Nanooptics and photonics

Enhanced nonlinear-optical response in hybrid liquid crystal cells based on photonic crystalline substrates

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Photorefractive hybrid liquid crystal cells were prepared, which included nonuniform substrates comprising photonic crystals with periodic structures of different types. Nonlinear-optical response is studied by means of dynamic holographic technique [1]. After dc voltage application, a dynamic diffraction grating was induced in the cell with many diffraction orders appearing (see Figure).

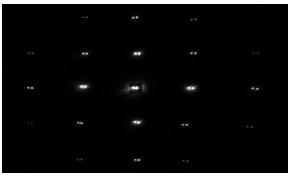
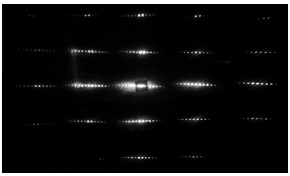
(a)  (b) 

Figure. Self-diffraction in hybrid nonlinear LC cell at the Raman-Nath regime: (a) no field; (b) at application of dc electric field to cell.

A developed theoretical model allows one to calculate nonlinear optical characteristics of thin nonlinear films from the two-wave mixing experiment with the consideration of large losses of light intensity on the absorption and/or scattering. The hybrid cells demonstrate strong nonlinear optical response, prospective for many applications in electro-optical micro-systems, such as SLMs or in cells controlling the spatial solitons. Moreover, the wave-mixing with such nonlinear cells may be successfully implemented in multichannel systems, namely in multi-channel couplers, switches and optical communication lines.

1. Bugaychuk S., Lytvynenko O., Kravchuk R., Slussarenko S., Pinchuk V., Iljin A., Yaroshchuk O., Karachevtseva L. Nonlinear-optical liquid crystal cells based on microstructured substrates // Submitted to Liquid Crystals -2016.