Investigation of Silicon Nanophotonic Single-Mode Polarization Insensitive Waveguides

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Silicon nanophotonic platform has been considered so far as the straightforward solution for the implementation of Photonic Integrated Circuits (PICs). The ability to turn light in a few μm allows the implementation of very dense design layouts with small footprint, while also providing compatibility with CMOS process. These features enable unpreceded advantages in terms of cost, size and performance compared to circuits assembled from discrete devices or based on other material platforms e.g. III-Vs. However the nanophotonic waveguides exhibit one major drawback related to the high polarization sensitivity of the propagating light.

Usuallydue to this problem, the PICs operate only in one polarization (TE) or if they want to support both polarizations, they are duplicating the number of components; one for each polarization state that results doubling of its footprint. Towards the simplification of SiP PICs, in this work we are examining configurations of single mode waveguides that exhibit very low polarization sensitivity by exploiting the deposition of a SiN layer on top of the Si core. The investigation is extended to two sidewall angles; 3^0 and 8^0 in accordance with experimental data, while the SiN layer is covering either only the core or the whole waveguide. For each of the four generic configurations the parameters under variation are the height and width of the waveguide and the height of the slab. The simulation results for each waveguide profile reveal its single mode conditionality in both polarizations and their effective refractive index difference (Δn_{eff}). The investigation demonstrates that there are at least sixteen set of parameters where the Δn_{eff} is lower than 10^{-2}, while there arealso three layout where Δn_{eff} is lower than $2x10^{-3}$. These results pave the way for the realization of polarizationinsensitive SiP PICs.This work is conducted in the frames of H2020 ICT L3 matrix project.