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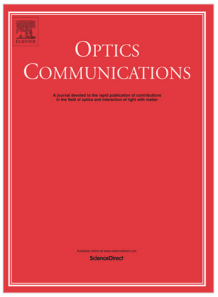

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Design of a polarization-insensitive triple-band metamaterial absorber

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Abstract

A polarization-insensitive triple-band metamaterial absorber (MMA) is proposed in this paper. It is composed of three-layer structure: metal - dielectric –metal. The top metal layer is consisted of two close ring resonators. The outer is a square ring resonator and the inner is a circular ring resonator, the two ring resonators have a common center. A commercial software CST Microwave Studio (CST MWS) is used to investigate the MMA. The simulation result shows that the MMA has three absorption peaks at 3.70GHz, 6.57GHz and 17.62GHz, with absorption rate of 99.67%, 99.05% and 99.98%, respectively. The electric field, magnetic field and surface current distribution of the MMA are given to study its absorption mechanism. The polarization-insensitivity of the absorber is also analyzed. Moreover, the effects of line width and thickness of dielectric layer on absorption are discussed. Because of its excellent absorption performance and simple structure, the triple-band MMA has potential applications in many fields, such as radar stealth, thermal radiometer, spectral imaging and so on.

Key words: metamaterial absorber, microwave, triple-band, polarization-insensitive

1. Introduction

Metamaterial is a composite material with a subwavelength structure which has extraordinary physical properties that are not found in natural materials, such as negative refractive index [1-2]. One of the most notable applications of metamaterials is the MMAs, which can achieve a 100% absorption rate in theory. The arbitrary permittivity and permeability can be obtained by the design of the size and structure of the metamaterial array unit. Therefore, metamaterial structure has become an ideal material for the manufacture of electromagnetic wave absorbers. In 2008, Landy et al. [3] first proposed an MMA, which has a near unit of absorbance. Subsequently, the MMAs have been extensively studied worldwide during the past years. So far, the absorption spectrum of the designed MMAs have covered microwave [3-5], terahertz