

Densely Integrated Photonic Devices based on Microring Resonators in Access Networks

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ABSTRACT

The application of optical fibers has led to virtually lossless point to point data links in the core network with practically unlimited bandwidth. In response to increasing bandwidth demands of consumers the optical techniques employed in these networks are now gradually extended towards the consumers premises. At the access network level, where equipment is shared by a few users at the most, cost is the major issue. In addition the demand of optical transparency at the nodes and hubs, excluding conversion between the optical and electrical domains, results in a high degree of complexity of the devices. Fortunately, through the use of flexible WDM bandwidth allocation schemes that provide bandwidth where needed [1], and cheap mass-produced densely integrated optical components, the cost can be reduced significantly. Promising building blocks in these components are Microring Resonators (MRs) [2-4] built using high refractive index waveguides which can be used to create densely integrated wavelength filters as well as more complex functionality.

In this work we [5] present a 1x4 reconfigurable optical add-drop multiplexer (rOADM) [6] as well as a 1x4x4 reconfigurable wavelength router [7] in variants operating in the second and third telecom window. The devices, which can be used at bit rates up to 40 Gbit/s, have a footprint less than 2 mm² and are based on thermally tunable vertically coupled microring resonators fabricated in the high contrast ($\Delta n \approx 0.55$) Si₃N₄/SiO₂ materials system [8]. In addition to the presented devices a new polarization diversity scheme is proposed that solves the issue of polarization dependence behavior of microring resonators without the need of doubling the optical circuit.

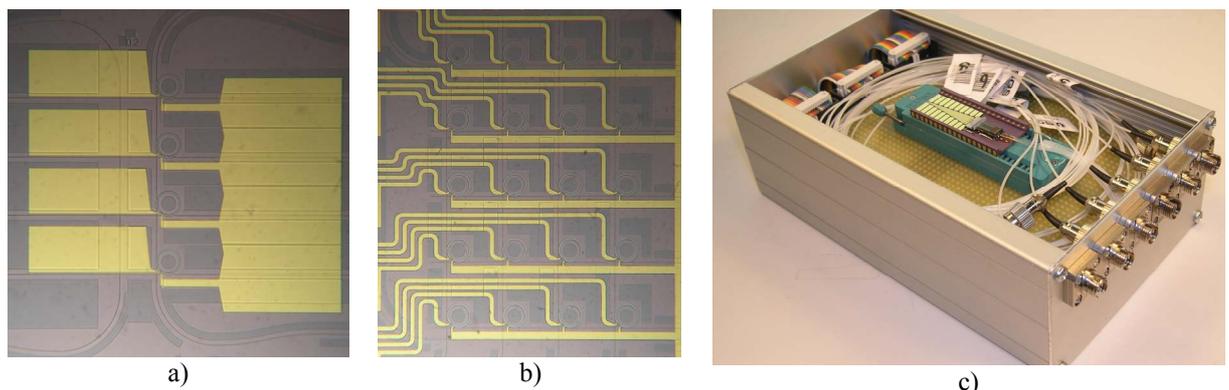


Figure 1. Realized rOADM a) and λ -router b) devices. After fabrication these have been packaged and put in a box with control electronics c) for easy characterization.

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