Nanooptics and nanophotonics

Oxidation as a factor affecting range and sensitivity of a photonic crystal device

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The multicomponent comb-like nanophotonic structures like shown in Fig.1 may be of interest for optical technologies due to their more extensive set of useful properties as compared to binary analogues. In particular, the omnidirectional mirrors have wide application in various optical technologies. Besides, optical filters, optical resonators, all-optical logic gate platforms and many others important applications of silicon based photonic structures attract the attention of investigators to seek efficient ways to fabricate structures with predicted properties. Therefore the intrinsic optical contrast may be considered as a useful technological property of an optical system. The ability of a complicated photonic structure to create well expressed gaps in spectrum may be connected with optical contrast between constituents of a multi component system. In [1], a general expression for the internal optical contrastivity determined over the frequency range of optical transparency in a view of a ratio gaps/(gaps+bands) was proposed. The advantage of this definition is that it may be used for systems of any complexity. Here, we study theoretically the influence of oxidation and others factors on the optical properties of a three-component comb-like layered structure grown on silicon substrate. It is shown that oxidation and temperature can play a role of a technological mechanism to control the needed positions of bands and gaps.

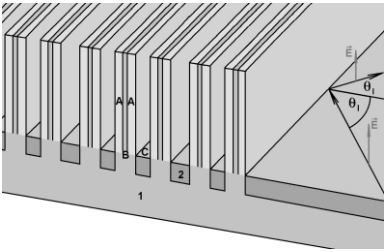

Fig. 1: (A three component $(A/B/A/C)^{N-1}(A/B/A)$ photonic crystal resonator as a part of a logic gate. 1, silicon substrate; 2, protective anti-oxidizing layer, C, air voids, A, oxide layer, B, matrix material layer; θ_l , angle of incidence of the external s-polarized plane wave.

1. E.Ya. Glushko, Opt. Commun. 285 3133-3139 (2012).