Title: Optically pumped broadband LED emission coupled to SOI waveguides

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Abstract :

Silicon photonics, widely used for applications in telecom and datacom, has been recently proposed as an emerging platform also for bio-sensing. Among the main advantages of silicon photonics circuitry, we can list the fact of being a low-cost technology, together with the excellent quality of the passive photonics components that can be fabricated in the state-of-the-art CMOS fabs. In addition to that, silicon waveguides allow broadband operations in IR and mid-IR spectral region, thus permitting sensing at various wavelengths. However, silicon is still a material with indirect band-gap, thus it remains a very poor light emitter. Many attempts have been done to integrate an efficient light source onto a silicon waveguide, of which the most preferred solution is the heterogeneous integration of a III-V stack, being III-V a class of materials which can provide excellent light sources (both LEDs and lasers). For the applications related to bio-sensing, and particular spectroscopic sensing, there is a need of an efficient broadband light source, that can optically probe the analytes and that can be efficiently integrated with the photonic circuitry. Here we propose the integration of a thin III-V (InP based) membrane on top of an SOI waveguide in order to create an efficient optically pumped LED.

The membrane is obtained by physically attaching a III-V stack onto the SOI chip and by various post-processing steps, removing the unnecessary capping layers and creating a certain geometry by optical lithography and wet and dry etching steps.

Simulations demonstrate that it is possible to design the III-V membrane in such a way that light can be efficiently coupled to the SOI waveguides from the membrane and vice-versa. In fact, under a proper excitation pump, a significant fraction of the spontaneous emission from the LED is coupled back into the waveguide. We demonstrated that such a light source is broadband and can be easily demultiplexed, in order to be able to perform on-chip spectroscopy. A correlation between the carrier lifetime and the geometrical parameters of the LED demonstrates the role of the side-walls of the LED and the fabrication-induced defects.



The sessions will include also the following devices and application areas

- · light emitters and detectors
- · medulaters, optical switches
- · resonators, photonic crystals plasmonic sensors
- Integrated v/aveguide sensing
- building blocks for telecommunication

List of invited speakers (confirmed):

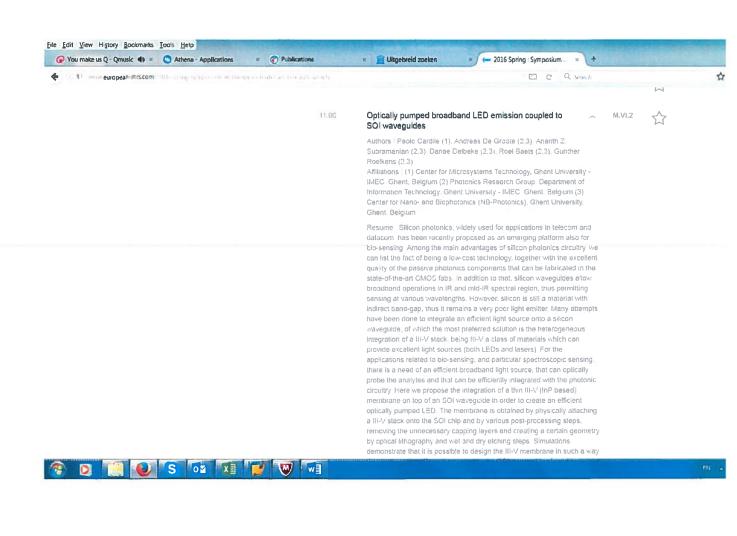
- Ryan Balley (University of Illinois Urbana USA)
- Silke Christlansen (Helmholtz-Center for Materials and Energy Berlin -HZE Germany) *Three-dimensional silicon based nano-architectures for energy conversion and sensing*
- Philippe Fauchet (Vanderbilt University USA) "Photonic crystals for sensors"
- Ewold Verhagen (FOM Institute: The Netherlands): Nano-optomechanical sensing with subwavelength light fields."
- · Romain Quidant (ICFO The Institute of Photonic Sciences, Spain) "Nanoplasmonics for biosensing"
- Gunther Roelkens (University of Ghent, Belgium) "Ill-V on silicon photonic integrated circuits for optical communication and sensing"
- Ioannis Raptis (Institute of Nanosciences & Nanotechnologies (INN) NCSR "Demoknlos", Greece)
- Markus Schmidt (IPHT Jena, Germany) "Hybrid fibers" a new base for plasmonic nanoprobes and oprofluidic nanoparticle sensing"
- Pol Van Dorpe (IMEC Belgium)
- Ralf B. Wehrspehn (Fraunhofer Institute, Germany) "Stable field-enhanced emission and surface ionization from stilicon nano-up arrays"

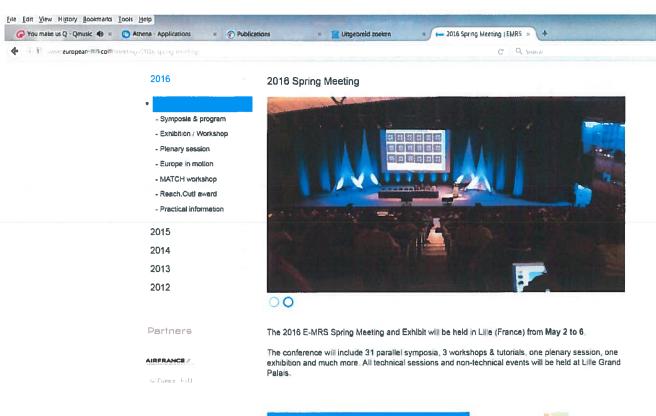
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