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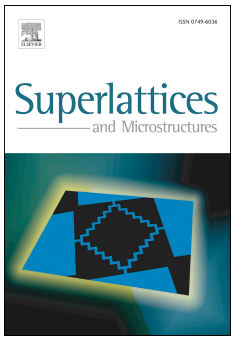


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# Photonic spectra of a Bragg microresonator with a ferroelectric resonator layer

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**Abstract**

Transmission spectra of a photonic crystal resonator structure have been obtained where the Bragg dielectric mirrors contain a finite number of periods with an inverted order of layers and the resonator layer is made of a ferroelectric with a permittivity many times exceeding the permittivity of the layers in Bragg mirrors. Almost a complete transmission suppression was detected not only in the photonic band gap (except for a narrow region of the defect mode), but also outside the forbidden band.

*Keywords:* photonic crystal, layered periodic structure, defect mode, photonic band gap

## 1. Introduction.

In recent years, one-dimensional photonic crystals (PC) and microresonators on their basis have attracted close attention of the researchers. This is associated with wide possibilities of their practical use in creation of numerous devices to control electromagnetic radiation of various ranges [1, 2, 3]. Photonic crystals, in which the period of spatial modulation of material parameters is commensurable with the wavelength of the radiation propagating in them, are of a particular interest. In such structures, the effects associated with the presence in the transmission spectra of photonic band gaps are detected [4, 5].

With violation of periodicity, i.e. when one or more defects are introduced into the structure, it becomes possible to localize propagating radiation in so-called defective modes with frequencies lying in the zones of nontransmission of a defect-free structure. For many practical applications, an important task is the predicted rearrangement of the photon spectrum, which, first of all, is related to the correct choice of the layer material and the defect created in the structure. To create a symmetric Bragg microresonator, it is required to form two imperfections in the center of a defect-free periodic structure those of interstitial and inversion [5, 6]. In this case, the interstitial layer located between the dielectric Bragg mirrors fulfils the microresonators functions. For this layer, as a rule, an active material is selected, whose state can be controlled by means of external fields, temperature and wave intensity [7, 8, 9, 10].

In this paper, we are studying the transmission spectrum features of a Bragg microresonator, in which a ferroelectric layer in the paraelectric phase is used as a resonator. In the frequency range under consideration, for a ferroelectric, high permittivity values are assumed to be many times greater than the permittivity of the layers in Bragg mirrors. Since the permittivity of the ferroelectric depends on the external electric field and temperature [11, 12, 13], they can help to effectively control position and width of the photonic band gaps and the defect mode, i.e. the spectrum of transmission and reflection of the PC as a whole.

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