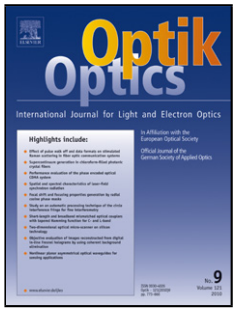

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Temperature dependence of defect mode in band structures of the one-dimensional photonic crystal

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Abstract

Using the plane wave expansion method the effect of temperature variation and the thickness of the defect in a one-dimensional photonic crystal consisting of alternate layers of silicon and air, in the band structures has been investigated. The refractive index of silicon layers is taken as a function of temperature and wavelength. It is found that there exists defect mode within the forbidden frequency gap in the band structures. It is shown that increasing the temperature originates a defect mode shift in the band structure at low frequencies due to contrast increase of the refractive index.

Keywords: Photonic crystal, defect mode, plane wave expansion method.

1. Introduction

In 1987 two works were independently published which mark the birth of what is known today as photonic crystals (PC) [1,2]. The PCs represent a new class of artificial optic materials having a simple functionality principle, dielectric constant periodicity. This type of materials are called as light semiconductors, which light always finds some direction by which it can be propagate. Analogously, as in an atomic crystal, wherein constructive interference between electronic waves originates allowed electronic states such as conductive or valence bands, and destructive interference originates forbidden electronic states. In PCs, photons experiment multiple dispersions, the constructive interference originates allowed bands or states and the destructive interference originates forbidden photonic bands in which no light mode