OMICS Group Conferences
Accelerating Scientific Discovery

International Conference and Exhibition on
Lasers, Optics & Photonics
October 07-09, 2013 Hilton San Antonio Airport, TX, USA

Novel material and device platform for ultra-compact reconfigurable integrated nanophotonic systems

Ali A. Eftekhar, Ali Adibi, Amir H. Atabaki, Qing Li, Payam Alipour and Zhixuan Xia
Georgia Institute of Technology, USA

The development of ultra-compact integrated nanophotonic structures for communications, sensing, and signal processing has been of great interest lately. The use of compact microresonators (e.g., microrings, racetracks, and microdisks) with high quality factors has resulted in order of magnitude reduction in the size of functional integrated photonic devices that used to be formed using waveguides. Such resonators can be effectively tuned using the free carrier dispersion and/or thermo-optic effect. This feature can be used to form reconfigurable photonic systems for on-chip signal processing and communications. Among existing substrates, silicon (Si) is the most promising one for infrared wavelengths due to the existence of excellent CMOS-based fabrication facilities. The same fabrication infrastructure can also be used to manufacture integrated nanophotonic structures in silicon nitride (SiN) for operation in visible and near-infrared wavelengths. With recent advances in the design and fabrication tools for photonic nanostructures, Si-based integrated photonic platforms are a strong candidate for the realization of ultra-compact functional photonic microchips for a wide range of applications including signal processing, communications, and sensing. However, some of the shortcomings of Si for the formation of low-loss structures at high operating powers (e.g., two-photon absorption, free-carrier absorption, and third-order nonlinearity) limit the maximum operation power in Si-based structures. This requires a new material platform that is CMOS-compatible but allows low-loss operation at higher power levels.

In this talk, we will present a new three-dimensional hybrid material platform based on vertical integration of different materials layers (e.g., Si and SiN layers). This new material platform is capable of addressing the main shortcomings of Si for practical applications. We will further introduce different new device architectures that are enabled by this new material platform. Finally, using the developed low-loss, fast, and low-power reconfigurable devices, we will discuss the realization of reconfigurable photonic chips for signal processing applications.

Biography

Ali A. Eftekhar is currently a research faculty at Georgia Institute of Technology. His current research includes the development of integrated photonic and acoustic material platform and device technology for signal processing and sensing applications. He has co-founded several start-up companies in the field of digital broadcasting, communication signal processing, and integrated photonics devices for spectroscopy and sensing applications. He has authored and co-authored more than 30 journal papers and more than 100 conference papers. He has received several awards including honorable mention diploma from 23rd international physics Olympiad 1992 and ECE research spotlight award from Georgia Tech in 2012.

eftekhar@gatech.edu