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Fabrication of two-dimensional elliptic photonic lattices in photorefractive crystal by optical induction method

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Abstract We fabricate two-dimensional elliptic photonic lattices in iron-doped lithium niobate photorefractive crystal for the first time with optical induction method. The experimental setup of our method is very simple and flexible without complicated optical adjustment system. We analyze and verify the two-dimensional elliptic photonic lattices by plane wave guiding, far field diffraction pattern imaging, and Brillouin-zone spectroscopy. Induced elliptic photonic lattices can stably exist for a long time in the iron-doped lithium niobate crystal. The induced two-dimensional elliptic photonic lattices might offer an easy method to study generic band gap phenomena in anisotropic periodic structures.

Keywords Optically induced · Two-dimensional · Elliptic · Photonic lattices · Photorefractive · Lithium niobate crystal

1 Introduction

Nonlinear periodic micro/nanostructures have become the subject of extensive research for several years now, holding great possibilities for diverse applications in photonics (Blanco et al. 2000; Smirnov et al. 2006; Edelmann and Helfert 2009). Photonic lattices are artificial microstructures materials in which the dielectric constant is periodically modulated on a length scale comparable to the desired wavelength of operation. The propagation of electromagnetic waves can be forbidden for all wave vectors in a certain range of frequencies if there is a full band gap in the photonic lattices. They offer new possibilities to route, control, and steer light in all-optical information processing and micro/nano-photonics devices (Yu et al. 2007; Guo et al. 2011; Zhang et al. 2012).

Fabrication of photonic microstructures has always been of great interest (Sato et al. 2002; Subramania and Lin 2004; Mizeikis et al. 2004). The optical induction technique is a conve-

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