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Microwave properties of one-dimensional hybrid quasi-periodic multilayered photonic structure

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This work presents the results of modeling of microwave transmission properties at normal incidence for the shields designed as one-dimensional quasi-periodic multilayered photonic structure in frequency ranges of 26 – 37.5 and 37.5 – 54 GHz. The simulation of the transmission and reflection indexes was performed in C++ and Wolfram Mathematica environments using the impedance method.

The transmission spectra through the periodic multilayer structure show a stacking band gap. The number of such band gaps can be controlled by varying the number and parameters of layers (type 1 and type 2), namely the complex permittivity * and the layer thickness. Fig. 1 presents the transmission spectra for multi-layered periodic structure consisting of 10 layers: 5 layers of type 1 ($'$=2.9, tan=0, l=5mm) and 5 layers of type 2 (polymer layers filled with carbon nanotubes or graphite nanoplatelets, $'$=20, $\tan_e$=0.003, l=1.1mm). It was found that the insertion of the defects into the quasi-periodic multilayer photonic crystals can lead to distortion of the transmission spectrum. So, as it is seen from Fig. 1, the substitution of one layer of type 2 by magnetic layer (composite layers filled with Fe_3O_4, or BaM, or Co) causes the arising in transmission spectrum of the defect mode which is very sensitive to the parameters of the defect layer.

Fig. 1. EMR transmission index for periodic quasi-photonic structure

Thus by increasing these photonic band gaps, we can obtain high reflection or absorption indexes, necessary for technological applications in devices, capable of storing, guiding and filtering microwaves.