



Iranian Journal of Physics Research, Vol. 17, No. 4, 2017

Band structure and thermal emission of two dimensional silicon photonic crystal

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(Received 16 March 2016 ; in final form 15 February 2017)

Abstract

In this research, we have studied the band structure, optical properties and thermal emission spectrum of 2D silicon photonic crystal with hexagonal structure. The band structure, band gap map and the band gap size have been calculated by plane wave expansion method in terms of radius. The maximum band gap size of TE and TM polarization, and the complete gap size are 51%, 20% and 17% at air hole radii of $r=0.43a$, $0.50a$ and $r=0.48a$, respectively. The thermal emission spectrum has been calculated by Finite Difference Time Domain (FDTD) method and Kirchhoff's Law in the range of 1 to 10 μm . The obtained results show that by adjusting the geometric parameters, one can engineer the band structure, and the thermal emission spectrum of 2D silicon photonic crystal can be controlled in a manner that can be used in thermophotovoltaic systems.

Keywords: silicon photonic crystal, band structure, band gap, optical properties, thermal emission

For full article, refer to the Persian section