PROCEEDINGS OF SPIE

Advanced Laser Technology and Applications

Shibin Jiang Lijun Wang Zejin Liu Wei Shi Pu Zhou Editors

22–24 May 2018 Beijing, China

Organized by

Chinese Society for Optical Engineering (CSOE) (China)
Photoelectronic Technology Committee, Chinese Society of Astronautics (China)
Photoelectronic Industrialization Committee, CHIA (China)
Department of Cooperation and Coordination for Industry, Academe and Research, CHIA (China)
Science and Technology on Low-light-level Night Vision Laboratory (China)

Sponsored by

Division of Information and Electronic Engineering of Chinese Academy of Engineering (China) Chinese Society for Optical Engineering (CSOE) (China)

Published by SPIE

Volume 10844

Proceedings of SPIE 0277-786X, V. 10844

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

Advanced Laser Technology and Applications, edited by Shibin Jiang, Lijun Wang, Zejin Liu, Wei Shi, Pu Zhou, Proc. of SPIE Vol. 10844, 1084401 · © 2018 SPIE CCC code: 0277-786X/18/\$18 · doi: 10.1117/12.2521330

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 Advanced Laser Technology and Applications, edited by Shibin Jiang, Lijun Wang, Zejin Liu, Wei Shi, Pu Zhou. Proceedings of SPIE Vol. 10844 (SPIE, Bellingham, WA, 2018) Seven-digit Article CID Number.

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510623309

ISBN: 9781510623316 (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 Conference Committee
- xi Introduction

ADVANCED LASER TECHNOLOGY AND APPLICATIONS

10844 02	Structure, luminescence and scintillation characteristics of Yb, Na, Ba-codoped yttrium-aluminum garnet [10844-1]
10844 03	Detection of ammonia using logarithmic-transformed wavelength modulation spectrum [10844-2]
10844 04	Analysis of photo-darkening losses in high power Yb doped fiber lasers and amplifiers [10844-3]
10844 05	Numerical investigation of high-power single frequency fiber amplifiers at a wavelength of 1018nm [10844-4]
10844 06	Theoretical investigation of mode competition in high-power fiber lasers and amplifiers at 1018nm [10844-5]
10844 07	Unified theory of the temporal-spectral dynamics in ytterbium-doped fiber lasers [10844-6]
10844 08	Study self-generated magnetic field and proton acceleration in the interaction of ultra-intense laser-plasma concave target [10844-7]
10844 09	Study on the characteristic parameters of nickel plasma based on laser induced breakdown spectroscopy [10844-8]
10844 0A	Experimental analysis of carbon-doped glycidyl azide polymer with Nd:YAG laser pulse in vacuum [10844-9]
10844 OB	Preliminary research on seed pulse-shaping of an all-fiber supercontinuum source [10844-10]
10844 0C	Study of the impact of crack width on wedge waves by laser ultrasound technique [10844-11]
10844 0D	Controlling the photoelectron momentum spectra of negative hydrogen ions by few-cycle orthogonal two-color laser pulses [10844-14]
10844 0E	Room temperature diode-pumped single-frequency Tm:LuYAG laser at 2023 nm [10844-15]

10844 OF	Research on high-frequency modulation characteristics of semiconductor laser [10844-16]
10844 0G	Analysis of a cloud measurement using Lidar [10844-17]
10844 OH	Simulation and modeling of laser backscattering in laser semi-active guidance [10844-18]
10844 01	Narrow bandwidth liquid crystal tunable filter based on Lyot-Solc composite structure [10844-19]
10844 OJ	Bright-dark pulses produced by passively mode-locked fiber laser with molybdenum disulfide saturable absorber [10844-20]
10844 OK	Mode evolution in photonic lanterns and requirements for achieving good beam quality and mode control [10844-21]
10844 OL	Micro-CT evaluation of fit of CAD/CAM occlusal veneers with Er:YAG laser treatment on dentin [10844-22]
10844 OM	Optical design of VIS-SWIR imaging spectrometer based on acousto-optic tunable filter [10844-24]
10844 ON	Surface properties estimation of sandy land based on multi-angle polarized image information [10844-25]
10844 00	Pulsed laser annealing for metallic nanorods embedded in alumina [10844-26]
10844 OP	Study on mid-infrared transmission characteristics of non-node anti-resonance hollow-core fiber [10844-27]
10844 0Q	Effect for an anti-ASE cap thickness on pump spot uniformity in a thin disk laser [10844-28]
10844 OR	11.08W picosecond azimuthally polarized beam output from Nd:YAG amplifier [10844-29]
10844 OS	The research on ytterbium-doped double-clad fiber for high power fiber lasers [10844-30]
10844 OT	The key technology on high power fiber optic laser in laser weapon [10844-31]
10844 OU	Study on the effect of fiber refractive index distribution on the homogenization of semiconductor laser beam [10844-32]
10844 OV	3.53 kW average power all-fiber amplifier with 0.16nm narrow-linewidth single-mode beam quality [10844-33]
10844 0X	Performance analysis of strong atmospheric turbulence multi-hop coherent OFDM FSO system [10844-35]
10844 0Y	Dual-wavelength mode-locked Yb-doped fiber laser based on Sagnac loop [10844-36]
10844 OZ	Sea trial of flow noise of fiber laser hydrophone array [10844-37]

10844 11	Passively mode-locked tunable wavelength linear cavity Yb-doped fiber laser based on volume grating $[10844\text{-}39]$
10844 12	A new design for indirectly measuring laser power with improved performance [10844-41]
10844 13	Theoretical simulation of laser-supported absorption wave induced by millisecond multiple pulsed laser on aluminum alloy [10844-43]
10844 14	Dithering phase locked technique analysis in photonic lantern [10844-44]
10844 15	Optimization design on the amplification of low-power pulsed single-frequency fiber laser [10844-46]
10844 16	Single-frequency fiber laser operating above 2 µm based on cascaded single-mode-multimode-single-mode fiber structures and Sagnac loop [10844-47]

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.

Abudurexiti, A., 08 Aikanbaier, K., 08 Bai, Yangbo, 11 Bo, Tiezhu, OU

Boneberg, Johannes, 00

Cai, Mena, 0E Cao, Dongdong, 0A Chen, Fang, 0E Chen, Jian-hong, 0D Chen, Meng, OR Chen, Sheng-Ping, OB Cheng, Chi, 0M Cheng, Zhen, 09 Chu, Quihui, 0V Cong, Menglong, 03 Cui, Lixuan, 0H Deng, Songwen, 0Q Dong, Xiang-cheng, 0D Dou, Zhiguo, 0A Feng, Jing, 0V Feng, Yuechong, 0U

Feng, Yuyi, 0O Fu, Shijie, 04, 05, 06, 15, 16 Gao, Xiaoqiana, OR Geng, Jian, 0Y Geng, Pengcheng, 0S Gong, Faquan, 0Q Graus, Philipp, 0O Guo, Qi, 0I Han, Hetong, 02 Han, Qingbang, 0C Hao, Ge-yang, 0Z

He, Jun-Fang, 09

Hu, Yonghao, 0H

Huang, Lingling, 00 Jia, Bo, ON Jia, Guorui, 0M Jia, Jing, 0C Jia, Yong, 0Q Jiang, Xueping, 0C Jiang, Zongfu, 07, 0K, 14 Jin, Guangyong, 13

Jin, Li, OY Jin, Yaxue, 02 Jin, Yuqi, 0Q Ke, Xin, 11 Ke, Xizheng, OF Kemmer, Tobias, 00 Lai, WenChang, 12

Leiderer, Paul, 0O Li, Bangjun, 0H Li, Baozhu, OH Li, Bin, 11 Li, Cuiping, 11 Li, Gana, 0Q Li, Jingyi, 13 Li, Meihua, OL Li, Na, 0N Li, Qi, 0Z Li, Qiushi, OL, OT Li, Shu-Li, 09 Li, Xia, 0G Li, Yuan-Yuan, 09 Li, Zhixian, OP Li'e, Ouyang, 0V Liu, Bo, OZ

Liu, Heng, 15 Liu, Hui, OU Liu, Juan, 00 Liu, Rui, 0Q Liu, Wei, 07, 0Z Liu, Wenguang, OK, 14 Liu, Xingrun, 0G Liu, Zhaohui, OF Lu, Shang, OR Lu, Yao, 0K, 14 Luo, Lele, 0A Luo, Liyi, 0N Luo, Wen-Feng, 09 Luo, Yun, 0V Ma, Jing, 0X

Ma. Penafei, 07

Ma, Xianhua, 0H

Ma, Yanxing, 14

Ma, Yuwei, 0X Mao, Yuanho, OP Mi, Zhiyuan, Ol Nemitz, Clayton A., 0O Ning, Ding, 0S Pan, Honggang, 11 Pan, Mingyan, 02 Pan, Rong, OS Pang, Lu, OS Peng, Hongpan, OR Qi, Hongji, 02 Qu, Zhou, OL, OT Ren, Guangjun, 11

Schmidt-Mende, Lukas, 00

Sheng, Quan, 15, 16 Shi, Chaodu, 16 Shi, Guannan, 16 Shi, Wei, 04, 05, 06, 15, 16 Shi, Xiaoxuan, OU Shi, Yi, OV

Si, Xi, OL Song, Zhaohui, 02 Sun, Dandan, 03

Tian, Jiajun, 0J Wang, Biao, OS Wang, Caili, 0U

Wang, Jianjun, 0V Wang, Jiuwang, 0U

Wang, Qingxue, 11

Wang, Rui, OJ Wang, Yi, 0X

Wang, Yiding, 03 Wang, Ying, OF

Wang, Yongtian, 00

Wang, Zefeng, OP Wang, Ziye, 0M

Wei, Xiaole, 15 Wen, Jing, 0V

Wu, Guo-jun, 0Z

Wu, Haolong, 14

Wu, Kaifeng, 0G Wu, Qianchao, 0J

Xie, Kun, 0K, 14

Xie, Zhaoxin, 04, 05, 06

Xu, Ke, 0J

Xu, Qingshan, 0G

Xu, Ying, 0G

Xu, Ze-Hua, OB

Xuan, Jiabin, 0N

Yan, Kexin, Ol

Yang, Baolai, 14

Yang, Ce, OR

Yang, Sen-Lin, 09

Yang, Xianheng, 0V

Yang, Xiaoqian, Ol

Yang, Xin, 0B

Yang, Yanfu, 0J

Yao, Jianquan, 04, 05, 06, 15, 16

Yao, Yong, 0J Ye, Jifei, 0A

Yi, Yongqing, OS

Yin, Benkang, OF

You, YunFeng, 0V

Zhang, Guoan, 0Y

Zhang, Haiwei, 11

Zhang, Hui, 02

Zhang, Mo, 0X

Zhang, Tianhao, Ol

Zhang, Tian-yun, 0D

Zhang, Wei, 13

Zhang, Xian, 0U

Zhang, Xihe, 0Q

Zhang, Ying, 0M, 0N

Zhang, Yuansheng, 0E

Zhao, Huijie, OI, OM, ON

Zhao, Lei, OV

Zhao, Xiao-Xia, 09

Zhao, Xuesong, 13

Zheng, Xiao-ping, 0D

Zhou, Pu, 07, 12

Zhou, Qiong, 0K

Zhou, Qu, 0L

Zhu, Maodong, 02

Zhu, Xiaojun, OY

Zhu, Xijuan, 0G

Zou, Li, 0Y

viii

Conference Committee

Conference Chair

Guangjun Zhang, Southeast University (China)

Conference Co-chairs

Junhao Chu, Shanghai Institute of Technical Physics (China)

Qionghai Dai, Tsinghua University (China)

Dianyuan Fan, Shenzhen University (China)

Jiancheng Fang, Beihang University (China)

Gu Min, Royal Melbourne Institute of Technology University (Australia)

Desheng Jiang, Wuhan University of Technology (China)

Huilin Jiang, Changchun University of Science and Technology (China)

Lin Li, The University of Manchester (United Kingdom)

Yueguang Lv, Chinese Academy of Engineering (China)

Zhejin Liu, National University of Defense Technology (China)

Wang Xiaomo, China Academy of Electronics and Information Technology (China)

Huaming Wang, Beihang University (China)

Lijun Wang, Changchun Institute of Optics, Fine Mechanics and Physics (China)

Wei Wang, China Aerospace Science and Technology Corporation (China)

Jianyu Wang, Shanghai Branch of Chinese Academy of Sciences (China)

Zuyan Xu, The Technical Institute of Physics and Chemistry (China)

Jiubin Tan, Harbin Institute of Technology (China)

Jianguan Yao, Tianjin University (China)

Hao Yin, China Electronic Systems Engineering Corporation (China)

Shaohua Yu, Wuhan Research Institute of Posts and

Telecommunications (China)

Renhe Zhang, Institute of Acoustics (China)

Zisen Zhao, Wuhan Research Institute of Posts and

Telecommunications (China)

Liwei Zhou, Beijing Institute of Technology (China)

Shouhuan Zhou, North China Research Institute of Electro-optics (China)

Zhongliang Zhu, Southwest Electronic Telecom Technology Research Institute (China)

Program Committee

Byoungho Lee, Seoul National University (Korea, Republic of)

Liangcai Cao, Tsinghua University (China)

Weibiao Chen, Shanghai Institute of Optics and Fine Mechanics (China)

Haimei Gong, Shanghai Institute of Technical Physics (China)

Sen Han, University of Shanghai for Science and Technology (China)

Huikai Xie, University of Florida (United States)

John McBride, University of Southampton (United Kingdom)

Yanbiao Liao, Tsinghua University (China)

Dong Liu, Zhejiang University (China)

Jian Liu, Harbin Institute of Technology (China)

Jin Lu, Tianjin Jinhang Institute of Technical Physics (China)

Mircea Guina, Tampere University of Technology (Finland)

Shibin Jiang, AdValue Photonics, Inc. (United States)

Guohai Situ, Shanghai Institute of Optics and Fine Mechanics (China)

Hongbo Sun, Tsinghua University (China)

Yongtian Wang, Beijing Institute of Technology (China)

Yuelin Wang, Shanghai Institute of Microsystem and Information Technology (China)

Renhe Zhang, Institute of Acoustics (China)

Xuejun Zhang, Changchun Institute of Optics, Fine Mechanics and Physics (China)

Pu Zhou, National University of Defense Technology (China)

Zhongliang Zhu, Southwest Electronic Telecom Technology Research Institute (China)

Session Chairs

- Ultrafast Laser Science and Technology
 Shibin Jiang, AdValue Photonics, Inc. (United States)
- 2 Fiber Lasers I

Wei Shi, Tianjin University (China)

- 3 Advanced Laser Materials
 Zhiyi Wei, Institute of Physics (China)
- Lasers For Advanced Manufacturing
 Guoqiang Xie, Shanghai Jiaotong University (China)
- Nonlinear Phenomenon in Optoelectronics Materials
 Pu Zhou, National University of Defense Technology (China)
- 6 Fiber Lasers II

Jian Zhang, Shanghai Institute of Ceramics (China)

Introduction

The International Symposium on Optoelectronic Technology and Application 2018 (OTA 2018) is the annual conference of the Chinese Society for Optical Engineering. It continues to be one of the largest academic and industrial conferences in the field of optical and optoelectronic technology in China. This year's program included academic exchanges, industry exhibitions, and cooperation negotiations together in one event. There were five technical conferences, seven exhibition themes, and 600 technical negotiations. We sincerely hope that this event continues to promote research and development of optoelectronic technology and to enhance international cooperation in the optical and optoelectronic fields.

OTA 2018 was sponsored by The Division of Information and Electronic Engineering of the Chinese Academy of Engineering (China), and The Chinese Society for Optical Engineering (CSOE) (China). The conference was organized by the Chinese Society for Optical Engineering (CSOE) (China), the Photoelectronic Technology Committee, the Chinese Society of Astronautics (China), the Photoelectronic Industrialization Committee, CHIA (China), the Department of Cooperation and Coordination for Industry, Academe, and Research, CHIA (China), and the Science and Technology on Low-light-level Night Vision Laboratory (China). We received more than 759 contributions from more than 15 countries, including the United States, United Kingdom, Germany, France, Spain, Australia, Canada, Mexico, Brazil, Japan, Republic of Korea, Thailand, Singapore, Russian Federation and China. There were more than 400 contributions published in SPIE Proceedings, including 70 contributions from invited speakers. After careful discussion, six keynote speeches were selected and presented by famous scientists from the United States, United Kingdom, Republic of Korea, and China. There were 138 excellent invited talks, 45 from overseas, that reflected first-class level in the field of optics and photonics technology. On behalf of the OTA 2018 Organizing Committee, I would like to express thanks to all the invited speakers and authors for their contributions and support.

Finally, on behalf of the other Co-chairmen and the Organizing Committee, I would like to heartily thank our sponsors and cooperating organizers for all they have done for the conference, and to all of the participants and friends for their interests and efforts in helping us to make the conference a success. Thanks also to the Program Committee for their effective work and valuable advice, especially the Secretariat, and to the staff of SPIE for their tireless efforts and outstanding service preparing and publishing the proceedings.

We hope to see you next year!

Guangjun Zhang