INVESTIGATION ELECTRIC-FIELD TUNABILITY OF MICROWAVE PHOTONIC CRYSTAL BASED ON A WIDTH MODULATED SLOT-LINE

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Nowadays an increased interest for theoretical and experimental investigations of artificial periodic waveguide structures is evident. These structures divided on photonic crystals (PCs) for electromagnetic waves (EMWs) [1], magnonic crystals for the spin waves [2], plasmonic crystals for plasmons [3], polaritonic crystals for polaritons [4], and phononic crystals for acoustic waves [5]. The main features of such structures as opposed to regular ones is the formation of a band structure with band gaps in the wave spectra. The advantages of the PCs based on a ferroelectrics are possibility of smooth and continuous tuning of operation characteristics with application of the electric field.

One of the ways to produce a planar PC based on a ferroelectric film is periodical variation of the slot-line gap width. Advantages of slot transmission line are planar technology and minimization of control voltage in contrast to bulk structures. Therefore, this work reports theoretical investigations and numerical calculations of dispersion characteristics and frequency response of the microwave PC based on a slot transmission line with width modulation. Dispersion relations of EMWs in the investigated PCs were obtained by coupled-mode approach. Frequency response was calculated according to the transfer-matrix method. Formation of band gaps in the frequency response was demonstrated. Influence of different geometrical and physical properties of microwave PCs at frequency response and band gap position was analyzed. Electrical tuning range of dispersion and transmission characteristics was investigated at different structure parameters. For example, it was shown that application of bias voltage of 100 V leads to the shift of the band gaps toward several hundreds MHz.

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