu, Xiaojun, OX Wu, Zhaoxin, 16 Xiang, Boyuan, OE Xiang, Guohong, OE Xiang, Huabing, 1C Xiang, Pengfei, 1C Xiao, Meng, OX Xiao, Yegao, OM Xie, Xiu-Min, 1J Xin, Hongbao, OD Xiong, Limin, 1L Xiong, Ping, 1C Xu, Ji, OF Xu, Lijuan, Ol Xu, Qiang, 1J Xu, Wenhao, OB Xu, Yingqiang, 16 Yang, Linyun, 1M Yang, Liwei, 1E Yang, Tao, 19 Yang, Tianyu, OP Yang, Xinning, 1M Yang, Xiuwei, 1C Yang, Zhenjun, 1G

Yao, Jianguan, 11 Yu, Changyuan, OP Yu, Jinzhong, 12 Yu, Libo, 1J Yu, Yu, 11 Yu, Yuan, 09 Yuan, Anbo, 1C Zabihi, Mohammadmasoud, 0Q Zarubin, Mikhail, 17, 18 Zhang, Bifeng, 1L Zhang, Junchao, 1L Zhang, Lin, Ol Zhang, Lu, 1G Zhang, Peng, 12 Zhang, Qiubo, 1G Zhang, Wei, 1M Zhang, Xingyu, 1D Zhang, Xinliang, 09 Zhang, Xiu, OS, OV, 1F, 1H Zhang, Xuping, OB, OQ Zhang, Yating, 11 Zhang, Zhaoyu, OE Zhao, Weisheng, OX Zheng, Da'nong, 16 Zheng, Wanhua, OK Zhou, Taojie, OE Zhou, Yong, 0S, 0V, 1F, 1H Zhou, Zhangyu, 12 Zvaigzne, M., 06

# Symposium Committees

General Chairs

Maryellen Giger, President, SPIE and The University of Chicago (United States)Qihuang Gong, President, Chinese Optical Society and Peking University (China)

## General Co-chairs

 Arthur Chiou, National Yang-Ming University (Taiwan, China)
 Guangcan Guo, Past President, Chinese Optical Society and University of Science and Technology of China (China)
 Zejin Liu, Vice President, Chinese Optical Society and National University of Defense Technology (China)

### Technical Program Chairs

Ruxin Li, Vice President, Chinese Optical Society and Shanghai Institute of Optics and Fine Mechanics (China) Xingde Li, Johns Hopkins University (United States)

Technical Program Co-chairs

Tianchu Li, National Institute of Metrology (China)
Wei Huang, Northwestern Polytechnical University (China)
Ying Gu, Vice President, Chinese Optical Society and PLA General Hospital (China)
Huilin Jiang, Changchun University of Science and Technology (China)

Local Organizing Committee Chair

Xu Liu, Secretary General, Chinese Optical Society and Zhejiang University (China)

### Local Organizing Committee Co-chairs

Wenqing Liu, Vice President, Chinese Optical Society and Anhui Institute of Optics and Fine Mechanics (China)Guobin Fan, China Academy of Engineering Physics (China)

### Local Organizing Committee

Xiaomin Ren, Vice President, Chinese Optical Society and Beijing University of Posts and Telecommunications (China) Suotang Jia, Vice President, Chinese Optical Society and Shanxi University (China) Wenjie Wang, Vice President, Chinese Optical Society and Sunny Group Company, Ltd. (China) Qingming Luo, Huazhong University of Science and Technology (China) Ping Jia, Changchun Institute of Optics, Fine Mechanics and Physics (China) Wei Zhao, Xi'an Institute of Optics and Precision Mechanics (China) Yudong Zhang, Chengdu Branch, Chinese Academy of Sciences (China) Ninghua Zhu, Institute of Semiconductors (China) Yongtian Wang, Beijing Institute of Technology (China) Xiaocong Yuan, Shenzhen University (China) Limin Tong, Zhejing University (China) Weimin Chen, Chongging University (China) Yidong Huang, Tsinghua University (China) Tiegen Liu, Tianjin University (China) Zhiping Zhou, Peking University (China) Changhe Zhou, Jinan University (China) Yiping Cui, Southeast University (China) Zhongwei Fan, Academy of Optoelectronics, CAS (China) Xiaoying Li, Tianjin University (China) Yan Li, Deputy Secretary General, Chinese Optical Society and Peking University (China) Caiwen Ma, Xi'an Institute of Optics and Precision Mechanics (China) **Xinliang Zhang**, Huazhong University of Science and Technology (China) Jianxin Chen, Fujian Normal University (China) Yihua Hu, College of Electronic Engineering, National Univ. of Defense Technology (China)

### Secretaries-General

**Bo Gu**, Deputy Secretary General, Chinese Optical Society (China) **Hong Yang**, Deputy Secretary General, Chinese Optical Society and Peking University (China)

## Executive Organizing Committee

David J. Bergman, Tel Aviv University (Israel) **Qionghai Dai**, Tsinghua University (China) Keisuke Goda, The University of Tokyo (Japan) **Qihuang Gong**, Peking University (China) Ying Gu, Chinese PLA General Hospital (China) Guang-Can Guo, University of Science and Technology of China (China) Byoung S. Ham, Gwangju Institute of Science and Technology (Korea, Republic of) Sen Han, University of Shanghai for Science and Technology (China) and Suzhou H&L Instruments LLC (China) Werner H. Hofmann, Technische Universität Berlin (Germany) Minghui Hong, National University of Singapore (Singapore) **Bahram Jalali**, University of California, Los Angeles (United States) **Shibin Jiang**, AdValue Photonics, Inc. (United States) Satoshi Kawata, Osaka University (Japan) Tina E. Kidger, Kidger Optics Associates (United Kingdom) Baojun Li, Jinan University (China) Ming Li, Institute of Semiconductors (China) Ruxin Li, Shanghai Institute of Optics and Fine Mechanics (China) Xingde Li, Johns Hopkins University (United States) Jian Liu, PolarOnvx, Inc. (United States) Tiegen Liu, Tianjin University (China) Yongfeng Lu, University of Nebraska-Lincoln (United States) Qingming Luo, Huazhong University of Science and Technology (China) Yuji Sano, ImPACT (Japan) Yunlong Sheng, Université Laval (Canada) Kebin Shi, Peking University (China) Tsutomu Shimura, The University of Tokyo (Japan) Upendra N. Singh, NASA Langley Research Center (United States) Michael G. Somekh, The Hong Kong Polytechnic University (Hong Kong, China) Yuguo Tang, Suzhou Institute of Biomedical Engineering and Technology (China) Masahiko Tani, University of Fukui (Japan) Kimio Tatsuno, Koga Research Institute, Ltd. (Japan) Kevin K. Tsia, The University of Hong Kong (Hong Kong, China) Kazumi Wada, Massachusetts Institute of Technology (United States)

Yongtian Wang, Beijing Institute of Technology (China) Rongshi Xiao, Beijing University of Technology (China)

Hongxing Xu, Wuhan University (China)

**Toru Yoshizawa**, Tokyo University of Agriculture and Technology (Japan) and 3D Associates (Japan)

**Changyuan Yu**, The Hong Kong Polytechnic University (Hong Kong, China)

**Chongxiu Yu**, Beijing University of Posts and Telecommunications (China)

Xiao-Cong Yuan, Shenzhen University (China)

Xiaoyan Zeng, Huazhong University of Science and Technology (China)

Cunlin Zhang, Capital Normal University (China)

**Song Zhang**, Purdue University (United States)

Xi-Cheng Zhang, University of Rochester (United States)

**Xinliang Zhang**, Wuhan National Laboratory for Optoelectronics (China)

Xuping Zhang, Nanjing University (China)

**Changhe Zhou**, Shanghai Institute of Optics and Fine Mechanics (China)

Zhiping Zhou, Peking University (China)

Dan Zhu, Huazhong University of Science and Technology (China) Ning Hua Zhu, Institute of Semiconductors (China)

# **Conference Committee**

**Conference** Chairs

 Xuping Zhang, Nanjing University (China)
 Baojun Li, Jinan University (China)
 Changyuan Yu, The Hong Kong Polytechnic University (Hong Kong, China)
 Xinliang Zhang, Wuhan National Laboratory for Optoelectronics (China)

### Conference Program Committee

Dayan Ban, University of Waterloo (Canada) **Zhongping Chen**, Beckman Laser Institute and Medical Clinic (United States) Ho-Pui Ho, The Chinese University of Hong Kong (Hong Kong, China) Jan Ingenhoff, Ionexphotonics Inc. (Canada) Zhongcheng Liang, Nanjing University of Posts and Telecommunications (China) Xuejun Lu, University of Massachusetts Lowell (United States) Hai Ming, University of Science and Technology of China (China) **Gang-Ding Peng**, The University of New South Wales (Australia) Yuan Shi, Agilecom Photonic Solutions Inc. (United States) Anna K. Swan, Boston University (United States) Frank Vollmer, Max-Planck-Institut für die Physik des Lichts (Germany) Guanghui Wang, The Chinese University of Hong Kong (Hong Kong, China) Daniel M. Wasserman, The University of Texas at Arlington (United States) Lixin Xu, University of Science and Technology of China (China) Ningmu Zou, Advanced Micro Devices, Inc. (United States)

### Session Chairs

- Joint Keynote Session with Conferences 10814 and 10815
   Tina E. Kidger, Kidger Optics Associates (United Kingdom)
   Xuping Zhang, Nanjing University (China)
- 2 Optoelectronic Devices I
   Baojun Li, Jinan University (China)
   Changyuan Yu, The Hong Kong Polytechnic University (Hong Kong, China)

- 3 Nanophotonic and Metamaterial Devices I
   Changyuan Yu, The Hong Kong Polytechnic University (Hong Kong, China)
   Xinliang Zhang, Wuhan National Laboratory for Optoelectronics (China)
- 4 Nanophotonic and Metamaterial Devices II
   Xinliang Zhang, Wuhan National Laboratory for Optoelectronics (China)
   Xuping Zhang, Nanjing University (China)
- 5 Integrated Optical Devices **Xuping Zhang**, Nanjing University (China) **Baojun Li**, Jinan University (China)
- Fiber-based Devices for Sensing and Communication I
   Baojun Li, Jinan University (China)
   Changyuan Yu, The Hong Kong Polytechnic University (Hong Kong, China)
- Fiber-based Devices for Sensing and Communication II
   Changyuan Yu, The Hong Kong Polytechnic University (Hong Kong, China)
   Xinliang Zhang, Wuhan National Laboratory for Optoelectronics (China)
- 8 Optoelectronic Devices II
   Xinliang Zhang, Wuhan National Laboratory for Optoelectronics (China)
   Xuping Zhang, Nanjing University (China)

Proc. of SPIE Vol. 10814 1081401-14