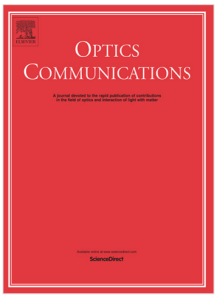

A convenient photopolarimeter based on a polarization sensitive metamaterial

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A convenient photopolarimeter based on a polarization sensitive metamaterial

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Abstract

The microstructure, simulation, mechanism, and measurement of a convenient photopolarimeter based on a polarization sensitive metamaterial are presented in this paper. The absorptivity of the metamaterial photopolarmeter (MP) is innovatively used to describe and reflect the polarization of the incident electromagnetic waves (EMWs). The MP sandwich microstructures are periodic asymmetric microstructure on the metasurface, a flame retardant 4 (FR4) interlayer, and a continuous copper film on the substrate. Both the full wave electromagnetic simulation and the measurement on the fabricated MP are performed to examine the absorption performance for oblique incident EMWs with different polarizations. The absorptivity caused by polarizations is 99.88% that is a key index to represents the polarization detection sensitivity and precision. The distributions of the electromagnetic fields are demonstrated to explore the physical mechanism of polarization sensitivity. Moreover, the operating range can be easily customized by modifying its microstructures and components. The proposed MP has distinctive merits that the conventional polarization detection and analysis systems do not possess, such as strong detectability, simple structure, mature process, strong flexibility, and ultrathin thickness.

Key words: polarization; metamaterial; microstructure; absorptivity; resonance.

1. Introduction

The polarization of electromagnetic waves (EMWs) is usually defined as the transversal vibration of its electric vector. Just as amplitude, and phase, polarization is one of the basic parameters describing the characteristics of EMWs. Polarization can reflect substantial information of the emitting sources and the measured objects. Thus, it is important for many scientific and engineering applications, such as optical measurement, secret communication, target recognition, biomedical, remote sensing, environmental monitoring, astronomical exploration, machine vision, virtual reality, augmented reality, and quantum computation [1-8]. The conventional