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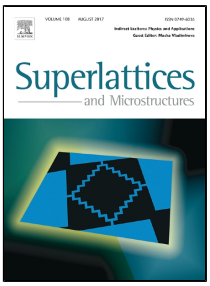

Low-threshold ultrafast all-optical switch implemented with metallic nanoshells in the photonic crystal ring resonator

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Low-threshold ultrafast all-optical switch implemented with metallic nanoshells in the photonic crystal ring resonator

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Abstract

An all-optical switch based on nonlinear photonic crystal ring resonator embedded with silica dielectric surrounded by silver nanoshell (NS) inside the ring resonator has been introduced and analyzed in this article. We considered silica with radius of 10 nm and silver with radius of 16 nm as core and shell, respectively. By placing NSs inside the photonic crystal ring resonator, we succeeded in reducing the threshold power to 12.8 mW/μm^2 and the switching time to about 0.4 ps. The results of this research suggest a new technique for reducing switching light intensity. With small size, ultra-fast switching time, and low-threshold power, the structure has the potential to be applied in optical integration circuits and nanoscale optical chips.

Keywords: nonlinear Kerr effect, photonic crystals, plasmonics, nanoshell (NS), switch.

1. Introduction

All-optical ultrafast devices using nonlinear photonic crystal have been in popular interest. Significant interest in the possibility of using nonlinear photonic crystal devices such as add-drop filters [1, 2], logic gates [3, 4], slow light waveguide [5], sensor [6], demultiplexer [7], and all-optical switching [8–11], for optical signal processing and optical communication systems is being seen. Among these applications, all-optical switches have been considered as a key component for signal processing in photonic integrated circuits. One of the important