One-dimentional Photonic Crystals Based on Porous Anodic Aluminum Oxide Films

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Abstract— One-dimensional photonic crystals based on porous anodic aluminum oxide films have been prepared by anodization under square wave changing current density, as described elsewhere [1]. The transmission and reflection spectra of the obtained samples have been recorded in the visible and UV spectral regions [2]. The angular dependencies of the spectral positions of photonic band gaps have been analyzed. It has been shown, that the maximum reflectance in the first stop band varies slightly from point to point on sample surface and reaches 95% for some of them. Using the model of infinite periodic structure a law of electromagnetic wave dispersion has been calculated theoretically for the samples under study. The validity of the models with infinite and finite numbers of layers for the calculation of reflectance spectra in the vicinity of the first optical stop band is discussed. The calculations make it possible to evaluate the optical contrast and the porosity of synthesized periodic structures [2].

Different applications of one dimensional photonic crystal films in sensing of aqueous-organic solutions and for laser generation are considered. Experimental data on the photonic stop band shift for the films infiltrated with different mixtures of water and ethanol and of water and glycerol are presented.

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