

Strain engineering of Pockels effect in silicon waveguides

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Silicon photonics is being considered as the future photonic platform, mainly for the reduction of photonic system costs and the increase of the number of functionalities on the same integrated chip by combining photonics and electronics. However, silicon is a centrosymmetric crystal, which inhibits Pockels effect: a second order nonlinear effect which allows for light modulation at speeds that are not limited by carriers and driven at very low power consumption. Nevertheless, this limitation can be overcome by straining the crystal lattice and breaking the crystal symmetry of silicon. This crystal modification is achieved by depositing a SiN high-stress overlayer.

Over the last few years, several researches have been performed exploring Pockels effect in strained silicon. In this work, we present recent developments on the subject taking into account parasitic effects including plasma dispersion effect and fixed charge effect under an electric field. We theoretically and experimentally demonstrated Pockels effect in silicon waveguides strained by a SiN overlayer.