# PROCEEDINGS OF SPIE

# **Photonics for Energy II**

Haizheng Zhong Rui Zhu Samuel D. Stranks Jianpu Wang Editors

5–11 December 2022 ONLINE, 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) • Capital Normal University (China) • Huazhong University of Science and Technology (China) • Beijing Jiaotong University (China) • China Jiliang University (China) • Shanghai Institute of Optics and Fine Mechanics, CAS (China) • Changchun Institute of Optics, Fine Mechanics and Physics, CAS (China) • Institute of Semiconductors, CAS (China) • Institute of Optics and Electronics, CAS (China) • Institute of Physics, CAS (China) • Shanghai Institute of Technical Physics, CAS (China) • China Instrument and Control Society (China) Optical Society of Japan (Japan) • Optical Society of Korea (Republic of Korea) • Australian and New Zealand Optical Society • Optics and Photonics Society of Singapore (Singapore) • European Optical Society

Supporting Organizations China Association for Science and Technology (CAST) (China) Department of Information of National Nature Science Foundation, China (NSFC) (China)

Published by SPIE

Volume 12313

Proceedings of SPIE 0277-786X, V. 12313

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

Photonics for Energy II, edited by Haizheng Zhong, Rui Zhu, Samuel D. Stranks, Jianpu Wang, Proc. of SPIE Vol. 12313, 1231301 · © 2022 SPIE · 0277-786X doi: 10.1117/12.2668946 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 *Photonics for Energy II*, edited by Haizheng Zhong, Rui Zhu, Samuel D. Stranks, Jianpu Wang, Proc. of SPIE 12313, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

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

ISBN: 9781510656925 ISBN: 9781510656932 (electronic)

Published by **SPIE** P.O. Box 10, Bellingham, Washington 98227-0010 USA Telephone +1 360 676 3290 (Pacific Time) SPIE.org Copyright © 2022 Society of Photo-Optical Instrumentation Engineers (SPIE).

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 fees. To obtain permission to use and share articles in this volume, visit Copyright Clearance Center 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.

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.



**Paper Numbering:** A unique citation identifier (CID) number is assigned to each article in the Proceedings of SPIE 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

- v Symposium Committee
- ix Conference Committee

#### PHOTONICS FOR ENERGY I

12313 07 Application of machine-learning techniques for characteristic analysis of refractory materials [12313-20]

## PHOTONICS FOR ENERGY II

12313 0B Study on polarized light based on controlling CsPbBr<sub>3</sub> nanowires by alternating electric field [12313-10]

# Symposium Committees

General Chairs

 Anita Mahadevan-Jansen, President, SPIE (United States) and Vanderbilt University (United States)
 Qihuang Gong, President, Chinese Optical Society (China) and Peking University (China)

#### General Co-chairs

Guangcan Guo, Past President, Chinese Optical Society (China) and University of Science and Technology of China (China)
Zejin Liu, Vice President, Chinese Optical Society (China) and National University of Defense Technology (China)

# Technical Program Chairs

Ruxin Li, Vice President, Chinese Optical Society (China) 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 (China) and Chinese People's Liberation Army General Hospital (China) Huilin Jiang, Changchun University of Science and Technology (China) Wenging Liu, Vice President, Chinese Optical Society (China) and Anhui Institute of Optics and Fine Mechanics (China) Guobin Fan, China Academy of Engineering Physics (China) Suotang Jia, Vice President, Chinese Optical Society (China) and Shanxi University (China) Xiaomin Ren, Vice President, Chinese Optical Society (China) and Beijing University of Posts and Telecommunications (China) **Qingming Luo**, Hainan University (China) Xiangang Luo, Institute of Optics and Electronics (China) Ninghua Zhu, Institute of Semiconductors (China)

#### Organizing Committee

Suotang Jia, Vice President, Chinese Optical Society (China) and Shanxi University (China)

**Wenjie Wang**, Vice President, Chinese Optical Society (China) and Sunny Optical Technology Group (China)

**Ping Jia**, Changchun Institute of Optics, Fine Mechanics and Physics (China)

Yudong Zhang, Chengdu Branch, Chinese Academy of Sciences (China)

Ninghua Zhu, Institute of Semiconductors (China) Yongtian Wang, Beijing Institute of Technology (China)

onglian wang, beijing institute of technology (China)

Xiaocong Yuan, Shenzhen University (China)

Limin Tong, Zhejiang University (China)

Weimin Chen, Chongqing 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, Aerospace Information Research Institute (China) Xiaoying Li, Tianjin University (China)

Yan Li, Deputy Secretary General, Chinese Optical Society (China) 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) Yanqing Lu, Nanjing University (China)

# Secretaries-General

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

Yan Li, Deputy Secretary General, Chinese Optical Society (China) and Peking University (China)

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

**Tianrui Zhai**, Deputy Secretary General, Chinese Optical Society (China) and Beijing University of Technology (China)

## Local Organizing Committee Chair

Yan Li, Deputy Secretary General, Chinese Optical Society (China) and Peking University (China)

## Local Organizing Committee Co-chairs

Hong Yang, Deputy Secretary General, Chinese Optical Society (China) and Peking University (China)
Quan Sun, Peking University (China)
Kebin Shi, Peking University (China)

#### Local Secretaries

Wei Xiong, Chinese Optical Society (China) Xiaowen Gu, Peking University (China) Yu Xiang, Peking University (China)

#### Local Organizing Committee

Jian Xu, Peking University (China) Hailin Wang, Peking University (China) Shuting Jiang, Peking University (China) Xiaoyan Zhang, Peking University (China) Yuhua Cao, Peking University (China) Quanquan Zheng, Peking University (China) Xiao Li, Chinese Optical Society (China) Jianxin Sun, Chinese Optical Society (China)

## Technical Organizing Committee

Mohammad Hossein Asghari, Loyola Marymount University (United States) and Tachyonics Inc. (United States) Liangcai Cao, Tsinghua University (China) P. Scott Carney, University of Rochester (United States) Benyong Chen, Zhejiang University of Science and Technology (China) Qionghai Dai, Tsinghua University (China) Gerd Ehret, Physikalisch-Technische Bundesanstalt (Germany) Xinyu Fan, Shanghai Jiao Tong University (China) Zheyu Fang, Peking University (China) and Rice University (United States) Ying Gu, Chinese People's Liberation Army General Hospital (China) Sen Han, University of Shanghai for Science and Technology (China) and Suzhou H&L Instruments LLC (China) Ingmar Hartl, Deutsches Elektronen-Synchrotron (Germany) Qiongyi He, Peking University (China) Werner Hofmann, Technische Universität Berlin (Germany) **Minghui Hong**, National University of Singapore (Singapore) Shibin Jiang, AdValue Photonics, Inc. (United States) Tina Kidger, Kidger Optics Associates (United Kingdom)

Dai-Sik Kim, Ulsan National Institute of Science and Technology (Republic of Korea) Wei Li, Institute of Semiconductors (China) Baojun Li, Jinan University (China) Xingde Li, Johns Hopkins University (United States) Ming Li, Institute of Semiconductors (China) Chuan-Feng Li, University of Science and Technology of China (China) Jun Liu, Shanghai Institute of Optics and Fine Mechanics (China) Qingming Luo, Hainan University (China) Gang-Ding Peng, The University of New South Wales (Australia) Ting-Chung Poon, Virginia Polytechnic Institute and State University (United States) Yuji Sano, Institute for Molecular Science (Japan) Kebin Shi, Peking University (China) **Tsutomu Shimura**, The University of Tokyo (Japan) Samuel Stranks, University of Cambridge (United Kingdom) Yikai Su, Shanghai Jiao Tong University (China) Takuo Tanaka, RIKEN (Japan) Masahiko Tani, University of Fukui (Japan) Limin Tong, Zhejiang University (China) Kazumi Wada, Massachusetts Institute of Technology (United States) Jianpu Wang, Nanjing University of Technology (China) **Yongtian Wang**, Beijing Institute of Technology (China) Rengmao Wu, Zhejiang University (China) Rongshi Xiao, Beijing University of Technology (China) Minghong Yang, Wuhan University of Technology (China) Jianhua Yao, Zhejiang University of Technology (China) Hiroshi Yoshikawa, Nihon University (Japan) Changyuan Yu, The Hong Kong Polytechnic University (Hong Kong, China) Xiao-Cong Yuan, Shenzhen University (China) Xuping Zhang, Nanjing University (Ching) Xinliang Zhang, Wuhan National Research Centre for Optoelectronics (China) Xi-Cheng Zhang, University of Rochester (United States) Cunlin Zhang, Capital Normal University (China) Zhenrong Zheng, Zhejiang University (China) Haizheng Zhong, Beijing Institute of Technology (China) Changhe Zhou, Shanghai Institute of Optics and Fine Mechanics (China) Zhiping Zhou, Peking University (China) **Rui Zhu**, Peking University (China) Dan Zhu, Huazhong University of Science and Technology (China)

# **Conference Committee**

Conference Chairs

Haizheng Zhong, Beijing Institute of Technology (China)
Rui Zhu, Peking University (China)
Samuel D. Stranks, University of Cambridge (United Kingdom)
Jianpu Wang, Nanjing University of Technology (China)

Conference Program Committee

Tae-Woo Lee, Seoul National University (Korea, Republic of) **Qihua Xiong**, Tsinghua University (China) Yabing Qi, Okinawa Institute of Science and Technology Graduate University (Japan) Anita Ho-Baillie, The University of Sydney (Australia) Osman M. Bakr, King Abdullah University of Science and Technology (Saudi Arabia) Sheng Xu, University of California, San Diego (United States) Feng Gao, Linköping University (Sweden) Jia Zhu, Nanjing University (China) Michael Saliba, Universität Stuttgart (Germany) and Forschungszentrum Jülich (Germany) Wolfgang R. Tress, Zurich University of Applied Sciences (Switzerland) Yuan Yang, Columbia University (United States) Haizheng Zhong, Beijing Institute of Technology (China) Wei Zhang, University of Surrey (United Kingdom) Feng Liu, Shanghai Jiao Tong University (China) **Hin-Lap Yip**, City University of Hong Kong (Hong Kong, China) Jingshan Luo, Nankai University (China) **Zhi-Kuang Tan**, National University of Singapore (Singapore) Guichuan Xing, University of Macau (Macao, China)