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CONFERENCE 11284

Monday–Thursday 3–6 February 2020 • Proceedings of SPIE Vol. 11284

Smart Photonic and Optoelectronic Integrated Circuits XXII

Conference Chairs: **Sailing He**, KTH Royal Institute of Technology (Sweden), Zhejiang Univ. (China); **Laurent Vivien**, Ctr. for Nanoscience and Nanotechnology, CNRS, Univ. Paris-Sud, Univ. Paris-Saclay (France)

Program Committee: **Pavel Cheben**, National Research Council Canada (Canada); **Ray T. Chen**, The Univ. of Texas at Austin (USA); **Louay A. Eldada**, Quanergy Systems, Inc. (USA); **Chennupati Jagadish**, The Australian National Univ. (Australia); **Stefan A. Maier**, Imperial College London (United Kingdom); **Lorenzo Pavesi**, Univ. degli Studi di Trento (Italy); **Joachim Piprek**, NUSOD Institute LLC (USA); **David V. Plant**, McGill Univ. (Canada); **Andrew W. Poon**, Hong Kong Univ. of Science and Technology (Hong Kong, China); **Ali Serpengüzel**, Koç Univ. (Turkey); **Bertrand Szelag**, CEA-LETI (France); **Augustine M. Urbas**, Air Force Research Lab. (USA); **Dries Van Thourhout**, Univ. Gent (Belgium); **Alan X. Wang**, Oregon State Univ. (USA); **Jian Wang**, Huazhong Univ. of Science and Technology (China); **Qian Wang**, Huawei Technologies Co., Ltd. (China); **Michael R. Watts**, Massachusetts Institute of Technology (USA); **Lin Yang**, Institute of Semiconductors, CAS (China); **Rui Q. Yang**, The Univ. of Oklahoma (USA)

MONDAY 3 FEBRUARY

OPTO PLENARY SESSION MON 8:00 AM TO 10:05 AM

- 8:00 am: **Welcome and Opening Remarks**
Sailing He, KTH Royal Institute of Technology (Sweden) and Zhejiang Univ. (China); **Yasuhiro Koike**, Keio Univ. (Japan)
- 8:05 am: **The future of optical components and materials in the fibre (Plenary)**
David N. Payne, Optoelectronics Research Ctr., Univ. of Southampton (United Kingdom)
- 8:45 am: **Efficient light emission from hexagonal SiGe (Plenary)**
Erik P. A. M. Bakkers, Eindhoven Univ. of Technology (Netherlands)
- 9:25 am: **Product design for the next wave of computing (Plenary)**
Trond Wuellner, Google (USA)

SESSION 1 MON 10:30 AM TO 12:10 PM

Photonics Based on Artificial Intelligence I

Session Chair: **Alan X. Wang**, Oregon State Univ. (USA)

- Optical neural networks: from integrated photonics to free-space solutions (Invited Paper)**, Volker J. Sorger, The George Washington Univ. (USA) [11284-1]
- Neuromorphic computing through photonic integrated circuits (Invited Paper)**, George Mourgias-Alexandris, Angelina Totovic, Nikolaos Passalis, George Dabos, Anastasios Tefas, Nikos Pleros, Aristotle Univ. of Thessaloniki (Greece) [11284-2]
- Silicon optical mode switches for on-chip optical interconnects (Invited Paper)**, Lin Yang, Ting Zhou, Hao Jia, Lei Zhang, Xin Fu, Institute of Semiconductors (China) [11284-3]
- Smart design of photonic structures with artificial intelligence and neural networks (Invited Paper)**, Wenshan Cai, Georgia Institute of Technology (USA) [11284-4]
- Lunch Break Mon 12:10 pm to 1:10 pm

SESSION 2 MON 1:10 PM TO 3:15 PM

Photonics Based on Artificial Intelligence II

Session Chair: **Lorenzo Pavesi**, Univ. degli Studi di Trento (Italy)

- Integrated photonic processing unit for acceleration of neural network training (Invited Paper)**, Roger Dangel, Folkert Horst, Efe Bueyuekoezer, Yannick Baumgartner, Bert J. Offrein, IBM Research - Zürich (Switzerland) [11284-5]
- Artificial neural computing with nanophotonics (Invited Paper)**, Zongfu Yu, Univ. of Wisconsin-Madison (USA) [11284-6]
- Artificial photonic neural networks (Invited Paper)**, Wolfram H. P. Pernice, Westfälische Wilhelms-Univ. Münster (Germany) [11284-7]
- All-optical deep feed forward network based on nonlinear microresonators for telecom applications (Invited Paper)**, Mattia Mancinelli, Univ. degli Studi di Trento (Italy) [11284-8]
- Information photonics empowered by artificial intelligence (Invited Paper)**, Min Gu, Univ. of Shanghai for Science and Technology (China) [11284-9]

SESSION 3 MON 3:45 PM TO 6:35 PM

Integration, Manufacturing and Photonic Circuits

Session Chair: **Bertrand Szelag**, CEA-LETI (France)

The International Integrated Photonic Systems Roadmap: defining the destination and the path (Keynote Presentation), Lionel C. Kimering, Massachusetts Institute of Technology (USA) [11284-10]

- GaAs nano-ridge lasers on silicon (Invited Paper)**, Dries Van Thourhout, Yuting Shi, imec, Univ. Gent (Belgium); Marina Baryshnikova, imec (Belgium); Yannick De Koninck, imec (Belgium); Marianna Pantouvaki, Joris Van Campenhout, Bernardette Kunert, imec (Belgium) [11284-11]
- Multisensor and closed-loop control of component and assembly processes for zero-defect manufacturing of photonics**, Erik Beckert, Fraunhofer-Institut für Angewandte Optik und Feinmechanik IOF (Germany); Jovana Milenkovic, ATLANTIS Engineering SA (Greece); Andreas Mantelos, SENSAP Swiss AG (Switzerland); Vassilis Tsolekas, ATLANTIS Engineering SA (Greece) [11284-12]

Immersion lithography introduction in Si photonics platform (Invited Paper), Cecilia Dupre, CEA-LETI, Univ. Grenoble Alpes (France); Celine Lapeyre, Laetitia Adelmini, Elise Arnoux, Estelle Guyez, Pierre Brianceau, Loic Perraud, Aurelien Fay, Karim Hassan, Quentin Wilmart, Bertrand Szelag, Daivid Fowler, Univ. Grenoble Alpes (France) [11284-13]

Towards field-programmable photonic gate arrays (Invited Paper), José Capmany Francoy, Daniel Pérez López, Prometheus DasMahapatra, Univ. Politècnica de València (Spain) [11284-14]

Wavelength-division-multiplexing-based electronic-photonic network for high-speed computing (Invited Paper), Chenghao Feng, Zhoufeng Ying, Zheng Zhao, Jiaqi Gu, David Z. Pan, Ray T. Chen, The Univ. of Texas at Austin (USA) [11284-15]

A monolithically-integrated 2 × 25-Gb/s Si photonic WDM receiver with thermally-tunable ring-resonator filters, Hyun-Kyu Kim, Youngkwan Jo, Minkyu Kim, Yonsei Univ. (Korea, Republic of); Hyun-Yong Jung, Samsung Electronics Co., Ltd. (Korea, Republic of); Christian Mai, Stefan Lischke, Lars Zimmermann, IHP GmbH (Germany); Woo-Young Choi, Yonsei Univ. (Korea, Republic of) [11284-16]

A Monolithically Integrated 2×25 -Gb/s Si Photonic WDM Receiver with Thermally-Tunable Ring-Resonator Filters

Hyun-Kyu Kim^a, Youngkwan Jo^a, Minkyu Kim^a, Hyun-Yong Jung^b, Christian Mai^c, Stefan Lischke^c,
Lars Zimmermann^c, and Woo-Young Choi^a

^aDepartment of Electrical and Electronic Engineering, Yonsei University, 03722 Seoul, South Korea;
^bSemiconductor Research Institute, Samsung Electronics, 18448 Hwaseong, South Korea; ^cIHP, Im
Technologiepark 25, 15236 Frankfurt (Oder), Germany

ABSTRACT

As the demand for interconnect capacity continuously increases, there is a strong need for employing the wavelength division multiplexing (WDM) technique for short-distance high-bandwidth interconnect applications. For such applications, WDM filters based on ring-resonators are of great interest as they can significantly reduce the WDM receiver footprint. However, since the ring-resonator performance strongly depends on its structure, it is very important to consider various trade-offs and to determine the optimum structure. With such considerations, we realized ring-resonator filters whose resonance wavelength can be tuned by the on-chip heater. Using them, we implemented a monolithically integrated Si Photonic 2-channel WDM receiver that contains Ge-photodetectors, transimpedance amplifiers, post amplifiers, and output buffers using 0.25- μm photonic BiCMOS technology provided by IHP. Using the simulation and measurement results, we investigated the performance uncertainty of ring-resonator filters due to process variation, and determine the optimal thermal control technique. Details of simulation and measurement results of our WDM receiver with thermally-tunable ring resonator filters will be presented.

Keywords: Si Photonics, Ring-resonator Filter, WDM Receiver