

Mid-IR Devices and Sub-systems Based on SOI Technology

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Abstract— Here, we review our work on mid-IR devices and sub-systems exploiting Silicon-On-Insulator (SOI) platforms. In particular, our sub- μm thick Si device layer SOI platform targets the mid-IR wavelength range between 2 and 4 μm . Above that, propagation losses caused by silicon dioxide absorption strongly increase the insertion loss of the devices.

Firstly, we will present the SOI platform and the performance of basic devices such as Mach-Zehnder interferometers (MZIs) and arrayed waveguide gratings (AWGs) addressing the relevant wavelength ranges around 2.3 and 3.4 μm to build sub-systems for sensing and spectroscopic applications.

We will then introduce a spectrometer working at 2.3 μm based on an AWG, which allows to monitor multiple channels with a single photodetector by exploiting channel modulation. This approach allows to reduce the number of on-chip integrated photodetectors and consequently device footprint and cost.

Afterward, we will present an SOI photonic integrated circuit (PIC) functioning as external cavity for a GaSb gain chip. By using a Vernier configuration based on ring resonators for spectral selectivity, we have demonstrated broadband tunable lasing around 2 μm with maximum output powers of 7.5 mW with no cooling. This approach allowed to cover a bandwidth of 58 nm from 2.01 to 2.07 μm .

To provide constant feedback because of wavelength shifting for this type of on-chip external cavity sub-systems, we have developed a digital Fourier Transform spectrometer targeting wavelength monitoring applications. Such spectrometer has been designed at 2.3 μm and provides good performance achieving 130 nm bandwidth, 100 pm accuracy and 500 pm resolution of 2 separate lines.

- 16:10 Disk-tip Microtools for Light Robotics
Einstom Engay (Technical University of Denmark); Alexandre Wetzel (Technical University of Denmark); Ada-Ioana Bunea (Technical University of Denmark); Jesper Gluckstad (Technical University of Denmark);
- 16:30 Coffee Break
- 17:00 Light Robots Based on Shape-changing Materials
Arri Priimagi (Tampere University of Technology);
- 17:20 Soft Microrobots Controlled by Structured Light
Invited
Stefano Palagi (Istituto Italiano di Tecnologia);
- 17:40 3D Printing for Light-fueled Polymeric Microrobots
Invited
Sara Nocentini (European Laboratory for Non-linear Spectroscopy); Daniele Martella (European Laboratory for Non-linear Spectroscopy); Camilla Parmeggiani (European Laboratory for Non-linear Spectroscopy); Diederik S. Wiersma (European Laboratory for Non-linear Spectroscopy);
- 18:00 Biomimetic 3D Micro-structures for Soft Micro-robotics
Invited
Larisa Florea (Trinity College Dublin); Alexa Ennis (Trinity College Dublin); Colm Delaney (University College Dublin);
- 18:20 Circumgyration of Nonlinear Nanoparticles by Focusing Gaussian Ultrashort Pulses
Yaqiang Qin (Institute of Genetics and Developmental Biology, Chinese Academy of Sciences); Lu Huang (Institute of Genetics and Developmental Biology, Chinese Academy of Sciences); Yuqiang Jiang (Institute of Genetics and Developmental Biology, Chinese Academy of Sciences);

Session 1P8a
Photonics Packaging & Integration 2

Monday PM, June 17, 2019

Room 6 - Mezzanine

Organized by Francesco Floris

Chaired by Francesco Floris

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- 14:30 ACTPHAST — Accelerating Photonics Innovation for SME's and Researchers
Marc Rensing (Tyndall National Institute);
- 14:50 Actilabel: A Smart Active Label for Monitoring Real Shelf Life of Goods
Carlo Maria Carbonaro (University of Cagliari); Daniele Chiriu (University of Cagliari); Pier Carlo Ricci (University of Cagliari);

- 15:10 From Laboratory Measurements to a Commercial Prototype: The Case of Plasmore
Franco Marabelli (University of Pavia); Lucia Fornasari (Plasmore s.r.l.); L. Lopez-Sanchez (Plasmore s.r.l.); P. Pellacani (Plasmore s.r.l.);
- 15:30 A High-speed Vertical Transition for Multi-layer AlN Carrier Boards Designed by Time-domain Reflectometry
Moises A. Jezzini (Tyndall National Institute); P. J. Marraccini (Tyndall National Institute); F. H. Peters (Tyndall National Institute);

Session 1P8b
SC3: Mid-infrared Integrated Photonics and Applications

Monday PM, June 17, 2019

Room 6 - Mezzanine

Organized by Zhenzhou Cheng, Yingdong Han

Chaired by Zhenzhou Cheng

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- 15:50 Miniaturization of Mid-IR Sensors on Si: Challenges and Perspectives
Invited
Jean-Guillaume Coutard (Université Grenoble Alpes); S. Nicoletti (CEA-Leti MINATEC Campus); J.-M. Fedeli (CEA LETI); M. Fournier (Université Grenoble Alpes); P. Labeye (CEA-Leti MINATEC Campus); Pierre Barritault (Université Grenoble Alpes); A. Marchant (Université Grenoble Alpes); Alain Gliere (Université Grenoble Alpes); A. Teulle (Université Grenoble Alpes); L. Duraffourg (Université Grenoble Alpes);
- 16:10 The Chalcogenide Waveguides for Mid-infrared Optical Applications
Invited
Xin Gai (City University of Hong Kong);
- 16:30 Coffee Break
- 17:00 Mid-IR Devices and Sub-systems Based on SOI Technology
Invited
Fabio Pavanello (Ghent University); Anton Vasilev (Ghent University); Ruijun Wang (Ghent University); Muhammad Muneeb (Ghent University); A. Malik (Ghent University); Guy Lepage (Imec); Peter DeHeyn (Imec); Joris Van Campenhout (IMEC); Ieva Simonyte (Brolis Semiconductors); Augustinas Vizbaras (Brolis Semiconductors); Kristijonas Vizbaras (Brolis Semiconductors); Roe Baets (Ghent University); Gunther Roelkens (Ghent University, IMEC);