Fabrication of photonic integrated circuits using high resolution CMOS fabrication process

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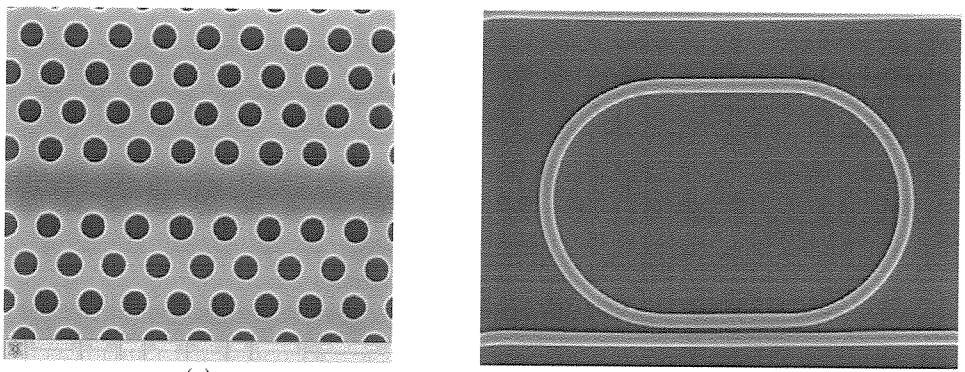
Silicon photonics is an attractive platform for wide range of applications. High index contrast and superior material quality enables high-density and low loss photonic integrated circuits. Various optical functionalities such as filtering, modulation are demonstrated on silicon using CMOS compatible fabrication process. CMOS fabrication platform enables mass production thus reducing the cost of the photonic integrated circuits. One of the major advantages of using CMOS fabrication process is the fabrication tools are already in use for fabricating microelectronic circuits. There is no need to develop new tools for fabricating photonic circuits.

Having addressed the advantages of using CMOS fabrication process, one might think, what still holds mass production of photonic integrated circuits. The answer is not simple; one of the major issues is reproducibility of photonic devices. The silicon photonic devices are sensitive to small dimensional changes resulting in change in device response. Roughly 1nm change in the width of a filter will shift the filter peak by 1nm. Hence a high resolution fabrication process is necessary.



(a) (b)

Photonic crystal waveguide (a) and Racetrack ring resonator (b) fabricated using CMOS fabrication process

One of the goals in my research is to address the issue of reproducibility of photonic integrated circuits. The research focuses at high uniformity and reproducibility using advanced CMOS fabrication tools. Studying the source of variation during the fabrication process such as optical lithography and dry etching will result in a scheme to reduce/remove such variations.

SPRING SCHOOL

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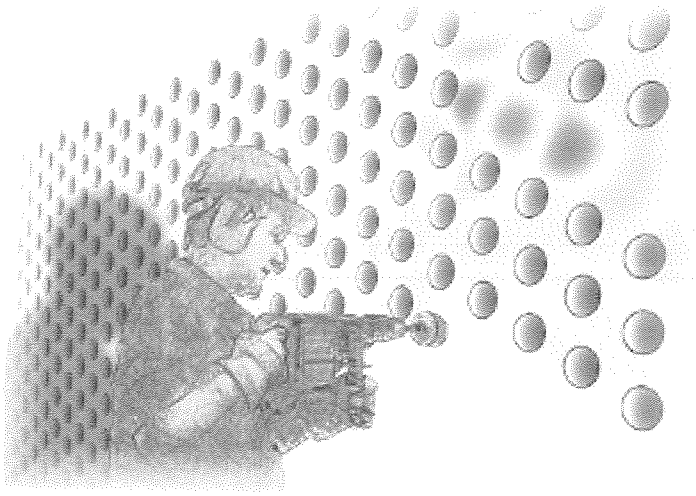

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Abstracts of Posters

Poster session I:

1. **V-Groove approach for inverted taper coupling in silicon photonics**: J. V. Galán
2. **Experimental Study of the Non-Linear Dynamics of Quantum-Dot InAs/InGaAsP/InP (100) Twin-Stripe Lasers Emitting at 1.5µm**: Jose Pozo
3. **InGaAs-InAlGaAs Monolithically Integrated Temporal Phase Coded OCDMA Encoder/Decoder**: S. McMaster
4. **A spectrally resolved study of quantum dot lasers**: G.A.P. Thé
5. **Carrier Transport Effects in Multi Layer Quantum Dot Lasers**: M. Rossetti
6. **Membrane couplers for optical interconnections on CMOS ICs**: A. Morant
7. **Optical Losses in Photonic Crystal Waveguides, Induced by Contact Strips for Electrical Pumping**: Peter Kaspar
8. **Measuring the Time-of-Flight with an optical MEMS-modulator**: Joris Roels
9. **InP-membrane based photodetector for optical interconnections on Si**: P.R.A. Binetti
10. **High bandwidth InP-based 1.55 µm waveguide photodetector fabricated in an amplifier layer stack with active-passive integration**: L. Xu
11. **Design and simulation of movable micromirrors on silicon substrate**: Comanescu Florin Constantin
12. **Fabrication of polymer-based devices using nanoimprint technology**, Jie Teng
13. **Liquid crystal technology for wavelength tuning in SOI structures**: Wout De Cort
14. **Photonic Reservoir Computing: interconnected Semiconductor Optical Amplifiers**: Kristof Vandoorne
15. **Waveguide – grating photonic system analysis for sensor applications**: Roxana Ileana Rebigan
16. **Design Of A Monolithically Integrated All-Optical Label Swapper For Spectral Amplitude Code Labels Using Cross-Gain Modulation**: Christian Habib
17. **Combined Technologies: Photolithography and Electron Beam Lithography for RF Filters on GaN Development**: Herghelegiu Alexandru
18. **Deep dry-etched single-mode narrow waveguide for all-optical switches with InGaAs/AlAsSb quantum wells**: Ping Ma
19. **Assessment of mesh-interconnected integrated photonic switch circuits**: Aaron Albores Mejia
20. **SOI-based couplers for the transition from DPSK- to DQPSK-demodulators**: Karsten Voigt
21. **Adjustment of birefringence on Silicon-on-Insulator (SOI) by mechanical bending**: Georg Winzer
22. **Analysis of thermal crosstalk between DFB-laserdiodes on SOI**: B. Wohlfeil
23. **Towards optimization of Raman effect in SOI rib waveguides – compromise between linear loss and carrier lifetime**: Andrzej Gajda
24. **Bragg Gratings on SOI Rib Waveguides - A Comparison of Different Geometries**: Ivano Giuntoni
25. **Slow Light in Chalcogenide Photonic Crystals**: Marcel Spurny

Poster session II:

26. **A comparative study of compact electro-optic modulators based on 1D corrugated waveguide surrounded by Silicon dioxide**: Antoine Brimont
27. **Design and Fabrication of Apodised Crows on Silicon Nitride:** J.D. Domenech
28. **Silicon optical modulator:** Fengqiao Dong
29. **Large Integration Scale Circuits in SiON Technology:** Carlo Ferrari
30. **SOI photonic wires-based devices: sidewall roughness-induced losses and characterization:** Antonio Canciamilla
31. **InP Photonic Crystals bonded to SOI wires:** Yacine Halioua & Tim Karle
32. **Fabrication of photonic integrated circuits using high resolution CMOS fabrication process:** Shankar Kumar Selvaraja
33. **Silicon compatible laser based on colloidal quantum dots:** Bram De Geyter
34. **Al2O3:Er waveguide amplifiers for Si-technology compatible integrated optical applications:** L. Agazzi
35. **Label-free nanophotonic biosensors in silicon based on slot waveguides:** Tom Claes
36. **Design of an integrated electo-optically tunable filter for tunable laser purposes:** B.W. Tilma
37. **Sol-Gel Ormosil-on-Silicon Microphotonics:** Paulo Moreira
38. **10 Gb/s All-Optical Non-Inverted 1x4 Multi-Wavelength Conversion in a 1.55 μm QD-SOA:** J. Herrera
39. **Photonic Crystal Membrane Type Tunable Nanocavities in InP/InGaAsP:** Mehmet Ali Dundar
40. **Process Development for passive photonic circuits on BCB- bonded InP membranes on silicon:** F. Bordas
41. **Novel grating structures for dual-mode laser devices:** S. Ginestar
42. **Hybrid III-V/Silicon laser based on DVS-BCB die-to-wafer bonding:** Stevan Stankovic
43. **Fabrication of high brilliance diode lasers in the near-infrared wavelength range:** D. Feise
44. **The Nanostructuring Platform for Photonic Integration:** William Whelan Curtin
45. **Design of a reconfigurable optical interconnect for large-scale multiprocessor networks:** Iñigo Artundo
46. **Photonic crystal waveguides with ring-shaped holes on silicon-on-insulator:** A. Säynätjoki
47. **Towards optimizing photonic crystal cavities for Quantum Dot coupling:** Khaled Mnaymneh
48. **Quantum Confined Stark Effect (QCSE) Tuned Lasers:** Francesca Pozzi
49. **Multi-waveguide based collector array for the detection of backscattered light from highly scattering media:** N. Ismail
50. **Continuous wave InGaAsP/InP Fabry-Perot lasers on silicon:** Tiphaine Dupont