PROCEEDINGS OF SPIE

[SPIDigitalLibrary.org/conference-proceedings-of-spie](https://spiedigitallibrary.org/conference-proceedings-of-spie)

Front Matter: Volume 8914

, "Front Matter: Volume 8914," Proc. SPIE 8914, International Symposium on Photoelectronic Detection and Imaging 2013: Fiber Optic Sensors and Optical Coherence Tomography, 891401 (29 August 2013); doi: 10.1117/12.2044153

SPIE.

Event: ISPDI 2013 - Fifth International Symposium on Photoelectronic Detection and Imaging, 2013, Beijing, China

PROCEEDINGS OF SPIE

*International Symposium on Photoelectronic
Detection and Imaging 2013*

Fiber Optic Sensors and Optical Coherence Tomography

Yunjiang Rao
Editor

25–27 June 2013
Beijing, China

Organized by
Photoelectronic Technology Committee, Chinese Society of Astronautics • Tianjin Jinhang
Institute of Technical Physics (China) • Science and Technology on Low Light Level Night
Vision Laboratory (China) • Science and Technology on Optical Radiation Laboratory
(China) • Science and Technology on Electromagnetic Scattering Laboratory (China)

Sponsored by
SPIE • The Optical Society • European Optical Society • Chinese Society of Astronautics

Published by
SPIE

Volume 8914

Proceedings of SPIE 0277-786X, V. 8914

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

International Symposium on Photoelectronic Detection and Imaging 2013: Fiber Optic Sensors and Optical
Coherence Tomography, edited by Yunjiang Rao, Proc. of SPIE Vol. 8914, 891401 · © 2013 SPIE
CCC code: 0277-786X/13/\$18 · doi: 10.1117/12.2044153

Proc. of SPIE Vol. 8914 891401-1

The papers included 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. The papers published in these proceedings 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 this book:

Author(s), "Title of Paper," in *International Symposium on Photoelectronic Detection and Imaging 2013: Fiber Optic Sensors and Optical Coherence Tomography*, edited by Yunjiang Rao, Proceedings of SPIE Vol. 8914 (SPIE, Bellingham, WA, 2013) Article CID Number.

ISSN: 0277-786X

ISBN: 9780819497833

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 © 2013, 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/13/\$18.00.

Printed in the United States of America.

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

SPIDigitalLibrary.org

Paper Numbering: Proceedings of SPIE follow an e-First publication model, with papers published first online and then in print and on CD-ROM. Papers are published as they are submitted and meet publication criteria. A unique, consistent, permanent citation identifier (CID) number is assigned to each article at the time of the first 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, print, and electronic versions of the publication. SPIE uses a six-digit CID article numbering system in which:

- The first four 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. The complete citation is used on the first page, and an abbreviated version on subsequent pages. Numbers in the index correspond to the last two digits of the six-digit CID Number.

Contents

ix	Conference Committee
xi	Introduction

FIBER OPTIC SENSORS AND OPTICAL COHERENCE TOMOGRAPHY

8914 02	Random noise study of the digital closed-loop fiber optic gyroscope [8914-1] H. Gu, S. Li, F. Wang, H. Zhang, Tianjin Polytechnic Univ. (China)
8914 03	Low-temperature nonlinear effect of fiber Bragg gratings [8914-2] Z. Yin, D. He, Y. Wang, T. Wang, Y. Quan, P. Wang, Beijing Jiaotong Univ. (China)
8914 04	The performance analysis of the optical frequency domain reflectometry fiber grating strain sensor system [8914-3] Z. Li, B. Qin, Z. Liu, G. Wu, S. Li, P. Liu, X. Zhang, China Electronics Technology Group Corp. (China)
8914 05	Temperature and pressure sensor based on fiber grating lasers [8914-4] C. Chen, Q. Li, H. Chen, Yangtze Univ. (China)
8914 06	Real-time measurement with a fiber optical surface plasmon resonance sensor for biochemical interaction analysis [8914-5] Z. Tan, X. Li, Y. Chen, P. Fan, Shenzhen Univ. (China)
8914 07	Numerical investigation of tapered optical fiber sensor based on multimode interference [8914-7] Y. Tan, J. Lou, H. Xu, J. Huang, W. Shen, China Jiliang Univ. (China)
8914 08	The research of optical fiber Brillouin spectrum denoising based on wavelet transform and neural network [8914-8] Z. Zhang, W. Hu, J. Yan, P. Zhang, China Electronics Technology Group Corp. (China)
8914 09	Fiber optic quasi-distributed sensors for water leak detection [8914-11] T.-S. Cho, I.-B. Kwon, Korea Research Institute of Standards and Science (Korea, Republic of)
8914 0A	A novel ring resonator with series coupled double-ring [8914-16] X. Li, Harbin Institute of Technology (China); L. Wang, S. Guo, Yanshan Univ. (China); M. Yang, Harbin Institute of Technology (China)
8914 0B	Application of Morlet wavelet in the extraction of Brillouin scattering signal envelope [8914-17] X. Wang, Jiangxi Institute of Chemical Industry Technology (China); C. Huang, L. Zhou, Nanchang Hangkong Univ. (China)

- 8914 0C **Strain monitoring of railway based on fiber Bragg grating sensors** [8914-18]
P. Wang, D. He, Y. Wang, T. Wang, Y. Quan, Z. Yin, Beijing Jiaotong Univ. (China)
- 8914 0D **An integrated fiber-optic turbulence sensor and its applications in maritime atmospheric optical turbulence research** [8914-19]
S. Xiao, Anhui Institute of Optics and Fine Mechanics (China) and Graduate Univ. of the Chinese Academy of Sciences (China); H. Mei, Anhui Institute of Optics and Fine Mechanics (China); Q. Wang, Anhui Institute of Optics and Fine Mechanics (China) and Graduate Univ. of the Chinese Academy of Sciences (China); R. Rao, Anhui Institute of Optics and Fine Mechanics (China)
- 8914 0E **Modeling and simulation of the second feedback loop for fiber optic gyroscope** [8914-21]
Y. Zhang, Z. Gao, G. Wang, W. Gao, Harbin Engineering Univ. (China)
- 8914 0G **A novel density sensor based on high-birefringence fiber loop mirror** [8914-23]
D. Bai, S. Hu, T. Xu, C. He, Beijing Univ. of Technology (China)
- 8914 0H **Piecewise compensation for the nonlinear error of fiber-optic gyroscope scale factor** [8914-24]
Y. Zhang, X. F. Wu, S. Yuan, L. Wu, Harbin Engineering Univ. (China)
- 8914 0I **Package security recorder of vibration** [8914-25]
X. Wang, J. Hu, S. Song, Dalian Univ. of Technology (China)
- 8914 0J **Selective-fluid-filled photonic crystal fibers and applications (Invited Paper)** [8914-26]
Y. Wang, C. Liao, X. Zhong, Z. Li, Y. Liu, J. Zhou, K. Yang, Shenzhen Univ. (China)
- 8914 0K **Analysis and simulation of the local micro-structured long period fiber grating** [8914-30]
Y. Cao, F. Pan, Y. Pei, X. Yan, H. Sun, Tianjin Univ. of Technology (China)
- 8914 0L **Twin-core fiber-based sensor for measuring the strain and bending simultaneously** [8914-33]
Y. Yang, Y. Zhang, Z. Liu, J. Yang, L. Yuan, Harbin Engineering Univ. (China)
- 8914 0M **Performance evaluation of temperature-compensated FBG pressure sensor** [8914-35]
T. Fu, Y. Gong, Y. Wu, Y.-J. Rao, Y.-Y. Ma, W.-Q. Niu, Univ. of Electronic Science and Technology of China (China)
- 8914 0N **Phase generated carrier technique for fiber laser hydrophone** [8914-36]
R. Li, Huazhong Univ. of Science and Technology (China) and Naval Univ. of Engineering (China); X. Wang, Huazhong Univ. of Science and Technology (China); J. Huang, H. Gu, Naval Univ. of Engineering (China)
- 8914 0O **Design and experiment study of solution refractive index sensor based on TFBG-SPR** [8914-41]
Q. Jiang, D. Lv, Shandong Univ. (China)
- 8914 0P **The polarization characteristics of PZT phase modulation in single mode fiber** [8914-42]
Q. Wang, Y. Liang, H. Deng, Harbin Engineering Univ. (China)
- 8914 0Q **Test of optical fiber grating based new-type wavelength standard instrument** [8914-43]
J. Li, N. Xu, J. Li, Z. Zhang, National Institute of Metrology (China)

- 8914 OR **Cantilever-based two-axis fiber Bragg grating accelerometer** [8914-44]
Y. Hou, Institute of Semiconductors (China) and Sembawang Huangqiu Engineering Co. Ltd. (China); W. Zhang, F. Li, Institute of Semiconductors (China)
- 8914 OS **The basic study on application of optical coherence tomography to monitoring of viability *in vivo* rat brain** [8914-45]
M. Sato, I. Nonaka, T. Kitano, T. Takahashi, Yamagata Univ. (Japan); I. Nishidate, Tokyo Univ. of Agriculture and Technology (Japan)
- 8914 OT **Study of the polarization maintaining optical fiber beat length variation with external force** [8914-48]
Z. Ou, Univ. of Electronic Science and Technology of China (China); P. Sun, Sichuan Agricultural Univ. (China); Y. Chen, J. Li, Y. Liu, H. Yue, Z. Dai, L. Zhang, Univ. of Electronic Science and Technology of China (China)
- 8914 OU **Optimal fusion offset in splicing photonic crystal fibers** [8914-51]
W. Jin, W. Bi, G. Fu, Yanshan Univ. (China)
- 8914 OV **A novel differential optical fiber accelerometer** [8914-52]
S. Pi, J. Zhao, G. Hong, B. Jia, Fudan Univ. (China)
- 8914 OW **The measurement of average refractive index with substrate-calibrating by using complex frequency-domain optical coherence tomography method** [8914-53]
H. Huang, Z. Jiang, W. Cai, Y. Wang, Y. Wan, Beijing Univ. of Technology (China)
- 8914 OX **Broadband mid-infrared hollow core photonic bandgap fiber for multi-component trace-gas sensing** [8914-54]
L. Shang, Qufu Normal Univ. (China); X. Yang, Qufu Normal Univ. (China) and Shandong Univ. (China); F. Lin, Shandong Kaiwen College of Science and Technology (China)
- 8914 OY **A novel all-fiber velocity measurement system with high fringe contrast** [8914-55]
P. Lin, B. Jia, G. Hong, Fudan Univ. (China)
- 8914 OZ **Based on optical fiber Michelson interferometer for acoustic emission detection experimental research** [8914-56]
Y. Liang, D. Qu, H. Deng, Harbin Engineering Univ. (China)
- 8914 10 **Stability control of the polarization switching** [8914-57]
X. Yin, H. Lin, Z. Hu, Y. Hu, National Univ. of Defense Technology (China)
- 8914 11 **High sensitivity fiber optic accelerometer based on folding F-P cavity** [8914-58]
Z. Yang, H. Luo, S. Xiong, National Univ. of Defense Technology (China)
- 8914 12 **Melamine sensing based on evanescent field enhanced optical fiber sensor** [8914-59]
J. Luo, Institute of Optics and Electronics (China) and Univ. of the Chinese Academy of Sciences (China); J. Yao, Institute of Optics and Electronics (China); W. Wang, Institute of Optics and Electronics (China) and Univ. of the Chinese Academy of Sciences (China); X. Zhuang, East China Institute of Photo-Electron ICs (China); W. Ma, Chengdu Univ. of Information Technology (China); Q. Lin, Columbia Univ. (United States)

- 8914 13 **A novel microfluidic chip based on fiber sensor** [8914-61]
B. Su, Capital Normal Univ. (China); G. Duan, Beijing Institute of Technology (China);
X. Han, Capital Normal Univ. (China)
- 8914 14 **Research of sound sensitivity of multilayer coating optic fiber** [8914-62]
C. Xiao, J. Ren, L. Ye, China Electronics Technology Group Corp. (China)
- 8914 15 **Novel bidirectional path measurement of polarization cross-coupling distribution in PMF**
[8914-63]
J. Jin, S. Wang, J. Song, N. Song, Z. Sun, Y. Pan, Beihang Univ. (China)
- 8914 16 **The research of high birefringence polymer photonic crystal fiber with elliptical air holes
and squeezed lattice** [8914-64]
P. Song, Univ. of Jinan (China)
- 8914 17 **Analysis of optimum coupling efficiency between random light and single-mode fiber**
[8914-65]
J. Kang, P. Guo, Y. Zhang, H. Chen, S. Chen, X. Ge, Beijing Institute of Technology (China)
- 8914 18 **The dispersion properties of polymer photonic crystal fibers with squeezed lattice and
elliptical air holes** [8914-66]
P. Song, Univ. of Jinan (China)
- 8914 19 **Compact all-fiber interferometer system for shock acceleration measurement** [8914-69]
J. Zhao, S. Pi, G. Hong, D. Zhao, B. Jia, Fudan Univ. (China)
- 8914 1A **Optimization design for inter-mode interference sensors based on micro/nano optical
fibers** [8914-70]
Z. Hong, L. Zhang, Z. Lu, Y. Wu, Y. Li, Shanghai Institute of Mechanical and Electrical
Engineering Co., Ltd. (China)
- 8914 1B **Research on polarization control in the long distance fiber-optic sensing** [8914-71]
D. Wang, J. Zhou, Beijing Univ. of Technology (China)
- 8914 1C **A versatile frequency domain multiplexer for optical coherence tomography** [8914-73]
M. Zurasukas, A. G. Podoleanu, Univ. of Kent (United Kingdom)
- 8914 1D **Research on interferometric photonic crystal fiber hydrophone** [8914-74]
H. Luo, Z. Zhang, F. Wang, S. Xiong, National Univ. of Defense Technology (China)
- 8914 1E **Effects of fiber bundle on the performance of full-field swept source OCT** [8914-76]
X. Zhou, Xi'an Jiaotong Univ. (China); J. Wang, K. Selvon, M. Matela, G. M. Dobre,
A. G. Podoleanu, Univ. of Kent (United Kingdom)
- 8914 1F **Research on small signal detection of optical voltage/current transformer** [8914-77]
H. Li, G. Zhang, X. Cai, Z. Guo, W. Yu, G. Huo, Harbin Institute of Technology (China)
- 8914 1G **Tuning parameters and performance of a real-time depth-resolved wavefront sensor**
[8914-78]
J. Wang, A. G. Podoleanu, Univ. of Kent (United Kingdom)

8914 1H **Time domain optical coherence tomography investigation of bone matrix interface in rat femurs** [8914-79]

L.-C. Rusu, M.-L. Negruțiu, C. Sinescu, B. Hoinoiu, F.-I. Topala, Univ. of Medicine and Pharmacy Victor Babes Timisoara (Romania); V.-F. Duma, Aurel Vlaicu Univ. of Arad (Romania); M. Rominu, Univ. of Medicine and Pharmacy Victor Babes Timisoara (Romania); A. G. Podoleanu, Univ. of Kent (United Kingdom)

Author Index

Conference Committee

Conference Chairs

Konstantin Vodopyanov, Stanford University (United States) and CREOL,
The College of Optics and Photonics, University of Central Florida
(United States)
Guofan Jin, Tsinghua University (China)
Songlin Zhuang, University of Shanghai for Science and Technology
(China)

Local Organizing Committee

Jiaqi Wang, Changchun Institute of Optics, Fine Mechanics and Physics
(China)
Zuyan Xu, Technical Institute of Physics and Chemistry (China)
Zunqi Lin, Shanghai Institute of Optics and Fine Mechanics (China)
Dianyuan Fan, Shanghai Institute of Optics and Fine Mechanics (China)
Jingshan Jiang, Center for Space Science and Applied Research (China)
Liwei Zhou, Beijing Institute of Technology (China)
Shouhuan Zhou, North China Research Institute of Electro-optics (China)
Desheng Jiang, Wuhan University of Technology (China)
Jianquan Yao, Tianjin University (China)
Qingxi Tong, Institute of Remote Sensing and Digital Earth (China)
Junhao Chu, Shanghai Institute of Technical Physics (China)
Yongqi Xue, Shanghai Institute of Technical Physics (China)

Program Committee

Junhao Chu, *Chair*, Shanghai Institute of Technical Physics (China)
Jinxue Wang, *Chair*, Raytheon Company (United States)
Min Gu, Swinburne University of Technology (Australia)
Andreas Tünnermann, Friedrich-Schiller-Universität Jena (Germany)
Connie Chang, University of California, Berkeley (United States)
Shibin Jiang, AdValue Photonics Inc. (United States)
H. C. Liu, Shanghai Jiao Tong University (China)
Xiaocong Yuan, Nankai University (China)
Wei Shi, Tianjin University (China)
Min Qiu, Zhejiang University (China)
Nanjian Wu, Institute of Semiconductors (China)

Session Chairs

- 1 Fiber Optic Sensors and Optical Coherence Tomography
Adrian Podoleanu, University of Kent (United Kingdom)
Chris Xu, Cornell University (United States)
Yunjiang Rao, University of Electronic Science and Technology (China)
Yanbiao Liao, Tsinghua University (China)

Introduction

We have had the great honor of organizing the Fifth International Symposium on Photoelectronic Detection and Imaging (ISPDl) in Beijing. It was truly a great pleasure for us to greet the more than 1,200 participants from many different countries attending ISPDl 2013! I firmly believe that the symposium will become an important international event in the field of photoelectronic detection and imaging technology.

ISPDl 2013 was sponsored by SPIE, The Optical Society, European Optical Society, and the Chinese Society of Astronautics, and was organized by the Photoelectronic Technology Committee, Chinese Society of Astronautics, Tianjin Jinhang Institute of Technical Physics, Science and Technology on Low Light Level Night Vision Laboratory, Science and Technology on Optical Radiation Lab. and Science and Technology on Electromagnetic Scattering Lab. There were 26 cooperating organizations that supported the meeting. Nearly 850 papers were accepted for presentation at ISPDl 2013, contributed by over 1,370 authors from more than 10 countries, including the United States, United Kingdom, Germany, France, Norway, Australia, Canada, Japan, Korea, Russia, China, and so on. We had seven plenary speeches and 135 famous scientists and experts from home and abroad to present the invited talks at 10 different conferences.

The purpose of ISPDl 2013 is to provide a forum for the participants to report and review the innovative ideas and up-to-date progress and developments, and discuss the novel approaches to applications in the field of photoelectronic detection and imaging. It is sincerely hoped that the research and developments in optical and photoelectronic fields will be promoted, and that international cooperation and the sharing of common interests will be enhanced.

On behalf of Prof. Konstantin Vodopyanov, and the other conference chairs, and the Organization Committee of ISPDl, I would like to heartily thank our sponsors and cooperating organizations for all they have done for the meeting. Thanks also to all the authors for their contributions to the proceedings, to all of the participants and friends for their interest and efforts in helping us make the symposium possible, to the Program Committee for their effective work and valuable advice, and especially the ISPDl 2013 Secretariat and the SPIE staff for their tireless effort and outstanding service in preparing the meeting and publishing the conference proceedings.

Guofan Jin