

Asymmetric transmission of low symmetric THz metamaterial**Osaka Univ.¹, °Boyoung Kang¹, Keisuke Takano, and Masanori Hangyo****E-mail: by-kang@ile.osaka-u.ac.jp**

In this study, the electromagnetic properties of 2-dimensional chiral (or planar chiral) structure, whose sense of twist is reversed for observation from opposite directions, are investigated by theoretical and experimental ways. The 2D chiral structure also shows optical activity. The circular dichroism is observed in high symmetric structures (C_4 symmetry) like planar gammadion structures. In a low symmetric structure, there is no optical rotation caused by chirality, but, directionally asymmetric transmission for circularly polarized waves arises from different circular polarization for opposite directions of the incident wave [1]. Here, we introduce novel planar metamaterial structure possessing mirror symmetries with respect to a plane perpendicular to the z-axis (M_{xy} symmetry), as shown in Fig. 1 (a). From Jones matrix calculation, it is expected to be observed the asymmetric transmission only for circular polarization [2]. We fabricated the planar array of meta-atoms with Ag nano paste on a Si substrate by using a super fine ink-jet (SIJ) printer. The transmission for linearly polarized wave is measured by THz-TDS and the transmission for circularly polarized wave is calculated from the Jones matrix. From experimental data, the asymmetric transmission is observed for circularly polarized wave in the low symmetric meta structure. Moreover, in Figs. 1(b) and (c), the polarization azimuth rotation is observed at low symmetric meta structure when linearly polarized wave is incident. The amount of rotation is quite larger than the amount of rotation through the gammadion structure. The ellipticity of transmitted wave is in the range of $-0.2 \sim 0.2$. The metamaterial changes the linearly polarized incident wave to elliptically polarized wave with large rotation azimuth angle. These large optical activity obtained in planar metamaterial can be applied in polarization control devices.

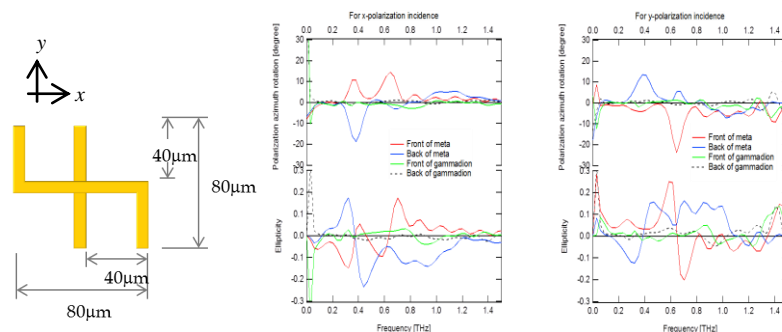


Fig.1 (a) The schematics of low symmetric meta-atom. (b) and (c) The polarization azimuth rotation and ellipticity for x- polarized wave and y- polarized wave, respectively.

References

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- [2] C. Menzel, *et. al.*, *Phys. Rev.A*, **82**, 053811 (2010).