Metamaterial Absorber for Oblique Incidence of Parallel and Perpendicular Polarization

Nguyen Toan Trung*, Sungjoon Lim
School of Electrical and Electronic Engineering, Chung-Ang University,
Seoul 156-756, Korea
nguyentoantrung28190@gmail.com, sungjoon@cau.ac.kr

In this paper, we propose a metamaterial absorber that is based on a split eight circular sectors (SECS) to achieve high absorptivity for oblique incidence of both parallel and perpendicular polarization. Due to a newly proposed SECS, the absorption frequency and absorption ratio are insensitive for wide oblique incident angles. The absorber performance is demonstrated with full-wave simulation and measurements. Because of the symmetric geometry, polarization insensitivity is achieved under normal incidence. Up to 70˚ oblique incidence in the both parallel and perpendicular polarization., the simulated absorptivity exceeds 90% and the frequency variation is less than 0.7% around 9.26 GHz.

We build the proposed absorber on a printed-circuit-board with 20 × 20 unit cells, and we demonstrate its performance experimentally in free space. The picture of the fabricated prototype is shown in Fig. 1(a). The metallic structures on the top and bottom layers of the substrate are is fully covered with a copper sheet. The substrate of absorber is FR4 with thickness of h = 0.8 mm. Its relative permittivity and dielectric loss tangent are 3.9 and 0.02, respectively. The measured under oblique incidence, both of (Figure 1. (b)) perpendicular polarization and (Figure 1. (c)) parallel polarization. The measured absorptivity at 9.26 GHz is close to 98% for all polarization angles at normal incidence. As the oblique incidence angle varies from 0˚ to 70˚, the measured absorptivity at 9.26 GHz remains above 92% in the both parallel and perpendicular polarization, respectively.

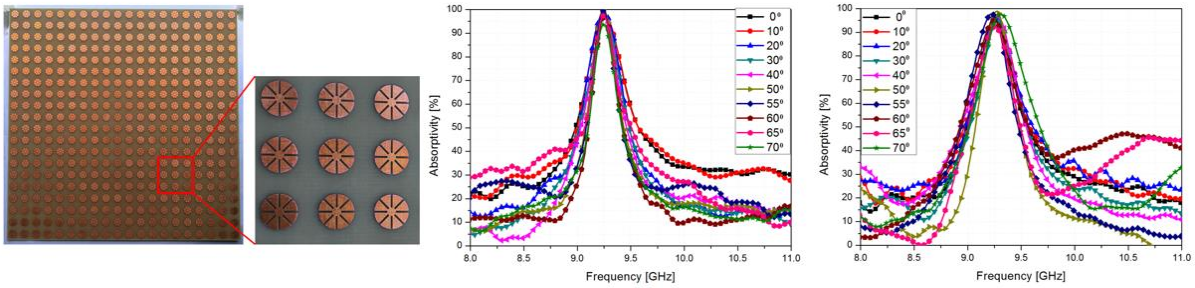

Figure 1. (a) Fabricated absorber sample. Measured absorptivity of the fabricated prototype absorber for oblique incident angles θ ranging from 0˚ to 70˚ in (b) perpendicular and (c) parallel polarization.