

PROCEEDINGS OF SPIE

Optical Components and Materials XIII

Shibin Jiang
Michel J. F. Digonnet
Editors

15–17 February 2016
San Francisco, California, United States

Sponsored and Published by
SPIE

Volume 9744

Proceedings of SPIE 0277-786X, V. 9744

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

Optical Components and Materials XIII, edited by Shibin Jiang, Michel J. F. Digonnet,
Proc. of SPIE Vol. 9744, 974401 · © 2016 SPIE · CCC code: 0277-786X/16/\$18
doi: 10.1117/12.2239302

Proc. of SPIE Vol. 9744 974401-1

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 SPIDigitalLibrary.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 *Optical Components and Materials XIII*, edited by Shibin Jiang, Michel J. F. Digonnet, Proceedings of SPIE Vol. 9744 (SPIE, Bellingham, WA, 2016) Article CID Number.

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781628419795

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 © 2016, 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/16/\$18.00.

Printed in the United States of America.

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

**SPIE. DIGITAL
LIBRARY**

SPIDigitalLibrary.org

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 six-digit CID article numbering system structured as follows:

- 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.

Contents

vii	<i>Authors</i>
ix	<i>Conference Committee</i>

SESSION 1 FABRICATION AND CHARACTERIZATION I

- 9744 02 **Pulsed laser deposition of rare-earth-doped glasses: a step toward lightwave circuits (Invited Paper)** [9744-1]
- 9744 04 **Direct femtosecond laser writing of buried infrared waveguides in chalcogenide glasses (Invited Paper)** [9744-3]

SESSION 2 SUPERCONTINUUM AND WHITE-LIGHT GENERATION

- 9744 06 **White-light emission studies of dysprosium-doped halide crystals** [9744-8]
- 9744 07 **Near-infrared diode-pumped white-light emission from erbium-doped calcium fluoride crystal** [9744-9]

SESSION 3 OPTICAL PROPERTIES OF MATERIALS

- 9744 0A **Mid-IR gain media based on transition metal-doped II-VI chalcogenides (Invited Paper)** [9744-12]
- 9744 0C **Design of a double grating-coupled surface plasmon color filter** [9744-44]

SESSION 4 OPTICAL SYSTEMS

- 9744 0D **Integrated compact optical current sensors with high sensitivity (Invited Paper)** [9744-14]
- 9744 0E **Enhancement of Rayleigh scatter in optical fiber by simple UV treatment: an order of magnitude increase in distributed sensing sensitivity** [9744-15]
- 9744 0F **Spherical transceivers for ultrafast optical wireless communications** [9744-16]
- 9744 0H **Design and test of a new facility for assessing spectral normal emittance of solid materials at high temperature** [9744-18]

SESSION 5 BULK-OPTIC COMPONENTS

- 9744 0I **Photo-thermo-refractive glass with sensitivity extended to near infrared region** [9744-27]
- 9744 0L **700 kHz beam scanning using electro-optic KTN planar optical deflector** [9744-30]

SESSION 6 FABRICATION AND CHARACTERIZATION II

- 9744 0N **Two-dimensional refractive index profiling of optical fibers by modified refractive near-field technique** [9744-24]

SESSION 7 OPTICAL AMPLIFIERS

- 9744 0P **An efficient scheme of inter-modal distributed Raman amplification using tailored doping profiles in spatial-division multiplexed coherent fiber-optic transmission systems** [9744-20]
- 9744 0Q **Highly nonlinear chalcogenide optical fibers with flattened chromatic dispersion invariant to the core fluctuation and their performances of parametric amplification** [9744-21]
- 9744 0R **KY₃F₁₀:Er³⁺/Yb³⁺ nanocrystals doped laser-induced self-written waveguide for optical amplification in the C-band** [9744-22]

SESSION 8 LASERS

- 9744 0T **A high power eye-safe Er³⁺:YVO₄ laser diode-pumped at 976 nm and emitting at 1603 nm** [9744-32]
- 9744 0U **1.8- μ m thulium microlasers integrated on silicon** [9744-33]

SESSION 9 OPTICAL PROPERTIES OF RARE-EARTH-DOPED MATERIALS

- 9744 0V **Optical excitation of Er centers in GaN epilayers grown by MOCVD (Invited Paper)** [9744-34]
- 9744 0X **Efficient 800nm upconversion luminescence emission in 1.319 μ m excited thulium-doped fluorogermanate** [9744-36]

SESSION 10 GUIDED-WAVE COMPONENTS

- 9744 10 **Dynamic control of a Fano resonance with a fully integrated silicon nanostructure** [9744-39]
- 9744 12 **Pseudo-circulator implemented as a multimode fiber coupler** [9744-41]
- 9744 13 **Lithium niobate integrated photonic crystal and waveguides** [9744-43]

POSTER SESSION

- 9744 14 **Coherent mid-infrared supercontinuum generation in all-solid chalcogenide microstructured fibers with all-normal dispersion** [9744-6]
- 9744 15 **Supercontinuum generation in a suspended core birefringent tellurite microstructured optical fiber pumped in telecommunication band by a picosecond laser** [9744-7]
- 9744 16 **Low polarization dependent loss of InP-based waveguide photodetector integrated with spot-size converter for 100Gb/s coherent receiver** [9744-42]
- 9744 17 **Analysis of uniformity of illumination of a freeform lens when combined with different optical sources** [9744-45]
- 9744 19 **Gain control dynamics of thulium-doped fiber amplifier at 2 μm** [9744-47]
- 9744 1B **Evolution of the mid-infrared higher-order soliton fission in a tapered tellurite microstructured optical fiber** [9744-49]
- 9744 1F **Design and fabrication of long wave infrared spectral filters** [9744-54]
- 9744 1G **Erbium-doped zinc-oxide waveguide amplifiers for hybrid photonic integrated circuits** [9744-55]
- 9744 1H **Design of intrinsically single-mode double clad crystalline fiber waveguides for high power lasers** [9744-56]
- 9744 1I **Power scaling estimate of crystalline fiber waveguides with rare earth doped YAG cores** [9744-57]
- 9744 1K **Low power compact hybrid plasmonic double microring electro-optical modulator** [9744-59]
- 9744 1M **Modern collinear LiNbO₃ acousto-optical filter for optical spectroscopy: the exploration of efficiency and spectral resolution** [9744-61]

Authors

Numbers in the index correspond to the last two digits of the six-digit citation identifier (CID) article numbering system used in Proceedings of SPIE. The first four 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.

Adam, Thomas N., 0U
Ang, Thomas Y-L., 13
Anthony, Deion, 1G
Arellanes, A. O., 1M
Babadi, S., 17
Balda, R., 02
Beccherelli, Romeo, 1K
Bélanger, P., 12
Bera, Arijit, 10
Bertone, E., 1M
Bonner, Carl, 1G
Born, Brandon, 0F
Boudoux, C., 12
Boutaleb, T., 17
Bowers, John E., 0D
Bradley, Jonathan D. B., 0U
Brown, EiEi, 06
Bueno, L. A., 0X
Bulota, F., 12
Bychkov, E., 04
Byrd, Matthew, 0U
Carey, Victoria A., 1F
Cheng, Tonglei, 0R, 14, 1B
Choe, Joong-Seon, 16
Collier, Christopher M., 0F
Coolbaugh, Douglas, 0U
Culp, Mical, 06, 07
Danner, Aaron J., 13
Deng, Jun, 13
Dubinskii, M., 0T
Edwards, Vernessa M., 07
El Sayed, A., 0N
Ennsner, K., 19
Fedorov, V. V., 0A
Fernandez, J., 02
Fouad, Nourhan H., 1K
Gafarov, O., 0A
Gao, Weiqing, 1B
Gapontsev, V., 0A
Geddis, Demetris, 1G
Geoffroy-Gagnon, Simon, 0F
George, D. K., 0V
Glebov, L., 0I
Glebova, L., 0I
Godbout, N., 12
Gonzalo, J., 02
Gouveia, E. A., 0X
Gouveia-Neto, A. S., 0X
Guo, Jingjing, 0C
Gupta, Neelam, 1F
Han, Won-Seok, 16
Hawkins, M. D., 0V
Holzman, Jonathan F., 0F
Hommerich, Uwe, 06
Hong, Pengda, 1H, 1I
Honkanen, Seppo, 10
Hristovski, Blago A., 0F
Huang, Duanni, 0D
Imai, Tadayuki, 0L
Jacinto, C., 0X
Jensen, Janet, 1F
Jiang, H. X., 0V
Jin, Xian, 0F
Kashyap, Raman, 0E
Kawamura, Harutaka, 15
Khamis, M. A., 19
Kim, Jong-Hoi, 16
Ko, Young-Ho, 16
Kobayashi, Junya, 0L
Kompan, F., 0I
Kuittinen, Markku, 10
Kwon, Yong-Hwan, 16
Lambin-lezzi, Victor, 0E
Le Coq, D., 04
Leake, Gerald, 0U
Leduc, M., 12
Li, Da, 1H, 1I
Li, Nanxi, 0U
Lim, Soon Thor, 13
Lin, J. Y., 0V
Liu, Lai, 14, 1B
Loranger, Sébastien, 0E
Magden, E. Salih, 0U
Mallick, T., 17
Martinez, A., 0A
Martyshkin, D. V., 0A
Masselin, P., 04
McElhiney, Morgan E., 1F
Meissner, Helmuth E., 1H, 1I
Meissner, Stephanie K., 1H, 1I
Mercatelli, L., 0H
Meucci, M., 0H
Mingareev, H., 0I
Mirotnik, Mark S., 1F
Mirov, M. S., 0A
Mirov, S. B., 0A
Morea, R., 02
Moskalev, I. S., 0A

Nagasaka, Kenshiro, 0Q, 14
Newburgh, G. A., 0T
Ohishi, Yasutake, 0Q, 0R, 14, 15, 1B
O'Neal, Lawrence, 1G
Pan, Zhongqi, 0P
Parent, François, 0E
Peppers, J., 0A
Pilz, Soenke, 0N
Pintus, Paolo, 0D
Png, Ching Eng, 13
Prather, Dennis W., 1F
Purnawirman, P., 0U
Ramirez-Iniguez, R., 17
Reddy, B. Rami, 06, 07
Romano, Valerio, 0N
Roussey, Matthieu, 10
Ryser, Manuel, 0N
Sakamoto, Tadashi, 0L
Sani, E., 0H
Sasaki, Yuzo, 0L
Shcherbakov, A. S., 1M
Smolski, V., 0A
Srinivasan, Sudharsanan, 0D
Su, Zhan, 0U
Suzuki, Takenobu, 0Q, 0R, 14, 15, 1B
Swillam, Mohamed A., 1K
Tatsumi, Shoko, 0L
Tong, Hoang Tuan, 0Q, 14, 15
Toyoda, Seiji, 0L
Trivedi, Sudhir B., 06
Tu, Yan, 0C
Vasilyev, S., 0A
Venus, G., 0I
Vermelho, M. V. D., 0X
Vinh, N. Q., 0V
Wang, Baoping, 0C
Wang, Lili, 0C
Watts, Michael R., 0U
Weng, Yi, 0P
Xue, Xiaojie, 0R, 1B
Yang, Lanlan, 0C
Zaki, Aya O., 1K
Zavada, J. M., 0V
Zhang, Lei, 15
Zografopoulos, Dimitrios C., 1K

Conference Committee

Symposium Chairs

Jean-Emmanuel Broquin, IMEP-LAHC (France)
Shibin Jiang, AdValue Photonics, Inc. (United States)

Symposium Co-chairs

David L. Andrews, University of East Anglia (United Kingdom)
Alexei L. Glebov, OptiGrate Corporation (United States)

Program Track Chair

James G. Grote, Air Force Research Laboratory (United States)

Conference Chairs

Shibin Jiang, AdValue Photonics, Inc. (United States)
Michel J. F. Digonnet, Stanford University (United States)

Conference Program Committee

Jean-Luc Adam, Université de Rennes 1 (France)
Joel Bagwell, Edmund Optics Inc. (United States)
Rolindes Balda, Universidad del País Vasco (Spain)
Robert P. Dahlgren, CSUMB/NASA Ames Research Center
(United States)
Leonid B. Glebov, CREOL, The College of Optics and Photonics,
University of Central Florida (United States)
Seppo K. Honkanen, University of Eastern Finland (Finland)
Jacques Lucas, Université de Rennes 1 (France)
Yasutake Ohishi, Toyota Technological Institute (Japan)
Aydogan Ozcan, University of California, Los Angeles (United States)
Giancarlo C. Righini, Museo Storico della Fisica e Centro Studi e
Ricerche Enrico Fermi (Italy)
Setsumisa Tanabe, Kyoto University (Japan)
John M. Zavada, National Science Foundation (United States)

Session Chairs

- 1 Fabrication and Characterization I
Shibin Jiang, AdValue Photonics, Inc. (United States)
- 2 Supercontinuum and White-Light Generation
Jesse Frantz, U.S. Naval Research Laboratory (United States)
- 3 Optical Properties of Materials
Shibin Jiang, AdValue Photonics, Inc. (United States)
- 4 Optical Systems
Raman Kashyap, Polytechnique Montréal (Canada)
- 5 Bulk-Optic Components
Ciro Falcony, Centro de Investigación y de Estudios Avanzados del
Instituto Politécnico Nacional (Mexico)
- 6 Fabrication and Characterization II
Rolindes Balda, Universidad del País Vasco (Spain)
- 7 Optical Amplifiers
Jasbinder S. Sanghera, U.S. Naval Research Laboratory
(United States)
- 8 Lasers
Angel Flores, Air Force Research Laboratory (United States)
- 9 Optical Properties of Rare-Earth-Doped Materials
Shibin Jiang, AdValue Photonics, Inc. (United States)
- 10 Guided-Wave Components
Michel J. F. Digonnet, Stanford University (United States)