Screen Printed Electromagnetic Metamaterial Absorber

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In this paper, we proposed a stretchable electromagnetic metamaterial absorber using screen printing technology. In order to fabricate the proposed stretchable absorber, we used a polydimethysiloxane (PDMS) substrate as a stretchable dielectric material. PDMS material provides good dielectric properties, flexibility and restoring capabilities. The conductive patterns on the top and bottom are screen printed on the PDMS. We used a Dupont PE872 stretchable silver conductive ink. In order to demonstrate its performance, the reflection coefficient of the proposed absorber was simulated by ANSYS high frequency structure simulator (HFSS) and measured by a vector network analyzer after loading the fabricated prototype on the open side of the rectangular waveguide as shown in Fig. 1.

The proposed absorber is designed based on a rectangular patch. The rectangular patch unit cell is illustrated in Fig. 1(a). The bottom plane is completely covered by a conductor. The rectangular size of the patch is 7 mm × 8 mm. The final absorber consists of 2 unit cells as shown in Fig. 1(b) and (c) in order to load on the waveguide. The open side of the WR-90 waveguide is 22.86 mm × 10.16 mm. Before stretching the fabricated prototype, the initial resonant frequency is 11 GHz as shown Fig. 2. When stretching along *x*-axis, the resonant frequency is shifted from 11 GHz to 10.9 GHz by 0.1 GHz, while keeping 99% absorptivity. When stretching along *y*-axis, the resonant frequency shifted from 11 GHz to 10.4 GHz by 0.6 GHz, with 99% absorption. Therefore, the proposed metamaterial absorber can detect whether it is stretched along *x*-axis or *y*-axis.

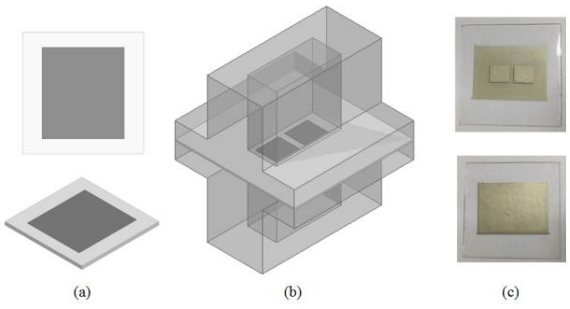

Figure 1. Illustration of (a) unit cell and (b) waveguide test setup. (c) Pictures of fabricated sample.

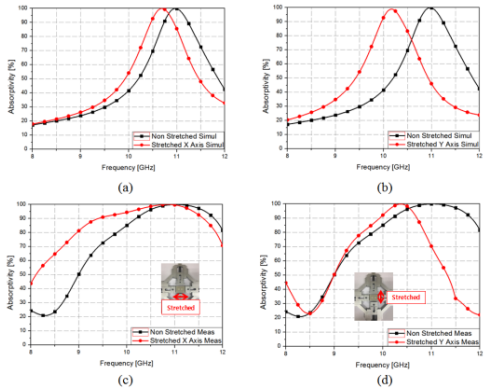

Figure 2. Simulated absorptivity along (a) *x*-axis (b) *y*-axis. Measured absorptivity along (c) *x*-axis and (d) *y*-axis.