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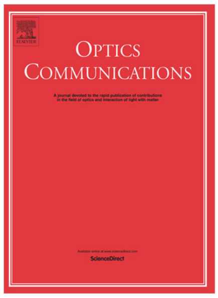

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Full telecomband covered half-wave meta-reflectarray for efficient circular polarization conversion

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Abstract

We report a full telecomband covered half-wave meta-reflectarray for efficient circular polarization conversion at near-infrared frequencies, which is composed of regular Z-shaped antenna array above a conductive ground layer separated with a dielectric spacer. The calculations of polarization conversion spectra demonstrate the ultra-broadband operation at 690 to 2010 nm continuously covering the whole telecom windows, with more than 90% conversion efficiency in full bandwidth. The relative bandwidth of as high as 98% is far higher than those reported previously never exceeding 50%. Sufficiently high conversion efficiencies of beyond 90% can be steadily performed for either left- or right-handed circular polarization incidence. The underlying mechanism is interpreted through the cross-coupling of multiple intrinsic resonances of meta-atoms. The effects of geometry and oblique incidence on the polarization conversion are discussed, showing the acceptable technical tolerance and wide operating angle. The proposed half-wave meta-reflectarray shows promising application in the field of on-chip integrated spin-based logic devices and optical communications.

Keywords: polarization, metamaterial, surface plasmons, subwavelength structures

1. Introduction

Polarization is an unique key property of electromagnetic waves. The ability to manipulate the polarization state holds great promise for development of advanced photonic devices [1,2]. By exploiting the polarization of light, novel photonic functionalities can be constructed in new principles to perform spin-based logic computing, ultrafast optical switching and optical encryption [2-5]. The conventional method of controlling optical polarization is to use optical active materials involving birefringent crystals and liquid crystals. By gradually accumulating phase delays during light propagation in space, various output polarization states can be achievable depending on the geometric