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The fascinating split-ring-resonators: progress in design, fabrication and applications of terahertz metamaterials

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Abstract

Metamaterials with many unique optical properties are made of periodically arranged sub-wavelength metallic structures that are able to couple to external electromagnetic (EM) waves. One of such structures is the commonly used split-ring-resonators (SRR). In this talk, I will discuss and demonstrate some new progress we made on SRR-based terahertz metamaterials. By looking into the coupling between SRRs and the effect of incident polarization, we proposed a way to continuously modulate their resonances, changing the transmission intensity at resonant frequency from 20% to 80% [1]. We also designed a SRR-based polarization-insensitive broadband filter in THz range and discovered its effect in eliminating asymmetric characteristics in device structure [2]. A stop band with bandwidth of as large as 1.40 THz was achieved. To improve the fabrication process, a facile metal transfer method was employed to create SRR patterns on PDMS surface, planar and otherwise, as well as PDMS-coated surfaces, such as paper, fabric and leaf [3]. Lastly, a design of 3D THz metamaterial device was proposed to be used in biomedical field for cancer cell studies, exploiting its structural similarities with the single-cell-capturing microfluidic devices.

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