## PROCEEDINGS OF SPIE

## Fiber Optic Sensors and Applications XV

Alexis Mendez Christopher S. Baldwin Henry H. Du Editors

17–18 April 2018 Orlando, Florida, United States

Sponsored and Published by SPIE

**Volume 10654** 

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 *Fiber Optic Sensors and Applications XV*, edited by Alexis Mendez, Christopher S. Baldwin, Henry H. Du, Proceedings of SPIE Vol. 10654 (SPIE, Bellingham, WA, 2018) Seven-digit Article CID Number.

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510618190

ISBN: 9781510618206 (electronic)

Published by

SPIF

P.O. Box 10, Bellingham, Washington 98227-0010 USA Telephone +1 360 676 3290 (Pacific Time)· Fax +1 360 647 1445 SPIF 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 Vm7 i ffUb 5 ggc WJUhY gž & Wži bXYf "JW bgY Zfca GD-9.

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

∨ii ix	Authors Conference Committee
SESSION 1	FIBER OPTIC SENSING FOR ELECTRIC POWER SYSTEMS
10654 02	Fiber optic current and voltage sensors for electric power transmission systems (Invited Paper) [10654-1]
10654 03	Fiber optic sensors and applications in the power generation industry (Invited Paper) [10654-2]
10654 04	Optical sensors technologies evolution applied for power quality monitoring in the medium-voltage [10654-3]
10654 05	Low-cost fiber optic sensor array for simultaneous detection of hydrogen and temperature [10654-4]
10654 06	Merits of a hybrid fluorescent fiber sensor and power over fiber partial discharge detection solution [10654-5]
SESSION 2	FIBER BRAGG GRATING SENSORS I
<b>SESSION 2</b> 10654 07	FIBER BRAGG GRATING SENSORS I  Multipoint high temperature sensing with regenerated fiber Bragg gratings (Invited Paper) [10654-6]
	Multipoint high temperature sensing with regenerated fiber Bragg gratings (Invited Paper)
10654 07	Multipoint high temperature sensing with regenerated fiber Bragg gratings (Invited Paper) [10654-6]  High temperature measurement of a low emission, high pressure combustor using
10654 07 10654 08	Multipoint high temperature sensing with regenerated fiber Bragg gratings (Invited Paper) [10654-6]  High temperature measurement of a low emission, high pressure combustor using femtosecond laser written fiber Bragg gratings [10654-7]  Packaged FBG based optical fiber sensor for simultaneous pressure and temperature
10654 07 10654 08 10654 09	Multipoint high temperature sensing with regenerated fiber Bragg gratings (Invited Paper) [10654-6]  High temperature measurement of a low emission, high pressure combustor using femtosecond laser written fiber Bragg gratings [10654-7]  Packaged FBG based optical fiber sensor for simultaneous pressure and temperature monitoring [10654-8]  Secondary Bragg grating based fiber sensors for the application in high temperature

10654 OC	Field tests of a distributed acoustic sensing system based on temporal adaptive matched filtering of phase-sensitive OTDR signals [10654-11]
10654 0D	Field test and fading measurement of a distributed acoustic sensor system over a 50 km-long fiber [10654-12]
10654 OE	Optical fibers for distributed sensing in harsh environments [10654-13]
SESSION 4	NEW AVENUES IN FIBER OPTIC SENSING
10654 OF	Multiplexed fiber-coupled accelerometers for security monitoring applications (Invited Paper) [10654-14]
10654 0G	Fiber optic sensors: technical trends from the mid-1970s to the present (Invited Paper) [10654-15]
10654 01	A novel multi-mode fiber optic accelerometer: an intelligent sensor [10654-17]
SESSION 5	APPLICATIONS OF FIBER OPTIC SENSORS FOR HARSH ENVIRONMENTS
10654 OM	Fiber optic sensors for harsh environment sensing: case studies on environmental sensing (Invited Paper) [10654-21]
10654 ON	Single-crystal fiber structures for harsh environment applications (Rising Researcher Presentation) [10654-22]
10654 00	Nanosecond resolution pressure, temperature, position, and velocity measurements in energetic materials [10654-24]
SESSION 6	FIBER BRAGG GRATING SENSORS II
10654 OP	Development of fiber Bragg grating pH sensors for harsh environments [10654-25]
10654 OR	Enhanced sensing and accessing capabilities of an FBG sensor using fiber loop mirror [10654-27]
10654 OS	Ultrafast pressure measurement in shock wave research using fiber Bragg grating sensors [10654-28]
SESSION 7	SPECIALTY FIBERS FOR SENSING APPLICATIONS
10654 OU	Characterization of ultrasonic generation from a fiber-optic sidewall [10654-30]

10654 0V	Multistage single clad 2µm TDFA with a shared L-band pump source [10654-31]
10654 OW	Precise calibration of optical fiber sensor for ammonia sensing using multivariate analysis [10654-32]
SESSION 8	DISTRIBUTED FIBER OPTIC SENSING II
10654 0Y	Simultaneous distributed temperature and disturbance sensing in single-mode fibre for power cable monitoring [10654-34]
10654 10	Sensitivity analysis of OFDR-based distributed sensing for flaws detection in representative coupon from filament wound motor vessel [10654-36]
10654 12	Long distance, high spatial resolution distributed temperature measurement using a graded index optical fiber at 1550 nm [10654-38]
	POSTER SESSION
10654 13	Intracavity absorption gas sensor in the near-infrared region by using a tunable erbium-doped fiber laser based on a Hi-Bi FOLM [10654-40]
10654 14	A power over fiber voltage and current sensor using multiplexed PWM signals [10654-41]
10654 15	Standard optical fibers for load measuring of concrete structures using BOTDR [10654-42]
10654 16	FBG strain sensor mounted on plastic carrier [10654-43]
10654 17	Temperature sensor with using of optical fibers [10654-44]
10654 18	Alternative fiber detector of vibrations [10654-45]
10654 19	Detection of magnetic field with use of optical sensors [10654-46]
10654 1C	Fiber-optic Bragg grating sensors signal processing for vital signs monitoring [10654-49]
10654 1D	Advanced methods for fiber-optic sensor signal processing [10654-50]
10654 1E	Pre-processing and extraction techniques for vital signs analysis from phonocardiographic-based interferometric fiber-optic sensor [10654-51]
10654 1F	Analysis of encapsulation the fiber Bragg sensors for biomedical applications [10654-52]
10654 1G	Sensor system based on the Mach-Zehnder interferometer for the rail transport [10654-53]

10654 1H	Analysis of the attenuation characteristics of cylindrical waveguides made from the polydimethylsiloxane (PDMS) polymer [10654-54]
10654 11	Analysis of transmission properties of optical couplers made from the polydimethylsiloxane (PDMS) [10654-55]
10654 1K	The detection and characterization of weak seismic waves using optical fiber Bragg grating sensor [10654-57]
10654 1L	Second generation fs-laser-written fiber Bragg gratings for high accuracy temperature measurement in harsh environments [10654-39]