Advances in silicon photonics technologies and fiber optics applications

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The field of silicon photonics is rapidly expanding, similarly to electronics in the 1970s, and much of the knowledge of this mature platform is applicable to photonics. As in electronics, the need for reduced footprint and cost as well as large-scale production pushed for higher levels of integration in photonic devices. In this paper, we will focus on fiber optic communication applications for this technology. On one side, coherent technologies have spurred a revolution in optical core networks and are expected to conquer a large market share in metropolitan and inter-datacenter networks in the very near future; however, these segments are particularly sensitive to cost, and therefore to footprint and power consumption, while still requiring high transmission performance. In order to contain cost, several chips can be co-packaged in the optoelectronic transmitter. For example, in, co-packaged laser and modulator chips produced optical data at 32 GBaud; however, monolithic integration is expected to provide even greater cost savings than co-packaging. In fact, novel integrated transceivers have been recently proposed and are being commercially deployed. On the other side, on-chip optical interconnects require extremely low power and compact optical devices, which can be integrated closely with Integrated Circuits (ICs). Emerging silicon photonics technology has demonstrated low-power optical devices that can operate in combination with energy-efficient CMOS drivers and amplifiers. These crucial energy-efficient optical devices include micro-ring and micro-disk modulators with energy consumption on the order of fJ/bit, compact and reconfigurable Wavelength Division Multiplexing (WDM) filters with extremely low thermal tuning power, sub- milliwatt optical switches, and high-speed germanium Photodetectors (PDs) just to cite a few. In this paper, we review some of the key silicon photonic devices necessary to achieve integrated optical links for next generation optical fiber networks ranging from short reach to long-haul. The integration of laser sources, modulators, detectors and switches are discussed, as well as more advanced photonic integrated circuits composed of such building blocks, and their current commercial deployment.

Biography: Dr. Guilhem de Valicourt received his BSc degree in applied physics from the National Institute of applied Sciences (INSA), Toulouse, France, in 2008. From 2007 to 2008, he passed the Master of Science in Photonics Devices at Essex University, U.K. In 2008, he joined Alcatel-Thales-CEA III-V lab where he was working on design, fabrication, and characterization of Reflective SOA and directly modulated DFB lasers toward the Ph.D. In 2011 he joined Alcatel-Lucent in France as a research engineer on optical communication systems and in 2014, he joined Bell Labs USA, NJ 07733 Holmdel, USA. Since 2017, he is Principal at IPG photonics, USA, NJ. His main research interests are focused on design, characterization and applications of advanced integrated photonics devices (in InP, silicon and hybrid III-V on silicon platform). He has authored or co-authored more than 120 scientific papers in journals and international conferences, 4 book chapters and holds more than 25 patents. He received the 2011 Best project award from Alcatel-Lucent, the 2012 Marconi Young Scholar award, 2015 Harm Dorren Commemoration Award and was a finalist for the ParisTech Ph.D. prize in 2012.

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