ELS-XV-2015 Abstracts
ELS-XV-2015-140
Electromagnetic & Light Scattering XV 2015, Leipzig
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Modulation of Defect Modes Intensity by Controlled Light Scattering in Photonic Crystal with Liquid Crystal Domain Structure

V.A. Gunyakov (2), M.N. Krakhalev (2), V.Ya. Zyryanov (2), V.F. Shabanov (2), and V.A. Loiko (1)

(1) Stepanov Institute of physics of NAS of Belarus, Minsk, Belarus (loiko@dragon.bas-net.by), (2) Kirensky Institute of Physics, Krasnoyarsk Scientific Center, Siberian Branch of Russian Academy of Sciences, Krasnoyarsk 660036, Russia

Recently, the defect modes behavior associated with a light scattering effects in photonic crystals (PC) comprising the optically inhomogeneous components has attracted some interest [1,2]. Optical inhomogeneity entered in a nematic liquid crystal (LC) by the electroconvective instability [3] is accompanied by intensive light scattering and can be also used to implement the defect modes control in a photonic structure with LC layer.
In this study, we demonstrate the possibility of modulation of defect modes intensity in a multilayer PC due to electro-optic effect of dynamic light scattering inside nematic LC inserted as a central layer in PC structure. To design the PC/LC cell two multilayer ZrO_2/SiO_2 mirrors was used. The 10 mkm gap between mirrors was filled with the planar aligned nematic LC. Optical responses of the PC structure with the liquid-crystalline electroconvective patterns for the differently polarized components of the transmitted light are considerably different. The transmission spectrum for the light polarized orthogonally to the substrate director n is relatively stable to the convective process while parallel-polarized light component is effectively scattered passing through the sample. For the 2D domain grid pattern at low-frequency, the continuous variation of the defect modes amplitude from maximum to approximately zero occurs due to changes of the angle between the n vector and the polarization of light incident normally at the sample.

References

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