PROCEEDINGS OF SPIE

Photonics for Energy III

Haizheng Zhong Rui Zhu Samuel D. Stranks Jianpu Wang Editors

15–16 October 2023 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) • 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 12763

Proceedings of SPIE 0277-786X, V. 12763

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

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 III*, edited by Haizheng Zhong, Rui Zhu, Samuel D. Stranks, Jianpu Wang, Proc. of SPIE 12763, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

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

ISBN: 9781510667754 ISBN: 9781510667761 (electronic)

Published by **SPIE** P.O. Box 10, Bellingham, Washington 98227-0010 USA Telephone +1 360 676 3290 (Pacific Time) SPIE.org Copyright © 2023 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 Committees
- ix Conference Committee

PHOTONICS FOR ENERGY I

12763 05 Perovskite as color conversion materials for micro-LED display (Invited Paper) [12763-4]

PHOTONICS FOR ENERGY IV

12763 01 Nanoscale light focusing of colloidal nanostructures for enhanced silicon solar cells [12763-20]

PHOTONICS FOR ENERGY V

12763 ON Interface treatment by oxygen plasma for PEDOT:PSS/silicon hybrid solar cell [12763-26]

PHOTONICS FOR ENERGY VI

12763 OR Perovskite-germanium heterostructure with periodical nanoparticles for broadband light harvesting [12763-31]

DIGITAL POSTER SESSION

- 12763 0V A wide field-of-view optical receiver based on a ball lens retroreflector for resonant beam charging applications [12763-16]
 12763 0W HTL doping density optimization for photovoltaic assessment of Pb-free Cs₂NaGaBr₆ n-i-p
- solar cell [12763-21]
 12763 0X An investigation of inorganic ETL materials for carbon-based HTL-free perovskite solar cell
- [12763-30]
- 12763 0Y A design of thin metal-nitrides broadband meta-absorber for application of solar energy [12763-35]