Direct observation of surface mode excitation and slow light coupling in photonic crystal waveguides

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Nanostructured materials with sufficiently strong periodic modulation of the refractive index behave towards light as semiconductors do towards electrons, forbidding the propagation of light within a range of frequencies residing in the so-called photonic band gap (PBG) [1]. The PBG materials, also called photonic crystals (PhCs), possess many interesting physical properties. For instance, by introducing point and/or line defects in PhCs, light can be localized [2] in and guided [3] along the defects, opening a way to realization of highly integrated optical circuits.

Using the collection SNOM, we have experimentally investigated the properties of guided modes in silicon-on-insulator (SOI)-based photonic crystal waveguides (PhCWs) with different terminations of the photonic lattice in the linear and slow-light regimes. High quality SNOM images are obtained for light at telecom wavelengths propagating in the PhCWs, demonstrating *directly*, for the first time to our knowledge, drastic widening of the PhCW guided mode in the slow-light regime and excitation of surface waves at the PhCW interface along with their feeding into the guided mode for the lattice terminations corresponding to significantly reduced coupling loss.

References:

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