Negative index metamaterials operating at terahertz frequencies

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Abstract

We review the various routes successfully developed so far for the fabrication of negative index metamaterials at Terahertz frequencies. We first consider omega-type patterns which are representative of the split ring and wire array technologies [1]-[3] with the requirement of a grazing incidence. They can exhibit broad band dispersion characteristic with balanced composite left- and right- handed dispersion branches. Tuneability can also be achieved by ferroelectric layers [4] or by infiltrating the basic arrays with liquid crystals [5]-[6] modifying by their reorientation the characteristic resonant frequencies. Transmission line approaches are considered in a second stage starting from the situation of a transmission line loaded periodically by series capacitances and self inductances [7] characterized by frequency or time domain spectroscopy. By means of the characterization and the analysis of the dispersion characteristic of a sub-wavelength hole array operating at 0.5 THz [8] we discussed the necessary conditions for negative index with a good figure of merit. At last, we consider artificial magnetism via the use of Mie resonance [9]–[11] targeting notably transformation optics applications.

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