SiN/SOI Sub-dB Butt-Coupling Scheme in the O-Band

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***Abstract*—The monolithic integration of micro-metric silicon nitride and silicon-on-insulator platforms is presented. We demonstrate an interconnection of sub-dB coupling loss and less than -16dB back-reflection for operation in the O-band.**

I. Introduction

Despite the low cost high volume capabilities that silicon manufacturing infrastructure can offer, the exploitation of silicon photonic devices towards compact and power efficient optical interconnects has been restricted [1-2]. The realization of compact silicon-on-insulator (SOI) passive waveguides is already a mature process. On the contrary, the quantum confinement-based optical sources [3] and modulators [4], require thick buffer and cladding layers in order to alleviate the material discrepancies with the silicon substrate. Consequently, the monolithic interconnection between the sub-micron sized passive waveguides and the micron-thick active components is challenging.

Silicon nitride (SiN) can be a promising low-loss CMOS compatible solution for the interconnection problem mentioned above [5]. Its amorphous structure along with its low-temperature (<350 ºC) PECVD growth capability [6], render the back end of line (BEOL) integration achievable. Moreover, its low thermo-optic coefficient (10^{-5} $ºC^{-1}$) sets the ground for WDM functionalities, while the lack of two-photon absorption (TPA) at the telecommunication wavelengths allows the realization of non-linear applications [5].

A direct integration of SiN waveguides with the thick active components entails complexity in terms of fabrication. Thus, in this paper we propose a monolithic butt-coupling scheme between micrometric SiN and SOI waveguides as a proof of concept.

II. INTERCONNECTION CONCEPT

The integration was based on 1.25 μm thick N-rich SiN (n=1.9) and SOI waveguides. The silicon nitride was grown on SOI wafers as described in [5]. A Si-rich SiN (n=2.54) anti-reflective coating layer was used in order to mitigate the refractive index difference between the waveguides. Cut-back structures were used for the measurement of the interface coupling loss in the O-band (1260-1360 nm). The back-reflection level was estimated through the fitting of the measured and the simulated spectral response.

A cut-back measurement reveals an achievable <0.5 dB coupling loss at 1310nm for both TE and TM polarizations, as Fig. 1 shows.

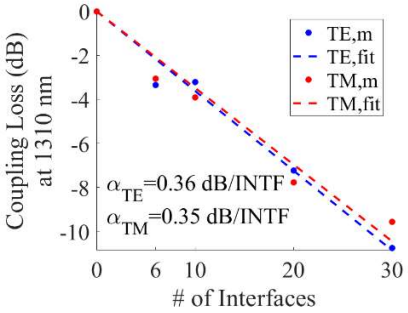

Fig. 1 Cut-back measurement of coupling loss per interface.

III. CONCLUSIONS

A temperature tolerant Si/SOI interconnection of low coupling loss is presented, towards the monolithic passive-active integration at the telecommunication wavelengths.

References

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