

Transparent Wideband Absorber Based on Narrow Pattern

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Introduction

This paper presents an optical transparent wide band absorber. The absorber consists of three parts. The top layer is made of a very narrow grooved metal square ring, the middle layer is made of a transparent dielectric substrate, and the bottom layer is made of a hexagonal metal grid structure. The simulation results show that the absorber performs well in the range of 8.0GHz to 20.5GHz, and the absorptivity is more than 90%. In addition, the absorber adopts a centrally symmetric structure, which is insensitive to polarization angle and maintains a high absorption rate at oblique incidence.

Working Mechanism

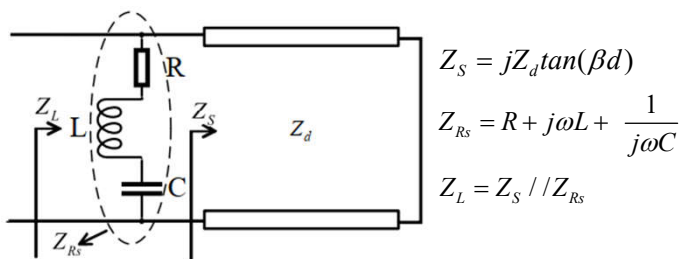


Fig. 2. Equivalent circuit model of the absorber.

The hexagonal underlying structure can be approximately equivalent to the PEC. Z_{R_s} can be represented by an equivalent model of an RLC series circuit. When the real part of the impedance Z_L is close to the free-space wave impedance in a broadband range and the imaginary part is close to zero, the absorber can achieve good absorption performance in this range.

Structure Design

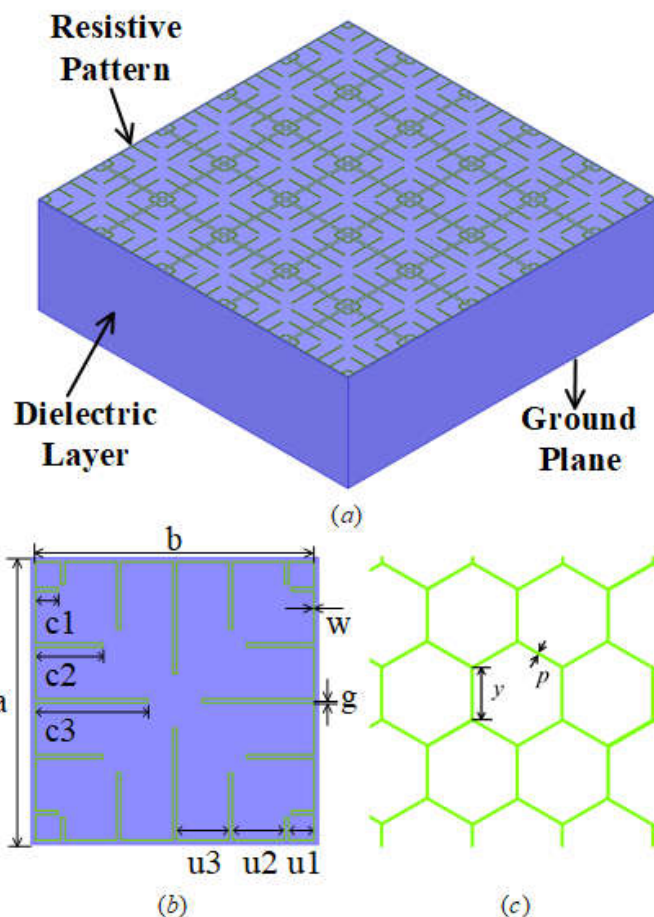


Fig. 1. (a) Structure of the proposed absorber. (b) top view. (c) bottom view.

Results

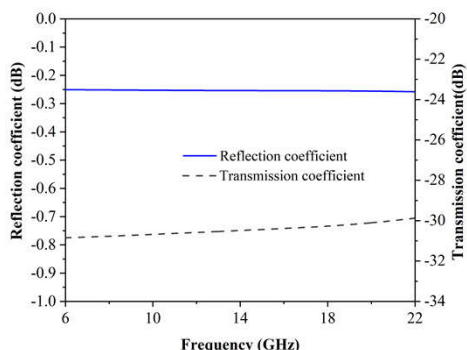


Fig. 3. Simulation results of bottom hexagon structure.

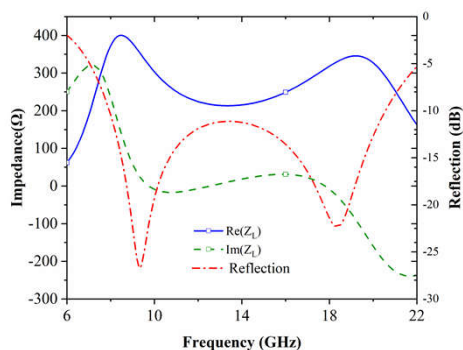


Fig. 4. Absorber impedance and reflection coefficient.

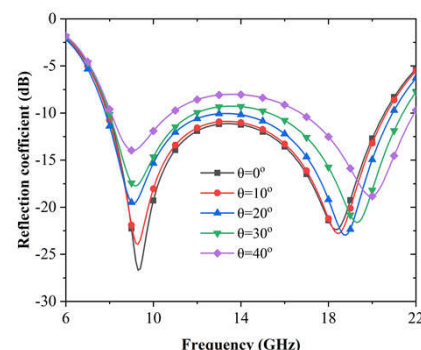


Fig. 5. Reflection coefficient at different incident angles.

In the frequency band from 6GHz to 22GHz, the reflection coefficient of the bottom hexagonal structure to the electromagnetic wave are all greater than -0.27dB. The absorber has two absorption peak points at 9.3GHz and 18.4GHz respectively. The imaginary part of the impedance of the absorber corresponding to these two peak points is close to 0, and the real part is close to the free space wave impedance. Because the structure of the absorber is centrally symmetric, it is insensitive to the incident waves with different polarization angles. when the incident wave is oblique incident at 0° - 30° , the broadband absorption range from 7.8GHz to 21.0GHz can be achieved, and the wave absorption rate is greater than 85%.