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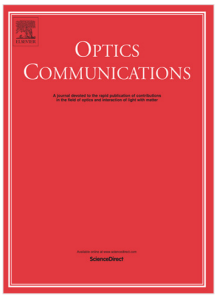

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Yadollah Shahamat, Mohammad Vahedi

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Mid-infrared Plasmonically Induced Absorption and Transparency in a Si-based Structure for Temperature Sensing and Switching Applications

Yadollah Shahamat, Mohammad Vahedi*

School of Physics, Iran University of Science and Technology, Tehran, Iran

*mvahedi@iust.ac.ir

Abstract: In this paper, a novel silicon-based integrated structure is proposed for plasmon-induced transparency (PIT) and plasmon-induced absorption (PIA) in the mid-infrared (MIR) band. The device consists of a semiconductor-insulator-semiconductor (SIS) plasmonic bus waveguide coupled to three rectangular nano-cavities. The transmission properties of the structure are numerically simulated by finite-difference time-domain (FDTD) method. The wavelengths of the PIA and PIT peaks can be simply tuned by adjusting the geometrical parameters of the device. It is shown that the proposed structure can be used either as a temperature sensor with the sensitivity of 1.48 nm/°C or as a plasmonic switch operating in the MIR range with the transmission of 83% and modulation depth (MD) of 20.74 dB. The proposed multifunctional device has potential applications for photonic switching and lab-on-a-chip applications in the MIR band.

Keywords: Surface plasmon polariton (SPP), Temperature sensor, Switch, FDTD, Nanocavity.

0. Introduction

Surface plasmon polariton (SPP) waves are among the most promising solutions for manipulating light in sub-wavelength scales since they could overcome the diffraction limit of light [1]. So far, varieties of SPP-based devices have been realized and parameters regarding their performance have been investigated [2-12].

Also, with the emergence of various applications in the MIR band, such as health-related fields, sensing, and industrial applications, the design of devices operating in this spectrum

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