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Joel A. Kubby
Graham T. Reed
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Contents

- ix *Conference Committee*
xi *Introduction*

SESSION 1 MATERIALS

- 7606 02 **InP overgrowth on SiO₂ for active photonic devices on silicon** [7606-01]
C. Junesand, Z. Wang, L. Wosinski, S. Lourdudoss, KTH (Sweden)
- 7606 04 **Optical spectroscopy of Er doped Si-nanocrystals on sapphire substrates fabricated by ion implantation into SiO₂** [7606-55]
N. P. Hylton, I. F. Crowe, The Univ. of Manchester (United Kingdom); A. P. Knights, McMaster Univ. (Canada); M. P. Halsall, The Univ. of Manchester (United Kingdom); S. Ruffell, The Australian National Univ. (Australia); R. M. Gwilliam, Univ. of Surrey (United Kingdom)

SESSION 2 DETECTORS

- 7606 07 **Preliminary radiation hardness tests of single photon Si detectors** [7606-05]
R. Pagano, Univ. of Catania (Italy) and CNR-IMM (Italy); S. Libertino, CNR-IMM (Italy); G. Valvo, G. Condorelli, B. Carbone, A. Pianca, M. Mazzillo, D. N. Sanfilippo, P. G. Fallica, STMicroelectronics (Italy); F. Principato, G. Cannella, Univ. of Palermo (Italy); G. Falci, Univ. of Catania (Italy) and CNR-MATIS (Italy); S. Lombardo, CNR-IMM (Italy)

SESSION 3 LAB-ON-A-CHIP I

- 7606 08 **Microfluidic-based detection platform for on-the-flow analyte characterization (Invited Paper)** [7606-06]
P. Kiesel, M. Beck, N. Johnson, M. Bassler, Palo Alto Research Center, Inc. (United States)
- 7606 09 **Optofluidic biosensing for the study of disease at the molecular level (Invited Paper)** [7606-07]
I. M. White, Univ. of Maryland, College Park (United States)
- 7606 0A **Waveguide based optofluidics (Invited Paper)** [7606-08]
G. Testa, IREA-CNR (Italy); Y. Huang, Technische Univ. Delft (Netherlands); L. Zeni, Seconda Univ. degli Studi di Napoli (Italy); P. M. Sarro, Technische Univ. Delft (Netherlands); R. Bernini, IREA-CNR (Italy)

SESSION 4 LAB-ON-A-CHIP II

- 7606 0B **Planar FRET detection from biomolecules on an optofluidic chip** [7606-09]
A. Chen, P. Measor, Univ. of California, Santa Cruz (United States); E. J. Lunt, B. S. Phillips, A. R. Hawkins, Brigham Young Univ. (United States); H. Schmidt, Univ. of California, Santa Cruz (United States)

- 7606 0C **Arrays of SOI photonic wire biosensors for label-free molecular detection** [7606-10]
A. Densmore, D.-X. Xu, M. Vachon, S. Janz, R. Ma, Y. Li, G. Lopinski, C. C. Luebbert, Q. Y. Liu, J. H. Schmid, A. Delàge, P. Cheben, National Research Council Canada (Canada)
- 7606 0D **A photonic biosensor system on a CMOS chip (Invited Paper)** [7606-11]
K. L. Lear, R. Yan, Colorado State Univ. (United States)
- 7606 0E **A porous-silicon-based microarray for label-free optical detection of DNA hybridization** [7606-12]
I. Rea, G. Coppola, M. Giofrè, E. De Tommasi, I. Rendina, Institute for Microelectronics and Microsystems, National Council of Research (Italy); A. Lamberti, Univ. of Naples Federico II (Italy); L. De Stefano, Institute for Microelectronics and Microsystems, National Council of Research (Italy)

SESSION 5 WAVEGUIDES I

- 7606 0F **Applications of subwavelength grating structures in silicon-on-insulator waveguides (Invited Paper)** [7606-13]
J. H. Schmid, National Research Council Canada (Canada); P. J. Bock, National Research Council Canada (Canada) and Univ. of Ottawa (Canada); P. Cheben, W. Sinclair, National Research Council Canada (Canada); J. García, Univ. Politècnica de Valencia (Spain); S. Janz, J. Lapointe, G. C. Aers, D. Poitras, Y. Li, G. Lopinski, A. Delàge, A. Densmore, B. Lamontagne, R. Ma, D.-X. Xu, National Research Council Canada (Canada)
- 7606 0G **Germanium implanted Bragg gratings in silicon on insulator waveguides** [7606-14]
R. Loiacono, G. T. Reed, R. Gwilliam, G. Z. Mashanovich, Univ. of Surrey (United Kingdom); L. O'Faolain, T. Krauss, Univ. of St. Andrews (United Kingdom); G. Lulli, Istituto per la Microelettronica e Microsistemi (Italy); C. Jeynes, Univ. of Surrey (United Kingdom); R. Jones, Intel Corp. (United States)
- 7606 0H **Effects of annealing silicon ion irradiated rib waveguides with respect to free carrier lifetime** [7606-15]
N. M. Wright, A. J. Smith, K. Litvinenko, R. Gwilliam, G. Mashanovich, G. T. Reed, Univ. of Surrey (United Kingdom)

SESSION 6 WAVEGUIDES II

- 7606 0J **Cantilever couplers for fiber coupling to silicon photonic integrated circuits (Invited Paper)** [7606-17]
R. M. Reano, P. Sun, The Ohio State Univ. (United States)
- 7606 0K **Fabrication of porous silicon channel waveguides with multilayer Bragg cladding** [7606-18]
A. A. Bettiol, E. J. Teo, National Univ. of Singapore (Singapore); S. Prashant, Sri Sathya Sai Univ. (India); X. Boqian, M. B. H. Breese, National Univ. of Singapore (Singapore)
- 7606 0L **Self-alignment and instability of waveguides induced by forces of guided and radiated fields** [7606-19]
A. Mizrahi, K. Ikeda, F. Bonomelli, V. Lomakin, Y. Fainman, Univ. of California, San Diego (United States)

- 7606 0M **Novel types of silicon waveguides fabricated using proton beam irradiation** [7606-20]
E. J. Teo, National Univ. of Singapore (Singapore); P. Yang, Univ. of Surrey (United Kingdom);
B. Q. Xiong, M. B. H. Breese, National Univ. of Singapore (Singapore); G. Z. Mashanovich,
Univ. of Surrey (United Kingdom); Y. S. Ow, National Univ. of Singapore (Singapore);
G. T. Reed, Univ. of Surrey (United Kingdom); A. A. Bettiol, National Univ. of Singapore
(Singapore)

SESSION 7 MODULATORS

- 7606 0N **Slow-light photonic crystal switches and modulators (Invited Paper)** [7606-21]
D. M. Beggs, T. P. White, Univ. of St. Andrews (United Kingdom); T. Kampfrath, K. Kuipers, FOM
Institute AMOLF (Netherlands); T. F. Krauss, Univ. of St. Andrews (United Kingdom)
- 7606 0O **High-speed silicon optical modulator (Invited Paper)** [7606-22]
D. Marris-Morini, G. Rasigade, L. Vivien, P. Crozat, E. Cassan, Institut d'Électronique
Fondamentale, Univ. Paris Sud, CNRS (France); P. Lyan, P. Rivallin, J.-M. Fédéli, CEA, LETI,
Minatec (France)
- 7606 0P **Power and speed analysis of miniaturized SOI y-branch Mach-Zehnder thermo-optic
switches** [7606-23]
K. P. Yap, National Research Council Canada (Canada) and Carleton Univ. (Canada);
T. Smy, Carleton Univ. (Canada); J. H. Schmid, P. Waldron, A. Densmore, National Research
Council Canada (Canada); B. Syrett, Carleton Univ. (Canada); S. Janz, National Research
Council Canada (Canada)
- 7606 0Q **Design of Ge/SiGe quantum-confined Stark effect modulators for CMOS compatible
photonics** [7606-24]
L. Lever, Z. Ikonić, A. Valavanis, R. W. Kelsall, Univ. of Leeds (United Kingdom)
- 7606 0R **Ultra-low energy switches based on silicon photonic crystals for on-chip optical
interconnects** [7606-25]
S. P. Anderson, P. M. Fauchet, Univ. of Rochester (United States)
- 7606 0S **Modulators and photodetectors developed in the framework of the European HELIOS
project (Invited Paper)** [7606-26]
L. Vivien, J. Osmond, G. Rasigade, D. Marris-Morini, P. Crozat, E. Cassan, Institut
d'Électronique Fondamentale, CNRS, Univ. Paris Sud (France); J.-M. Fédéli,
J. F. Damlencourt, CEA, LETI, Minattec (France); D. Thomson, F. Y. Gardes, G. T. Reed, Univ. of
Surrey (United Kingdom); D. Van Thourhout, J. Brouckaert, Ghent Univ. (Belgium)

SESSION 8 INTEGRATION

- 7606 0T **Integrated photonic devices based on silicon photonic wire waveguide platform (Invited
Paper)** [7606-27]
K. Yamada, H. Fukuda, T. Tsuchizawa, T. Watanabe, H. Shinojima, H. Nishi, S. Park, NTT Corp.
(Japan); Y. Ishikawa, K. Wada, The Univ. of Tokyo (Japan); S. Itabashi, NTT Corp. (Japan)

- 7606 0U **Semiconductor nanomembranes for stacked and flexible photonics (Invited Paper)** [7606-29]
W. Zhou, The Univ. of Texas at Arlington (United States); Z. Ma, Univ. of Wisconsin-Madison (United States); H. Yang, L. Chen, W. Yang, Z. Qiang, The Univ. of Texas at Arlington (United States); G. Qin, H. Pang, Univ. of Wisconsin-Madison (United States); S. Chuwongin, D. Zhao, The Univ. of Texas at Arlington (United States)
- 7606 0V **Nanomembrane enabled nanophotonic devices** [7606-30]
M. J. Zablocki, Univ. of Delaware (United States); A. S. Sharkawy, O. Ebil, EM Photonics, Inc. (United States); D. W. Prather, Univ. of Delaware (United States)
- 7606 0W **Integrated recirculating optical buffers (Invited Paper)** [7606-31]
M. J. R. Heck, G. Kurczveil, E. F. Burmeister, H. Park, J. P. Mack, D. J. Blumenthal, J. E. Bowers, Univ. of California, Santa Barbara (United States)

SESSION 9 RESONATORS

- 7606 0X **Optofluidic ring resonator dye lasers (Invited Paper)** [7606-32]
Y. Sun, J. D. Suter, X. Fan, Univ. of Missouri, Columbia (United States)
- 7606 10 **Numerical investigation of optical resonances in circular grating resonators** [7606-35]
S. Burger, F. Schmidt, L. Zschiedrich, Zuse Institute Berlin (Germany) and JCMwave GmbH (Germany)

SESSION 10 EMITTERS

- 7606 11 **Applications of coherent anti-Stokes Raman scattering in silicon photonics (Invited Paper)** [7606-36]
N. Vermeulen, C. Debaes, H. Thienpont, Vrije Univ. Brussel (Belgium)
- 7606 12 **Using reach-through techniques to improve the external power efficiency of silicon CMOS light emitting devices** [7606-37]
M. du Plessis, P. J. Venter, Univ. of Pretoria (South Africa); A. W. Bogalecki, INSiAVA (Pty) Ltd. (South Africa)
- 7606 13 **New interpretation of photonic yield processes (450-750nm) in multi-junction Si CMOS LEDs: simulation and analyses** [7606-38]
L. W. Snyman, Tshwane Univ. of Technology (South Africa); E. Bellotti, Boston Univ. (United States)
- 7606 14 **Lateral electrical injection into Si/SiO₂ horizontal multislotted waveguides** [7606-39]
S. P. Anderson, H. G. Yoo, K. Ni, P. M. Fauchet, Univ. of Rochester (United States)

SESSION 11 PHOTONIC CRYSTALS

- 7606 15 **Waveguide-based optofluidics (Invited Paper) [7606-40]**
C. Karnutsch, Hochschule Karlsruhe (Germany); S. Tomljenovic-Hanic, C. Monat, C. Grillet, P. Domachuk, R. McPhedran, B. J. Eggleton, The Univ. of Sydney (Australia); L. O'Faolain, T. F. Krauss, Univ. of St. Andrews (United Kingdom); S. Xiao, N. A. Mortensen, Technical Univ. of Denmark (Denmark)
- 7606 16 **Photonic crystal microcavities in SOI waveguides produced in a CMOS environment [7606-41]**
S. Meister, A. Al-Saadi, B. A. Franke, S. Mahdi, B. Kuhlow, K. Voigt, Technische Univ. Berlin (Germany); B. Tillack, H. H. Richter, L. Zimmermann, IHP GmbH (Germany); V. Ksianzou, S. K. Schrader, Technische Fachhochschule Wildau (Germany); H. J. Eichler, Technische Univ. Berlin (Germany)

POSTER SESSION

- 7606 17 **Silicon radiative cooler and optical amplifier by light down conversion [7606-28]**
V. K. Malyutenko, V. V. Bogatyrenko, O. Yu. Malyutenko, Lashkaryov Institute of Semiconductor Physics (Ukraine)
- 7606 18 **Silicon photonics: ready to wafer-bonding fibre grating coupler [7606-42]**
C. Kopp, T. Dupont, J.-M. Fédéli, CEA, LETI, Minatec (France); R. Orobtcouk, INL, INSA de Lyon (France)
- 7606 19 **Light emission from Si LED controlling by a gate voltage and SOS tunneling junction [7606-43]**
W.-L. Guo, Tianjin Polytechnic Univ. (China) and Tianjin Univ. (China); X.-Y. Li, C.-H. Huang, X.-S. Fu, P.-J. Niu, G.-H. Yang, Tianjin Polytechnic Univ. (China)
- 7606 1A **Athermal and low loss ridge silicon waveguides [7606-44]**
M. M. Milošević, G. Z. Mashanovich, F. Y. Gardes, Y. Hu, Univ. of Surrey (United Kingdom); A. P. Knights, McMaster Univ. (Canada); N. G. Tarr, Carleton Univ. (Canada); G. T. Reed, Univ. of Surrey (United Kingdom)
- 7606 1C **Taper-integrated multimode-interference-based crossings for silicon wire waveguides [7606-46]**
C.-H. Chiu, C.-H. Chen, National Chiao Tung Univ. (Taiwan)
- 7606 1E **Experimental and numerical analysis study of 1-D photonic crystal in Si photonic-wire waveguides [7606-48]**
T. Kita, H. Yamada, Tohoku Univ. (Japan)
- 7606 1F **Analysis of all optical logic gate based on photonic crystal multimode interference [7606-49]**
H.-S. Kim, T.-K. Lee, G.-Y. Oh, Chung-Ang Univ. (Korea, Republic of); D.-G. Kim, Korea Photonics Technology Institute (Korea, Republic of); Y.-W. Choi, Chung-Ang Univ. (Korea, Republic of)
- 7606 1G **Mode properties of ALD filled slot waveguides [7606-50]**
A. Säynätjoki, T. Alasaarela, A. Khanna, A. Tervonen, S. Honkanen, Aalto Univ. (Finland)

- 7606 1I **Superfocusing the light through nanosize circular aperture** [7606-53]
S. S. Choi, V. K. Jha, O. K. Suwal, Sun Moon Univ. (Korea, Republic of); M. J. Park, Korea Military Academy (Korea, Republic of); N. K. Park, D. S. Kim, Seoul National Univ. (Korea, Republic of)
- 7606 1J **An all-silicon optical transmission system for clock and data transmission** [7606-54]
P. Ellinghaus, INSiAVA (Pty) Ltd. (South Africa); P. J. Venter, M. du Plessis, Univ. of Pretoria (South Africa); P. Rademeyer, A. W. Bogalecki, INSiAVA (Pty) Ltd. (South Africa)
- 7606 1K **Formation of Si-nanocrystals in SiO₂ via ion implantation and rapid thermal processing** [7606-56]
I. F. Crowe, The Univ. of Manchester (United Kingdom); O. Hulko, A. P. Knights, McMaster Univ. (Canada); N. P. Hylton, M. P. Halsall, The Univ. of Manchester (United Kingdom); S. Ruffell, The Australian National Univ. (Australia); R. M. Gwilliam, Univ. of Surrey (United Kingdom)
- 7606 1L **Germanium p-i-n photodiode on silicon for integrated photonic applications** [7606-58]
J. Mathews, R. Roucka, C. Weng, J. Tolle, J. Menéndez, J. Kouvetakis, Arizona State Univ. (United States)

Author Index

Conference Committee

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1 Materials
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2 Detectors
Andrew P. Knights, McMaster University (Canada)

- 3 Lab-on-a-Chip I
Holger Schmidt, University of California, Santa Cruz (United States)
- 4 Lab-on-a-Chip II
Holger Schmidt, University of California, Santa Cruz (United States)
- 5 Waveguides I
Graham T. Reed, University of Surrey (United Kingdom)
- 6 Waveguides II
Graham T. Reed, University of Surrey (United Kingdom)
- 7 Modulators
Philippe M. Fauchet, University of Rochester (United States)
- 8 Integration
Andrew W. Poon, Hong Kong University of Science and Technology
(Hong Kong, China)
- 9 Resonators
Graham T. Reed, University of Surrey (United Kingdom)
- 10 Emitters
Joel A. Kubby, University of California, Santa Cruz (United States)
- 11 Photonic Crystals
Joel A. Kubby, University of California, Santa Cruz (United States)
- 12 Silicon Photonics: Joint Session with Conference 7616
Mario J. Paniccia, Intel Corporation (United States)

Introduction

Silicon has a legendary history as the material of choice for microelectronic integration, but has not been the material of choice for optoelectronic integration. That is now beginning to change with the introduction of monolithic and hybrid silicon photonics. Silicon photonic devices have been demonstrated with the capability to emit, modulate, guide, multiplex/demultiplex, buffer and detect light, and can be combined with microelectronics to form electronic and photonic integrated circuits. Silicon photonic devices such as high-speed (40 GSa/s) analog to digital converters are now being fabricated in commercial CMOS foundries, enabling these devices to leverage the \$500 billion fabrication infrastructure for integrated circuits. The previous barrier of silicon's indirect bandgap has been overcome through the integration of germanium and III-V materials to form novel in-plane silicon lasers and high-speed (40 Gb/s) modulators which has been achieved via the plasma dispersion effect. The cascaded Raman effect and nano-engineering of crystalline silicon and silicon-rich nitride films have also been used to obtain light from silicon and an electrically pumped silicon laser may be on the horizon.

The decrease in waveguide bend radius made possible in silicon-on insulator technology due to its high-index contrast, together with increased levels of optical and microelectronic integration, may lead to a new formulation of Moore's Law for silicon photonics. We are now seeing the convergence of communications and computing directly on-chip with the advent of optical interconnects, driven by the need for smaller and less expensive components that can leverage the infrastructure for CMOS manufacturing. In addition to on-chip communications and signal processing, silicon photonics is also being used to form laboratories on a chip with integrated micro-fluidics for low-cost, label-free biosensing and waveguide-based optofluidics. The past year has been an exciting time for silicon photonics! We hope you will enjoy the papers detailing these advancements that are included in these conference proceedings.

Joel A. Kubby
Graham T. Reed

