

International Conference on

NANOTECHNOLOGY AND NANOENGINEERING

July 16-18, 2018 | Paris, France

Two different beam deflection mechanisms together with unidirectionality in photonic structures without corrugations under oblique incidence

Colak E¹, Serebryannikov AE², Magath T³ and Ozbay E⁴

¹Ankara University, Turkey

²Adam Mickiewicz University, Poland

³European Technology Center, Germany

⁴Bilkent University, Turkey

Single beam deflection and unidirectionality are observed in a photonic crystal (PC) without surface corrugations, employing a defect layer, even if the defect layer is deeply buried. Two types of deflection is observed. In the first, Floquet-Bloch modes enable 0th order coupling. When 0th order is blocked, diffractions cause blazing and evanescent waves deliver energy to higher order diffraction modes. Without surface corrugations transmission value $T \approx 0.97$ is achieved due to diffraction order $m = -1$. Utilizing an extra line defect, T increases upto 0.99, even if the line defect layer is deeply embedded in PC.

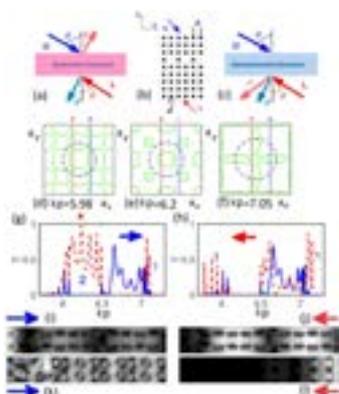


Fig. 1. (a) Symmetric structure with upper- (U) and lower-side (L) illumination, (b) PC nonsymmetric structure (three periods over x are shown) and schematics showing scenarios of ideal single-beam deflection in (c) nonsymmetric structure with simultaneous transmission and reflection processes, respectively. Equifrequency contours in (k_x, k_y) plane for the regular infinite PC with $d/a=0.4$, $\epsilon=11.4$ (solid) and air (dashed-dotted) at (d) $k_p=5.98$, (e) $k_p=6.2$, and (f) $k_L=7.05$ for $\theta=45^\circ$. + and - indicate the cases when coupling is possible or not, respectively, for $m=0$ and for $m=-1$ at period $p=2a$; Construction lines (vertical dashed lines) correspond to the orders $m=0$ (right blue) and $m=-1$ at $p=2a$ (left red lines), respectively; k_x and k_y vary from $-2\pi/a$ to $2\pi/a$ in all plots. Transmittance vs k_p with defect being 2nd layer from the upper interface; $d/a=0.4$, $\epsilon=11.4$; t_0 (solid blue), in (g) dashed red line, in (h) dashed red line. Electric field distribution within one period over x ($0 < x < p$, at $0 < y < 12a$, for $d/a=0.4$, $\epsilon=11.4$; U- and L-illumination are indicated by blue and red arrows, respectively; (i) and (j) are the field profiles (0th order is coupled) at $k_p= 5.78$ for upper and lower side illumination, respectively; (k) and (l) are the field profiles (0th order is not coupled) at $k_p= 6.23$ for upper and lower side illumination, respectively.

Biography

Evrin Colak earned his PhD from the Electrical and Electronics Engineering Department of Bilkent University, Ankara, Turkey in 2012. His research interests cover Metamaterials, Photonic Crystals, Microwave, RF Circuits, Photonics, Optics, computational electromagnetics and Biomedical applications. He is a faculty member in Electrical and Electronics Engineering Department, Ankara University, Ankara, Turkey. He has published 20 papers in SCI and SCIE journals.

ecolak@ankara.edu.tr

Notes: