

二重らせん配列構造による新奇マイクロ波円偏光子

Double stranded helix array as a new type of microwave circular polarizer

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We report a new type of circular polarizer which is based on metallic double-stranded (ds-) array particles and performing for a normal to helix axis wave propagation. The key distinction of this array from analogous ones is the composition of the array and its efficiency at the perpendicular to helix axis wave propagation. Theoretical foundation of the advantages of ds-helices over single ones was proposed. A finite element method computer model confirmed the feasibility of the circular polarizer for a microwave wavelength region.

In Fig. 1 (a,b) it is shown the schematic of the array with its parameters and the incident circularly polarized radiation direction. Propagated wave was predominantly RHCP (LHCP) polarized for respectively RHCP (LHCP) incidence. We assessed the transmittance and the extinction ratio coefficient. From the analysis of ER coefficient (see Fig.1 (c), black dashed curve) one can see the high transparency of the array for RHCP radiation in comparison with LHCP radiation, what is expectable because the array is composed of right-handed helices. The result of strong polarization interaction for the lower part of the considered frequency band was confirmed experimentally for mono-layered arrays elsewhere [1]. Moreover, similar effect takes place for pure dielectric photonic crystals [2,3].

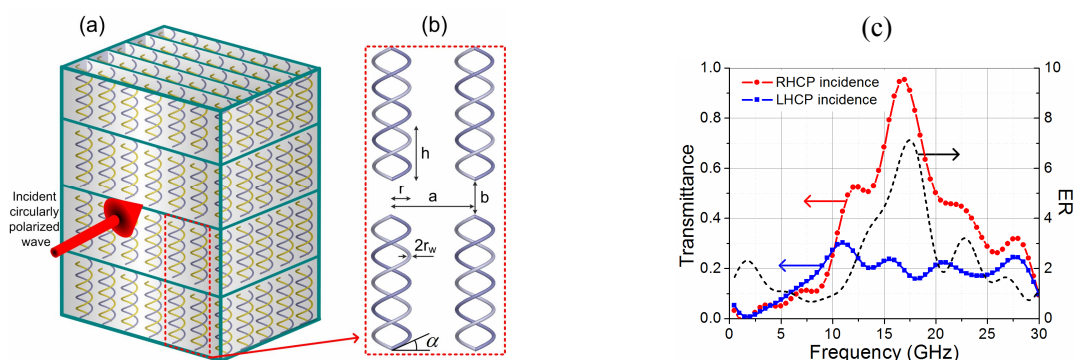


Fig. 1. (a) 3D array composed of metal ds-helices having the pitch angle of $\alpha=24.5^\circ$ and the incident circularly polarized radiation direction, (b) Schematic of the array fragment with its parameters: the helix pitch $h=41.5$ mm, the helix radius $r=14.5$ mm, the wire radius $r_w=1$ mm, the array parameters $a=2\lambda/5$, $b=\lambda/5$, the inter-layer interval is $2\lambda/5$, $\lambda=100$ mm, (c) Total transmittance vs. frequency for the array composed of 5 layers. Incident plane wave was circularly polarized, the red curve (circles) corresponds to RHCP radiation, the blue curve (squares) corresponds to LHCP radiation. The right scale and the black dashed curve represents the extinction ratio coefficient.

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