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Using a Dual-beam Multiple Exposure Technique, Photonic Crystals with Gaps Created

Carole Balding*

Department of Electrical Engineering, University of California, USA

Editorial

We offer a method for creating intricate 2D and 3D bandgap template structures in a photosensitive material using a dual beam multiple exposure setup. The system parameters relating to the sample's reorientation effect in relation to these planes and the planar interference pattern created by the two laser beams are discussed. Photonic crystal forms, including the 3-dimensional and 2-dimensional square and hexagonal arrays of dielectric "rods" and "holes." Similar to how semiconductor materials exhibit a band gap for electrons, artificially made structures known as photonic crystals can exhibit a band gap for photons. The optical designer now has a new production process for creating the optical gadgets of the future thanks to photonic band gap materials. There have previously been demonstrations of a number of device designs, including micro-optical circuits, lasers [1].

The photonic crystal with a full band gap is often a structure with great translational symmetry and dielectric contrast. Defect states that can be seen in the optical band gap are caused by flaws in the optical crystal. These imperfections can be set up to confine light to follow waveguides with sharp bends as in integrated optic devices or to offer wave guiding in a low dielectric region as utilised in the design of numerous band gap fibre architectures [2]. Studies and research findings suggest that photonic band gaps can be seen in quasi-periodic dielectric structures in addition to the work being done in translationally periodic photonic crystals. Early research has demonstrated that photonic band gaps are seen for stacked multi-layer dielectrics.

Complete photonic band gaps have recently been discovered in a number of quasi-periodic systems where the rotational symmetry revolves around a pattern centre. The rotationally symmetric quasi-crystals lack the long range translational symmetry typically associated with photonic crystals, suggesting that the band gap may be related to a more short range ordering of the dielectric material [3]. The isotropy of the band gap is more uniform with respect to the angle of propagation and the level of dielectric contrast can be relaxed to some extent in photonic quasi-crystal structures, which have primarily been 2D arrays of rods arranged with the N-fold rotational symmetry. Rods are used in the pattern can be attributed to the fact that photonic crystal properties scale with the lattice constant, and early measurements taken in the microwave region on rod type structured arrays can be used to confirm, or at least support, theoretical predictions of the optical properties of photonic quasi-crystals created for the various optical wavelengths of communication interest.

We theoretically investigate the 12-fold rotationally symmetric quasi-crystal patterns that a dual beam multiple exposure holographic lithography system is capable of producing. By using this method, the geometry of the high- or low-electricity zones can diverge significantly from the conventional rods and circular holes used in earlier quasi-crystal patterns. Recent research has demonstrated that dual beam quasi-crystal patterns can be directly written to a scale appropriate for communication frequencies on an e-beam resist coated substrate [4]. The dual beam method can be used to create 12-fold quasi-crystal formations. a computer programme that was used to conceptually analyse the quasi-crystal patterns. Defects are introduced into the quasi-crystal pattern and many quasi-crystal devices in the last portion.

We have demonstrated the polarised 2D structure's optical guiding and transmission characteristics [5]. It is simple to write the patterns based on fill-factor and dielectric contrast utilising optical holographic lithography or standard e-beam methods. It includes a propagation that is largely angle independent but placement dependent in relation to the quasi-crystal pattern's centre, among other intriguing waveguide qualities. The optical and waveguide characteristics of suggest that novel and intriguing device designs might be created.

Conflict of Interest

None.

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***Address for Correspondence:** Carole Balding, Department of Electrical Engineering, University of California, USA; E-mail: carolebalding@gmail.com*

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