

PROCEEDINGS OF SPIE

# ***Integrated Photonics: Materials, Devices, and Applications II***

**Jean-Marc Fédéli**

**Laurent Vivien**

**Meint K. Smit**

*Editors*

**24–26 April 2013**

**Grenoble, France**

*Sponsored and Published by*  
SPIE

**Volume 8767**

Proceedings of SPIE 0277-786X, V. 8767

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

Integrated Photonics: Materials, Devices, and Applications II, edited by Jean-Marc Fédéli, Laurent Vivien, Meint K. Smit,  
Proc. of SPIE Vol. 8767, 876701 · © 2013 SPIE · CCC code: 0277-786X/13/\$18 · doi: 10.1117/12.2031895

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 *Integrated Photonics: Materials, Devices, and Applications II*, edited by Jean-Marc Fédéli, Laurent Vivien, Meint K. Smit, Proceedings of SPIE Vol. 8767 (SPIE, Bellingham, WA, 2013) Article CID Number.

ISSN: 0277-786X  
ISBN: 9780819495648

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](http://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](http://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.



[SPIEDigitalLibrary.org](http://SPIEDigitalLibrary.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
- xii An autonomous structural health monitoring solution (Plenary Paper) [8763-501]  
C. A. Featherston, K. M. Holford, R. Pullin, J. Lees, M. Eaton, M. Pearson, Cardiff Univ. (United Kingdom)
- xviii Biologically inspired large scale chemical sensor arrays and embedded data processing (Plenary Paper) [8763-502]  
S. Marco, A. Gutiérrez-Gálvez, Univ. de Barcelona (Spain) and Institute for Bioengineering of Catalonia (Spain); A. Lansner, Kunliga Tekniska Högskolan (Sweden); D. Martinez, Ctr. National de la Recherche Scientifique (France); J. P. Rospars, Institut National de la Recherche Agronomique (France); R. Beccherelli, Consiglio Nazionale delle Ricerche (Italy); A. Perera, Univ. Politècnica de Catalunya (Spain); T. Pearce, Univ. of Leicester (United Kingdom); P. Vershure, Univ. Pompeu Fabra (Spain); K. Persaud, The Univ. of Manchester (United Kingdom)

---

## SESSION 1 MICRO CAVITIES AND MICRO RESONATORS

---

- 8767 02 **Systematic optimization of the storage capacity of slow light photonic crystal waveguides** [8767-3]  
P. Kanakis, National and Kapodistrian Univ. of Athens (Greece); T. Kamalakis, Harokopio Univ. of Athens (Greece); T. Sphicopoulos, National and Kapodistrian Univ. of Athens (Greece)
- 8767 03 **Fano lineshapes of 'Peak-tracking chip' spatial profiles analyzed with correlation analysis for bioarray imaging and refractive index sensing** [8767-2]  
K. Bougot-Robin, S. Li, Hong Kong Univ. of Science and Technology (Hong Kong, China); W. Yue, L. Q. Chen, X. X. Zhang, King Abdullah Univ. of Science and Technology (Saudi Arabia); W. J. Wen, Hong Kong Univ. of Science and Technology (Hong Kong, China) and KAUST-HKUST Micro/Nanofluidic Joint Lab. (Hong Kong, China); H. Benisty, Lab. Charles Fabry, CNRS, Univ. Paris Sud (France)
- 8767 04 **Monolithic integration of high-Q wedge resonators with vertically coupled waveguides** [8767-1]  
F. Ramiro-Manzano, N. Prtljaga, L. Pavesi, Univ. degli Studi di Trento (Italy); G. Pucker, M. Ghulinyan, Fondazione Bruno Kessler (Italy)
- 8767 05 **Talbot effect from periodic and quasi-periodic structures: application to 3D quasi-crystalline photonic lattices formation** [8767-5]  
A. Badalyan, P. Mantashyan, V. Mekhitarian, Institute for Physical Research (Armenia); V. Nersesyan, Russian-Armenian (Slavonic) State Univ. (Armenia); R. Drampyan, Institute for Physical Research (Armenia) and Russian-Armenian (Slavonic) State Univ. (Armenia)

---

**SESSION 2 PHOTONIC MATERIALS**

---

- 8767 06 **Hydrogenated amorphous silicon nanowires with high nonlinear figure of merit and stable nonlinear optical response** [8767-6]  
L. Carletti, Univ. de Lyon, Institut des Nanotechnologies de Lyon, Ecole Centrale de Lyon (France); C. Grillet, Univ. de Lyon, Institut des Nanotechnologies de Lyon, Ecole Centrale de Lyon (France) and The Univ. of Sydney (Australia); P. Grosse, B. B. Bakir, S. Menezo, J. M. Fédéli, CEA-Leti (France); D. J. Moss, The Univ. of Sydney (Australia); C. Monat, Univ. de Lyon, Institut des Nanotechnologies de Lyon, Ecole Centrale de Lyon (France)
- 8767 07 **Travelling wave resonators fabricated with low-loss hydrogenated amorphous silicon** [8767-7]  
T. Lipka, J. Amthor, H. K. Trieu, J. Müller, Technische Univ. Hamburg (Germany)
- 8767 08 **High-resolution 3D structural and optical analyses of hybrid or composite materials by means of scanning probe microscopy combined with the ultramicrotome technique: an example of application to engineering of liquid crystals doped with fluorescent quantum dots** [8767-8]  
K. E. Mochalov, Moscow Engineering Physics Institute (Russian Federation) and Shemyakin-Ovchinnikov Institute of Bioorganic Chemistry (Russian Federation); A. E. Efimov, V. I. Shumakov Federal Research Ctr. of Transplantology and Artificial Organs (Russian Federation) and SNOTRA, LLC (Russian Federation); A. Y. Bobrovsky, Lomonosov Moscow State Univ. (Russian Federation); I. I. Agapov, V. I. Shumakov Federal Research Ctr. of Transplantology and Artificial Organs (Russian Federation); A. A. Chistyakov, Moscow Engineering Physics Institute (Russian Federation); V. A. Oleinikov, Moscow Engineering Physics Institute (Russian Federation) and Shemyakin-Ovchinnikov Institute of Bioorganic Chemistry (Russian Federation); I. Nabiev, Moscow Engineering Physics Institute (Russian Federation) and Univ. de Reims Champagne-Ardenne (France)

---

**SESSION 3 GE-BASED DEVICES**

---

- 8767 0A **Ge on Si waveguide-integrated photodiodes for high speed and low power receivers** [8767-10]  
L. Vivot, Institut d'Electronique Fondamentale, CNRS, Univ. Paris Sud (France), CEA-Leti (France), and STMicroelectronics (France); L. Vivien, Institut d'Electronique Fondamentale, CNRS, Univ. Paris Sud (France); J. M. Hartmann, J. M. Fédéli, CEA-Leti (France); D. Marris-Morini, E. Cassan, Institut d'Electronique Fondamentale, CNRS, Univ. Paris Sud (France); C. Baudot, F. Boeuf, STMicroelectronics (France)
- 8767 0B **Phase-shift in waveguide integrated Ge quantum wells** [8767-11]  
J. Frigerio, Politecnico di Milano (Italy); P. Chaisakul, D. Marris-Morini, Institut d'Electronique Fondamentale, CNRS, Univ. Paris Sud (France); S. Cecchi, Politecnico di Milano (Italy); M.-S. Rouifed, Institut d'Electronique Fondamentale, CNRS, Univ. Paris Sud (France); G. Isella, Politecnico di Milano (Italy); L. Vivien, Institut d'Electronique Fondamentale, CNRS, Univ. Paris Sud (France)
- 8767 0C **Franz-Keldysh effect of Ge-on-Si pin diodes at common chip temperatures** [8767-12]  
M. Schmid, M. Kaschel, M. Gollhofer, M. Oehme, J. Werner, K. Ulbricht, E. Kasper, J. Schulze, Univ. Stuttgart (Germany)

- 8767 0D **Resistance-capacitance limitation of fast double heterojunction Ge p-i-n photodetectors**  
[8767-13]  
M. Kaschel, M. Schmid, M. Gollhofer, M. Oehme, E. Kasper, J. Schulze, Univ. Stuttgart  
(Germany)

---

**SESSION 4 PHOTONICS PLATFORM I**

---

- 8767 0E **TriPleX waveguide platform: low-loss technology over a wide wavelength range (Invited Paper)** [8767-14]  
A. Leinse, R. G. Heideman, M. Hoekman, F. Schreuder, F. Falke, LioniX BV (Netherlands); C. G. H. Roeloffzen, L. Zhuang, M. Burla, D. Marpaung, Univ. Twente (Netherlands); D. H. Geuzebroek, R. Dekker, E. J. Klein, XIO Photonics B.V. (Netherlands); P. W. L. van Dijk, R. M. Oldenbeuving, SATRAX B.V. (Netherlands)
- 8767 0F **Generic process for low-cost InP integrated photonics in industrial foundries (Invited Paper)**  
[8767-15]  
L. Augustin, Technische Univ. Eindhoven (Netherlands) and SMART Photonics B.V. (Netherlands); H. Ambrosius, Technische Univ. Eindhoven (Netherlands); P. Thijss, Technische Univ. Eindhoven (Netherlands) and SMART Photonics B.V. (Netherlands); F. Soares, N. Grote, Fraunhofer-Institut für Nachrichtentechnik Heinrich-Hertz-Institut (Germany); D. Szymanski, Oclaro, Inc. (United Kingdom); M. Wale, Technische Univ. Eindhoven (Netherlands) and Oclaro, Inc. (United Kingdom); M. Smit, Technische Univ. Eindhoven (Netherlands)

---

**SESSION 5 PHOTONICS PLATFORM II**

---

- 8767 0G **A CMOS-compatible silicon photonic platform for high-speed integrated opto-electronics (Invited Paper)** [8767-16]  
C. Galland, Univ. of Delaware (United States); A. Novack, A\*STAR Institute of Microelectronics (Singapore) and National Univ. of Singapore (Singapore); Y. Liu, R. Ding, Univ. of Delaware (United States); M. Gould, Univ. of Washington (United States); T. Baehr-Jones, Univ. of Delaware (United States); Q. Li, Columbia Univ. (United States); Y. Yang, Y. Ma, Y. Zhang, Univ. of Delaware (United States); K. Padmaraju, K. Bergmen, Columbia Univ. (United States); A. E.-J. Lim, G.-Q. Lo, A\*STAR Institute of Microelectronics (Singapore); M. Hochberg, Univ. of Delaware (United States), A\*STAR Institute of Microelectronics (Singapore), and National Univ. of Singapore (Singapore)
- 8767 0H **ePIXfab: the silicon photonics platform (Invited Paper)** [8767-17]  
A. Khanna, Y. Drissi, P. Dumon, R. Baets, P. Absil, IMEC, Univ. Ghent (Belgium); J. Pozo, D. M. R. Lo Cascio, TNO (Netherlands); M. Fournier, J.-M. Fédéli, L. Fulbert, CEA-Leti (France); L. Zimmermann, IHP GmbH (Germany); B. Tillack, IHP GmbH (Germany) and Technische Univ. Berlin (Germany); T. Aalto, VTT Technical Research Ctr. of Finland (Finland); P. O'Brien, Tyndall National Institute, Univ. of College Cork (Ireland); D. Deptuck, J. Xu, D. Gale, Canadian Microelectronics Corp. (Canada)

---

**SESSION 6 MATERIALS AND DEVICES FOR LIGHT EMISSION**

---

- 8767 0I **Electrically pumped Er-doped light emitting slot waveguides for on-chip optical routing at 1.54  $\mu\text{m}$  [8767-18]**  
J. M. Ramírez, Y. Berencén, Univ. de Barcelona (Spain); D. Navarro-Urrios, Institut Català de Nanotecnologia (Spain); F. Ferrarese Lapi, Istituto per la Microelettronica e Microsistemi, CNR (Italy); A. Anopchenko, N. Prtljaga, Univ. degli Studi di Trento (Italy); P. Rivallin, CEA-Leti (France); A. Tengattini, Univ. degli Studi di Trento (Italy); J. P. Colonna, J. M. Fedeli, CEA-Leti (France); L. Pavesi, Univ. degli Studi di Trento (Italy); B. Garrido, Univ. de Barcelona (Spain)
- 8767 0J **Light emission at telecom wavelengths from single-walled carbon nanotubes [8767-19]**  
A. Noury, Institut d'Electronique Fondamentale, CNRS, Univ. Paris Sud (France); E. Gaufrès, Univ. de Montréal (Canada); X. Le Roux, Institut d'Electronique Fondamentale, CNRS, Univ. Paris Sud (France); M. Tange, T. Okazaki, National Institute of Advanced Industrial Science and Technology (Japan); R. Martel, Univ. de Montréal (Canada); L. Vivien, N. Izard, Institut d'Electronique Fondamentale, CNRS, Univ. Paris Sud (France)
- 8767 0L **Warm white LED light by frequency down-conversion of mixed yellow and red Lumogen [8767-21]**  
M. Mosca, F. Caruso, L. Zambito, B. Seminara, R. Macaluso, C. Calì, Univ. degli Studi di Palermo (Italy); E. Feltin, Novagan, Sàrl (Switzerland)

---

**SESSION 7 SI AND INP BASED DEVICES**

---

- 8767 0M **Semi-insulating substrate based generic InP photonic integration platform [8767-22]**  
F. M. Soares, K. Janiak, J. Kreissl, M. Moehrle, N. Grote, Fraunhofer-Institut für Nachrichtentechnik Heinrich-Hertz-Institut (Germany)
- 8767 0N **Heterogeneously integrated III-V/Si single mode lasers based on a MMI-ring configuration and triplet-ring reflectors [8767-23]**  
S. Keyvaninia, S. Verstuyft, Univ. Ghent (Belgium); F. Lelarge, G.-H. Duan, III-V Lab. (France); S. Messaoudene, J. M. Fedeli, CEA-Leti (France); E. J. Geluk, T. De Vries, B. Smalbrugge, J. Bolk, M. Smit, Technische Univ. Eindhoven (Netherlands); D. Van Thourhout, Univ. Ghent (Belgium); G. Roelkens, Univ. Ghent (Belgium) and Technische Univ. Eindhoven (Netherlands)
- 8767 0P **Characterization of spectral optical responsivity of Si-photodiode junction combinations available in a 0.35 $\mu\text{m}$  HV-CMOS technology [8767-25]**  
A. Kraxner, austriamicrosystems AG (Austria) and Technische Univ. Graz (Austria); E. Wachmann, I. Jonak-Auer, J. Teva, J. M. Park, R. Minixhofer, austriamicrosystems AG (Austria)

---

**SESSION 8 NANOSTRUCTURES AND NANOPHOTONICS**

---

- 8767 0Q **A dense spot size converter array fabricated in a generic process on InP [8767-26]**  
D. D'Agostino, E. Kleijn, R. Santos, H. P. M. M. Ambrosius, M. K. Smit, Technische Univ. Eindhoven (Netherlands)

- 8767 0R **SWG dispersion engineering for ultra-broadband photonic devices** [8767-27]  
R. Halir, Univ. de Málaga (Spain) and The Andalusian Ctr. for Nanomedicine and Biotechnology (Spain); A. Maese-Novo, S. Romero-García, D. Pérez-Galacho, L. Zavargo-Peché, Univ. de Málaga (Spain); A. Ortega-Moñux, I. Molina-Fernández, Univ. de Málaga (Spain) and The Andalusian Ctr. for Nanomedicine and Biotechnology (Spain); J. G. Wangüemert-Pérez, Univ. de Málaga (Spain); P. Cheben, National Research Council Canada (Canada)
- 8767 0S **Theoretical model of an interleave-chirped arrayed waveguide grating (IC-AWG)** [8767-28]  
B. Gargallo, Univ. Politècnica de Valencia (Spain); P. Muñoz, Univ. Politècnica de Valencia (Spain) and VLC Photonics S.L. (Spain)
- 8767 0T **Metamaterial-based sensor for skin disease diagnostics** [8767-29]  
L. La Spada, R. Iovine, R. Tarparelli, L. Vigni, Univ. degli Studi di Roma Tre (Italy)

---

**SESSION 9 ORGANIC AND HYBRID DEVICES**

---

- 8767 0U **Low-loss silicon nitrite waveguides in polymer** [8767-30]  
Z. Zhang, D. Liu, N. Keil, N. Grote, Fraunhofer-Institut für Nachrichtentechnik Heinrich-Hertz-Institut (Germany)
- 8767 0V **Colloidal PbS nanocrystals integrated to Si-based photonics for applications at telecom wavelengths** [8767-31]  
M. Humer, R. Guider, W. Jantsch, T. Fromherz, Johannes Kepler Univ. Linz (Austria)
- 8767 0W **Experimental studies of cobalt ferrite nanoparticles doped silica matrix 3D magneto-photonic crystals** [8767-32]  
E. Abou Diwan, F. Royer, R. Kekesi, D. Jamon, M. F. Blanc-Mignon, Univ. de Lyon (France) and Univ. Jean Monnet Saint-Etienne (France); S. Neveu, Lab. PECSA, CNRS, Univ. Pierre et Marie Curie (France) and ESPCI ParisTech (France); J. J. Rousseau, Univ. de Lyon (France) and Univ. Jean Monnet Saint-Etienne (France)
- 8767 0X **Direct imprinting on chalcogenide glass and fabrication of infrared wire-grid polarizer** [8767-33]  
I. Yamada, Univ. of Shiga Prefecture (Japan); N. Yamashita, T. Einishi, Isuzu Glass Co., Ltd. (Japan); M. Saito, Ryukoku Univ. (Japan); K. Fukumi, National Institute of Advanced Industrial Science and Technology (Japan); J. Nishii, Hokkaido Univ. (Japan)

---

**POSTER SESSION**

---

- 8767 10 **Si-based light emitter in an integrated photonic circuit for smart biosensor applications** [8767-38]  
S. Germer, C. Cherkouk, L. Rebohle, M. Helm, W. Skorupa, Helmholtz-Zentrum Dresden-Rossendorf e. V. (Germany)
- 8767 12 **Liquid-crystal tunable plasmonic stripe directional coupler switches** [8767-40]  
D. C. Zografopoulos, R. Beccherelli, Istituto per la Microelettronica e Microsistemi, CNR (Italy)

- 8767 13    **Analysis of the Drever-Pound-Hall technique for the simultaneous detection of the detuning of more cavities on a single channel [8767-4]**  
M. De Laurentis, M. Riccio, G. De Falco, L. Maresca, A. Irace, G. Breglio, Univ. degli Studi di Napoli Federico II (Italy)

*Author Index*

# Conference Committee

## Symposium Chair

**Thomas Becker**, EADS Innovation Works (Germany)

## Symposium Cochairs

**Christos Tsamis**, National Center for Scientific Research Demokritos

(Greece)

**Gerhard Krötz**, University of Applied Sciences in Kempten (Germany)

## Symposium Local Chair

**Marc Belleville**, CEA-Leti (France)

## Conference Chair

**Jean-Marc Fédéli**, CEA-Leti (France)

## Conference Cochairs

**Laurent Vivien**, Institut d'Électronique Fondamentale (France)

**Meint K. Smit**, Technische Universiteit Eindhoven (Netherlands)

## Conference Programme Committee

**Pavel Cheben**, National Research Council Canada (Canada)

**Patrice Féron**, Ecole Nationale Supérieure des Sciences Appliquées et de Technologie (France)

**Norbert Grote**, Fraunhofer-Institut für Nachrichtentechnik Heinrich-Hertz-Institut (Germany)

**Giovanni Isella**, Laboratorio per Nanostrutture Epitassiali su Silicio e per Spintronica (Italy)

**Erich Kasper**, Universität Stuttgart (Germany)

**Eric Mazur**, Harvard University (United States)

**Andrea I. Melloni**, Politecnico di Milano (Italy)

**Iñigo Molina-Fernandez**, Universidad de Málaga (Spain)

**Richard V. Penty**, University of Cambridge (United Kingdom)

**Lorenzo Pavesi**, Università degli Studi di Trento (Italy)

**Andrew W. Poon**, Hong Kong University of Science and Technology (Hong Kong, China)

**Günther Roelkens**, Universiteit Gent (Belgium)

**Kazumi Wada**, The University of Tokyo (Japan)

*Session Chairs*

- 1 Micro Cavities and Micro Resonators  
**Andrea I. Melloni**, Politecnico di Milano (Italy)
- 2 Photonic Materials  
**Iñigo Molina-Fernandez**, Universidad de Málaga (Spain)
- 3 Ge-Based Devices  
**Laurent Vivien**, Institut d'Électronique Fondamentale (France)
- 4 Photonics Platform I  
**Meint K. Smit**, Technische Universiteit Eindhoven (Netherlands)
- 5 Photonics Platform II  
**Jean-Marc Fédéli**, CEA-Leti (France)
- 6 Materials and Devices for Light Emission  
**Jean-Marc Fédéli**, CEA-Leti (France)
- 7 Si and InP Based Devices  
**Norbert Grote**, Fraunhofer-Institut für Nachrichtentechnik Heinrich-Hertz-Institut (Germany)
- 8 Nanostructures and Nanophotonics  
**Laurent Vivien**, Institut d'Électronique Fondamentale (France)
- 9 Organic and Hybrid Devices  
**Norbert Grote**, Fraunhofer-Institut für Nachrichtentechnik Heinrich-Hertz-Institut (Germany)