

PROCEEDINGS OF SPIE

Optical Components and Materials XV

Shibin Jiang

Michel J. F. Digonnet

Editors

29–31 January 2018

San Francisco, California, United States

Sponsored and Published by

SPIE

Volume 10528

Proceedings of SPIE 0277-786X, V. 10528

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

Optical Components and Materials XV, edited by Shibin Jiang, Michel J. F. Digonnet, Proc. of SPIE Vol. 10528, 1052801
© 2018 SPIE · CCC code: 0277-786X/18/\$18 · doi: 10.1117/12.2323197

Proc. of SPIE Vol. 10528 1052801-1

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 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 *Optical Components and Materials XV*, edited by Shixin Jiang, Michel J. F. Digonnet, Proceedings of SPIE Vol. 10528 (SPIE, Bellingham, WA, 2018) Seven-digit Article CID Number.

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510615410

ISBN: 9781510615427 (electronic)

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 © 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.

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



SPIEDigitalLibrary.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 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

vii	Authors
xi	Conference Committee

SESSION 1 NANOPARTICLES

- 10528 02 **Optical multipole resonances of non-spherical silicon nanoparticles and the influence of illumination direction (Invited Paper)** [10528-1]
- 10528 05 **Rare-earth-doped wide-bandgap tin-oxide nanocrystals: pumping mechanisms and spectroscopy** [10528-4]
- 10528 06 **Site-resolved emission of Nd³⁺-doped oxyfluoride nano glass-ceramics** [10528-5]

SESSION 2 RARE-EARTH-DOPED FIBER LASERS AND AMPLIFIERS I

- 10528 08 **Comparison of Tm-doped fiber laser performance as diode pumped at 800 nm and 1620 nm** [10528-7]
- 10528 09 **Active materials for high-power fiber lasers prepared by all-solution doping technique** [10528-8]

SESSION 3 FREE-SPACE LASERS AND AMPLIFIERS

- 10528 0D **633-nm single-mode master-oscillator power-amplifier module** [10528-12]
- 10528 0E **Erbium-doped GaN bulk crystals as a gain medium for eye-safe high energy lasers (Invited Paper)** [10528-13]
- 10528 0F **Characteristics-improvement of QD semiconductor optical amplifier using rapid-thermal annealing process** [10528-14]

SESSION 4 SENSORS

- 10528 0H **Infrared sulfide fibers for all-optical gas detection (Invited Paper)** [10528-17]
- 10528 0K **Analysis of the sensitivity and dynamic characteristics of the birefringent fiber temperature response for realization of the thermal field disturbance sensor** [10528-19]

SESSION 5	OPTICAL PROPERTIES OF MATERIALS
10528 OM	Persistent luminescence in both first and second biological windows in ZnGa₂O₄:Cr³⁺,Yb³⁺ glass ceramics [10528-21]
SESSION 6	GLASS FABRICATION AND COMPONENTS
10528 OP	From VIS to SWIR: a challenge for optical glass and IR materials [10528-24]
10528 OQ	Analysis of form deviation in non-isothermal glass molding [10528-25]
10528 OR	Mid-infrared volume diffraction gratings in IG2 chalcogenide glass: fabrication, characterization, and theoretical verification [10528-26]
10528 OS	Optical characterization of random anti-reflecting subwavelength surface structures on binary gratings (Invited Paper) [10528-27]
SESSION 7	SPECIALTY OPTICAL FIBERS
10528 OT	Plasma technology for preparation of specialty fibers [10528-28]
10528 OU	Attenuation measurements in single-crystal sapphire fiber via Raman scattering intensity [10528-30]
10528 OV	Multimaterial photonic crystal fibers [10528-31]
10528 OW	Predicted static fatigue (delayed fracture) lifetime of a fiber optic test specimen: application of analytical modeling technique [10528-32]
SESSION 8	PHOTODETECTORS
10528 OX	Waveguide integration silicon MSM photodetector in silicon nitride-on-SOI platform for visible and NIR wavelength band [10528-33]
10528 OY	High optical power handling 1.2- to 2.2-micron-wavelength uncooled InGaAs photodiodes up to 6-GHz bandwidth for coherent spectroscopy [10528-34]
10528 OZ	Development of InGaAs MPPC for NIR photon counting applications [10528-35]
SESSION 9	FREE-SPACE OPTICS
10528 10	Automated assembly of lens barrels with active wavefront sensor guiding [10528-36]
10528 11	BRDF performance of highly polished Al6061T6 and impact on TMA performance [10528-38]

SESSION 10	RARE-EARTH-DOPED FIBER LASERS AND AMPLIFIERS II
10528 13	Design and characterization of a 10-mode few-mode erbium-doped fiber with multicore pedestal core (Invited Paper) [10528-40]
10528 14	Towards large-mode-area fibers fabricated by the full vapor-phase SPCVD process [10528-41]
10528 15	Evidence of photo-darkening in co-doped erbium-ytterbium double-clad fibers operated at high-output power [10528-42]
10528 16	High-power tunable grating-free cascaded Raman fiber lasers [10528-43]
10528 17	Low power generation of equalized broadband CW supercontinua using a novel technique incorporating modulation instability of line broadened pump [10528-44]
SESSION 11	OPTICAL COMPONENTS I
10528 19	Compensation of third-order intermodulation distortion of electro-optic modulator by using frequency chirp modulation [10528-46]
10528 1C	Achromatic devices in polarization optics [10528-49]
SESSION 12	OPTICAL COMPONENTS II
10528 1E	Polarization sensitivity of ordered and random antireflective surface structures in silica and spinel [10528-51]
10528 1H	New developments in the determination of the complex refractive index of arbitrary absorptance thin films from envelope profiles of a single transmittance curve [10528-54]
10528 1I	Study of second harmonic generation in poled and un-poled silica multilayer structures [10528-55]
POSTER SESSION	
10528 1J	Experimental investigation cascaded stimulated Raman in chalcogenide optical fiber [10528-56]
10528 1K	White-light emission characteristics of terbium-doped crystals [10528-57]
10528 1L	Self-bending of optical waveguides in a dry photosensitive medium [10528-58]
10528 1M	Far-detuned four-wave mixing for mid-infrared wavelength conversion in chalcogenide As₂S₅ suspended core fiber [10528-60]
10528 1N	Criteria of limit of applying DOE to precise optics [10528-61]

- 10528 1O **All-solid tellurite optical fiber with transversely disordered refractive index profile and its optical image transport performance** [10528-62]
- 10528 1P **Tailoring Nd³⁺ emission spectrum by a neodymium-doped tellurite all-solid photonic bandgap fiber** [10528-63]
- 10528 1R **Mode-locked NALM-based fibre laser with controllable operation regimes** [10528-65]
- 10528 1S **Mid-infrared frequency conversion via normal dispersion modulation instability in chalcogenide fibers** [10528-66]
- 10528 1T **Wavefront correction with photo-controlled deformable mirror** [10528-67]
- 10528 1U **Influence of the fraction of absorbed pump power on the performance of Nd³⁺:YVO₄ powder random lasers** [10528-68]
- 10528 1W **A cost-effective edge-filter-based FBG strain interrogator using catastrophic fuse effect microcavity interferometers** [10528-71]
- 10528 1X **Zinc selenide: an extraordinarily nonlinear material** [10528-72]
- 10528 1Y **Upconversion emission investigation of Tb³⁺/Yb³⁺ codoped CdF₂ single crystals under infrared laser pump** [10528-75]

Authors

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

- Aggarwal, I. D., 1E
Aka, Gérard, 14
Akahane, Kouichi, 0F
Albert, Jacques, 1I
Aljamimi, Salah A., 1I
Allix, M., 0M
André, Paulo S., 1W
Antunes, Paulo F. C., 1W
Aparanji, Santosh, 16
Araki, Keisuke, 1N
Ari, J., 0H
Artemyev, Yury A., 02
Arun, S., 16, 17
Baba, Takashi, 0Z
Baierl, H., 0T
Baker, Katherine, 1I
Balaswamy, V., 16
Balda, Rolindes, 05, 06
Barnini, Alexandre, 14, 15
Baryshnikova, Kseniia V., 02
Baum, C., 10
Baur, Tom, 1C
Beier, Franz, 09
Berger, M., 10
Bigot, Laurent, 13
Blume, G., 0D
Bonora, Stefano, 1T
Boriboon, Budsara, 0F
Boubekri, H., 1Y
Boussard-Plédel, C., 0H
Bouwmans, Géraud, 13
Braud, A., 0H
Brecher, C., 10
Brownsword, Richard A., 0R
Bureau, B., 0H
Buric, M., 0U
Busse, L. E., 1E
Butcher, Helen L., 0R
Cadier, Benoit, 15
Camy, P., 0H
Cascales, Concepción, 05
Cassez, Andy, 13
Cassidy, Derek, 1L
Castaing, V., 0M
Caurant, Daniel, 14
Chahal, R., 0H
Chatterjee, Avijit, 0X
Cheng, Tonglei, 1J
Cheng, Y., 0U
Cho, Shigeki, 1J
Chorpeling, B., 0U
Choudhury, Vishal, 17
Dambon, O., 0Q
Daniel, Jay, 1I
da Silva, Danilo A. A., 1U
Datta, Shubhashish, 0Y
Dellith, J., 0T
Demichi, Daisuke, 1P
Desforges, Jean, 1H
Diaf, M., 1Y
Díaz, Camilo A. R., 1W
Domingues, M. Fátima F., 1W
Doualan, J.-L., 0H
Douglas, Jade, 1K
Dubinskii, M., 08
Durán, Alicia, 06
Dvorak, Filip, 0K
Eberhardt, Ramona, 09
Edwards, Vernessa, 1K
Enokihara, Akira, 19
Evlyukhin, Andrey B., 02
Feise, D., 0D
Fernández, Joaquín, 05, 06
Fernández-Carrión, A. J., 0M
Frantz, J. A., 1E
Fujita, Takuya, 0Z
García-Revilla, Sara, 05
Gaudet, Eric, 1H
Gauvin, Serge, 1H
Giehl, Julia M., 1U
Gorni, Giulio, 06
Gotter, Thierry, 14, 15
Grunwald, T., 0Q
Guitton, Pascal, 14, 15
Guyon, Cédric, 14
Haarlammert, Nicoletta, 09
Hein, Sigrun, 09
Hill, C., 0U
Hiramatsu, Takashi, 1N
Homa, D., 0U
Hupel, Christian, 09
Hutchinson, Simon, 1T
Ivanenko, Alexey, 1R
Jafari, Seyed Hamed, 1I
Jedamzik, Ralf, 0P
Jedrzejczyk, D., 0D
Jiang, H. X., 0E
Jimenez-Villar, Ernesto, 1U

- Joshi, Abhay, 0Y
 Jouart, J.P., 1Y
 Kalide, A., 0T
 Karabchevsky, Alina, 02
 Kasamatsu, Hidenori, 1N
 Kashiwagi, Yuta, 19
 Kawai, Tadashi, 19
 Kawanishi, Tetsuya, 19
 Klocke, F., 0Q
 Kobtsev, Sergey, 1R
 Kraemer, Michael, 1C
 Krappig, R., 10
 Kreilkamp, H., 0Q
 Kuhn, Stefan, 09
 Kunala, Karteek, 0S
 Kurabayashi, Tomokazu, 0Z
 Kuroyanagi, Shunei, 1O
 Kyselak, Martin, 0K
 Laurent, Arnaud, 14, 15
 Le Cocq, Guillaume, 13
 Lee, David, 0R
 Leisching, P., 0D
 Li, J., 0E
 Li, Shuguang, 1J
 Liggins, Kristopher, 1K
 Lin, J. Y., 0E
 Liu, B., 0U
 Liu, Lai, 1S
 Lucianetti, Antonio, 1T
 MacLachlan, David G., 0R
 Makino, Kenji, 0Z
 Malallah, Ra'ed, 1L
 Marble, Christopher B., 1X
 Markos, Christos, 0V
 Marques, Carlos A. F., 1W
 Maschke, Jan, 0K
 Matsumoto, Atsushi, 0F
 Matsumoto, Morio, 1J
 Meiers, B., 10
 Mélin, Gilles, 15
 Michel, K., 0H
 Mocek, Tomas, 1T
 Möller, Friedrich, 09
 Montron, Ronan, 14, 15
 Müller, T., 10
 Muniraj, Inbarasan, 1L
 Nagasaka, Kenshiro, 1M, 1S
 Nakadate, Suezou, 1N
 Nakamura, Shigeyuki, 0Z
 Nazabal, V., 0H
 Neto, Anselmo Frizera, 1W
 Newburgh, G. A., 08
 Nguyen, Hoa Phuoc Trung, 1M
 Nodurft, Dawson T., 1X
 Nold, Johannes, 09
 Nölleke, C., 0D
 O'Connor, Sean P., 1X
 Ohishi, Yasutake, 1J, 1M, 1O, 1P, 1S
 Paschke, K., 0D
 Pascual, María J., 06
 Patel, Ankit, 11
 Pauperté, Th., 1Y
 Pelé, A.-L., 0H
 Petersen, Christian Rosenberg, 0V
 Petzold, Uwe, 0P
 Pickrell, G., 0U
 Pilar, Jan, 1T
 Pohl, J., 0D
 Pontes, Maria J., 1W
 Poutous, Menelaos K., 0S
 Prakash, Roopa, 17
 Quiquempois, Yves, 13
 Ranger, Carine, 14, 15
 Reddy, B. Rami, 1K
 Reichel, V., 0T
 Ribeiro, Moisés R. N., 1W
 Robin, Thierry, 14, 15
 Sahm, A., 0D
 Sanghera, J. S., 1E
 Sapkota, Gopal, 0S
 Sauer, S., 10
 Scheffel, A., 0T
 Schreiber, Thomas, 09
 Schuster, K., 0T
 Selby, J., 1E
 Selvaraja, Shankar Kumar, 0X
 Shalim, Alexander S., 02
 Shaw, L. B., 1E
 Sheridan, John T., 1L
 Shibuya, Masato, 1N
 Smelser, Christopher W., 1I
 Sontakke, A. D., 0M
 Starecki, F., 0H
 Suhir, E., 0W
 Sun, Z. Y., 0E
 Supradeepa, V. R., 16, 17
 Suzuki, Takenobu, 1J, 1M, 1O, 1P, 1S
 Suzuki, Yoshihito, 0Z
 Takase, Kosuke, 19
 Tamura, Yusei, 0Z
 Tanabe, S., 0M
 Terekhov, Pavel D., 02
 Thomson, Robert R., 0R
 Tong, Hoang Tuan, 1J, 1M, 1O, 1P
 Trinel, Jean-Baptiste, 13
 Tünnermann, Andreas, 09
 Velázquez, José J., 06
 Viana, B., 0M, 1Y
 Vlcek, Cestmir, 0K
 Wada, Naoya, 0F
 Wan, Min, 1L
 Wang, A., 0U
 Wang, Q. W., 0E
 Weber, Gernot, 0P
 Weidmann, Damien, 0R
 Werner, N., 0D
 Wetter, Niklaus U., 1U
 Wharmby, Andrew W., 1X
 Worasucheep, Duang-rudee, 0F
 Xu, J., 0M

Yakovlev, Vladislav V., 1X
Yamamoto, Koei, 0Z
Yamamoto, Naokatsu, 0F, 19
Yan, Xin, 1J
Yi, S., 0W
Yu, Z., 0U
Zhang, J., 08

Conference Committee

Symposium Chairs

- Connie J. Chang-Hasnain**, University of California, Berkeley
(United States)
Graham T. Reed, Optoelectronics Research Centre, University of Southampton (United Kingdom)

Symposium Co-Chairs

- Jean-Emmanuel Broquin**, IMEP-LAHC (France)
Shibin Jiang, AdValue Photonics, Inc. (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)
Angel Flores, Air Force Research Laboratory (United States)
Jesse A. Frantz, U.S. Naval Research Laboratory (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)
Setsuhisa Tanabe, Kyoto University (Japan)
John M. Zavada, National Science Foundation (United States)
Jun Zhang, U.S. Army Research Laboratory (United States)

Session Chairs

- 1 Nanoparticles
Michel J. F. Digonnet, Stanford University (United States)
- 2 Rare-Earth-Doped Fiber Lasers and Amplifiers I
Shibin Jiang, AdValue Photonics, Inc. (United States)
- 3 Free-Space Lasers and Amplifiers
Aydogan Ozcan, University of California, Los Angeles (United States)
- 4 Sensors
Rolindes Balda, Universidad del País Vasco (Spain)
- 5 Optical Properties of Materials
Leonid B. Glebov, CREOL, The College of Optics and Photonics,
University of Central Florida (United States)
- 6 Glass Fabrication and Components
Jesse A. Frantz, U.S. Naval Research Laboratory (United States)
- 7 Specialty Optical Fibers
Angel Flores, Air Force Research Laboratory (United States)
- 8 Photodetectors
Shibin Jiang, AdValue Photonics, Inc. (United States)
- 9 Free-Space Optics
Qing Wang, AdValue Photonics, Inc. (United States)
- 10 Rare-Earth-Doped Fiber Lasers and Amplifiers II
Michel J. F. Digonnet, Stanford University (United States)
- 11 Optical Components I
Jun Zhang, U.S. Army Research Laboratory (United States)
- 12 Optical Components II
Michel J. F. Digonnet, Stanford University (United States)